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Psychospołeczne i środowiskowe determinanty spożywania alternatywnych źródeł białka

Psychosocial and environmental determinants of alternative protein consumption

Rozprawa doktorska przygotowana pod kierunkiem:

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Abstrakt

Prezentowana rozprawa doktorska ma formę cyklu czterech publikacji: meta-przeglądu, dwóch przeglądów systematycznych oraz badania oryginalnego. Jej celem jest identyfikacja kluczowych psychospołecznych i środowiskowych determinant wyboru alternatywnych źródeł białka (APF) przez konsumentów.

Badanie 1 (meta-przegląd, *k*=28) przeprowadzono zgodnie ze standardami PRISMA, a jego protokół został zarejestrowany w bazie PROSPERO (nr CRD42023388694). Wykazano, że kluczowe determinanty obejmują: w domenie zdolności — ekspozycję i znajomość produktu oraz umiejętności kulinarne (dla żywności roślinnej), w domenie możliwości — normy społeczne i kulturowe ograniczające akceptację insektów, a w domenie motywacji — emocje (dla insektów) i przekonania proekologiczne (dla żywności roślinnej). Badania częściej dotyczą intencji niż rzeczywistego spożycia.

Badanie 2 (przegląd systematyczny, *k*=36) również przeprowadzono zgodnie ze standardami PRISMA i zarejestrowano w bazie PROSPERO (nr CRD42023388700). Wskazano, że kluczowym czynnikiem sprzyjającym wyborowi APF jest ich dostępność (faktyczna i postrzegana), a także czynniki kontekstowe, takie jak ekspozycja produktów, rutyny zakupowe i działania w e-commerce.

Badanie 3 (przegląd systematyczny, *k*=25) przeprowadzono zgodnie ze standardami PRISMA i zarejestrowano w bazie PROSPERO (nr CRD42023388700). Badanie wykazało różnice między krajami: w Europie Zachodniej obserwuje się bardziej pozytywne postawy wobec APF niż w Europie Wschodniej, gdzie występuje niższa wiedza i większa niechęć do innowacyjnej żywności. Różnice między obszarami miejskimi i wiejskimi są w większości nieistotne, a znaczenie lokalności produkcji jest niejednoznaczne.

Badanie 4 przeprowadzono stosując tzw. metody mieszane, przy użyciu metody system mapping. W badaniu wzięło udział *N*=166 interesariuszy systemu żywnościowego z

13 krajów Europy. Wyniki wskazują, że kluczowe tzw. punkty wpływu to wiedza o APF, normy społeczne dotyczące APF, promocja APF, ich spostrzegana zdrowotność oraz emocje (m.in. lęk przed nową żywnością, ciekawość), które tworzą powiązany system determinantów sprzyjający zmianie zachowań żywieniowych.

Słowa kluczowe: alternatywne źródła białka, system mapping, przegląd systematyczny, dieta

Abstract

This doctoral dissertation includes four publications: a meta-review, two systematic reviews, and one original study. It aims to identify key psychosocial and environmental determinants of consumers' choices of alternative protein foods (APF).

Study 1 (meta-review, *k*=28) was conducted in accordance with PRISMA standards, and its protocol was registered with the PROSPERO database (no. CRD42023388694). The findings indicate that key determinants include: within the Capability domain—exposure to and familiarity with the product, as well as cooking skills (for plant-based APF); within the Opportunity domain—social and cultural norms limiting the acceptance of insect-based APF; and within the Motivation domain—emotions (for insect-based APF) and pro-environmental beliefs (for plant-based APF). The literature focuses rather on intentions than on actual consumption.

Study 2 (systematic review, *k*=36) was also conducted in accordance with PRISMA standards and registered with PROSPERO (no. CRD42023388700). The results show that availability (both actual and perceived) is a key facilitator of APF choice, alongside context-specific factors such as product placement, shopping routines, and e-commerce practices.

Study 3 (systematic review, *k*=25), conducted in line with PRISMA and registered with PROSPERO (no. CRD42023388700), revealed cross-country differences. For example, consumers in Western Europe show more positive attitudes toward APF than those in Eastern Europe, where lower knowledge and greater reluctance toward novel foods are observed. Differences between urban and rural areas are mostly insignificant, and the role of product locality remains inconclusive.

Study 4 used mixed-methods and the system mapping approach. Food system stakeholders (N=166) from 13 European countries participated. The findings indicate that key

leverage points include APF knowledge, APF-related social norms, promotion of APF, perceived healthiness of APF, and emotions (e.g., neophobia, curiosity), which together form an interconnected system of determinants shaping dietary behavior.

Keywords: alternative protein food, system mapping, systematic review, diet

Wprowadzenie

Wprowadzenie do tematyki alternatywnych źródeł białka (APF).

Współczesne wyzwania środowiskowe wymagają od badaczy i praktyków promocji zdrowia uwzględniania kontekstu zmian klimatycznych w działaniach na rzecz zmiany zachowań zdrowotnych (Chevance et al., 2023; Papies et al., 2024). Jednym z możliwych podejść jest skupienie się na zachowaniach żywieniowych korzystnych zarówno dla zdrowia jednostki, jak i dla planety. Jak podkreśla Raport Komisji EAT-Lancet (Eat-Lancet Commission, 2022), ograniczenie spożycia tradycyjnych, odzwierzęcych źródeł białka na rzecz alternatywnych źródeł białka (APF) może przyczynić się do poprawy zdrowia publicznego oraz zrównoważonej produkcji żywności. Przykładowo, zastąpienie 3% białka odzwierzęcego białkami roślinnymi wiąże się z obniżeniem ryzyka przedwczesnej śmierci o 10% oraz zmniejszeniem ryzyka zgonu z powodu chorób układu krążenia o 11–12% (Huang et al., 2020). APF obejmują białka z insektów, kryla, mikroorganizmów, grzybów oraz roślin, charakteryzując się mniejszym wpływem na środowisko w porównaniu z tradycyjnymi białkami odzwierzęcymi (Grossmann & Weiss, 2021). Stanowią zatem szeroką gamę produktów wspierających zarówno zdrowie jednostki, jak i zrównoważone systemy żywnościowe.

Modele teoretyczne wyjaśniające badane zależności

Badane zależności osadzone są w ramach modeli teoretycznych, które łączą perspektywę psychologiczną, społeczną, środowiskową i systemową (Bronfenbrenner, 1979). Modele społeczno-ekologiczne zakładają, że zachowania żywieniowe (takie jak spożywanie alternatywnych źródeł białka) nie są jedynie wynikiem decyzji jednostki, lecz wypadkową wpływów na różnych poziomach (indywidualnym, środowiskowym, systemowym)

(Bronfenbrenner, 1979). Poziom mikro (poziom indywidualny) pozwala lepiej zrozumieć decyzje konsumenta, obrazując jego psychologiczne oraz fizyczne zdolności i motywacje. Poziom mezo (środowiskowy) precyzuje w jakich fizycznych strukturach środowiskowych realizują się możliwości jednostki. Poziom makro (kontekst geograficzny i systemowy) pozwala lepiej zrozumieć, że wybory jednostki są uwarunkowane przez szerokie polityki regionalne i krajowe, a ich zmiana wywołuje nieliniowe sprzężenia zwrotne w całym łańcuchu produkcji i konsumpcji żywności.

Model COM-B

Jednym z najczęściej stosowanych ujęć społeczno-ekologicznych, koncentrujących się na zmiennych indywidualnych (poziom mikro) jest model COM-B (Capability–Opportunity–Motivation), który integruje determinanty indywidualne oraz środowiskowe (Michie i in., 2011; West & Michie, 2020). Zgodnie z tym modelem zdolności (Capability) obejmują fizyczne i psychospołeczne umiejętności niezbędne do inicjacji danego zachowania, w tym wiedzę i kompetencje. Możliwości (Opportunity) odnoszą się do fizycznego i społecznego środowiska, w tym norm społecznych i dostępności zasobów fizycznych. Motywacja (Motivation) obejmuje zarówno procesy motywacyjne refleksyjne (np. przekonania, wartości), jak i automatyczne (np. emocje, nawyki) (Michie i in., 2011; Cane i in., 2012). Choć model COM-B uwzględnia czynniki środowiskowe, koncentruje się głównie na determinantach indywidualnych, psychospołecznych, które wymieniano są jako najbardziej bezpośrednie predyktory zachowania (Hagger i in., 2020).

Taksonomia środowiska żywieniowego (Downs i in., 2020)

Koncepcja „środowiska żywieniowego" opisuje struktury środowiska zbudowanego oraz zależności między tymi strukturami, kontekstem społecznym, politycznym, wyborami żywieniowymi (takimi jak włączenie APF do diety) a ich konsekwencjami dla zdrowia człowieka i środowiska (Glanz i in., 2005; McKinnon i in., 2009; Downs i in., 2020; Mylan i

in., 2023). W tym ujęciu szczególnie istotną rolę odgrywa fizyczne środowisko zbudowane (McKinnon i in., 2009; Downs i in., 2020), którego cechy strukturalne tworzą ramy, w obrębie których wzajemnie oddziałują czynniki społeczne i polityczne — odpowiadając tym samym poziomowi mezo i makro w modelach społeczno-ekologicznych.

Taksonomia Downs i in. (2020) opisuje charakterystyki środowiska żywieniowego jako ogólne cechy struktur środowiska zbudowanego, takie jak dostępność, przystępność cenowa czy zrównoważony środowiskowo charakter oferowanych produktów. Podejście to jest komplementarne z modelem CICI (*Context and Implementation of Complex Interventions Framework*) (Pfadenhauer i in., 2017), który proponuje podział tych charakterystyk na trzy poziomy: makro (np. krajowe polityki regulujące funkcjonowanie poszczególnych struktur), mezo (np. strategie sieci producentów i dystrybutorów) oraz mikro (np. indywidualne cechy aktorów systemu żywieniowego — producentów, sprzedawców i konsumentów). Aby precyzyjnie określić, jak struktury środowiska (w tym środowiska zbudowanego) różnicują decyzje żywieniowe konsumentów, potrzebna jest empiryczna identyfikacja ich charakterystyk, które mogą sprzyjać lub utrudniać zmianę diety, w tym zwiększenie spożycia APF.

Kontekst geograficzny i administracyjny

Geograficznie zdefiniowane jednostki, takie jak kraje, regiony i miasta, stanowią podstawowe czynniki makro-strukturalne, organizujące systemy żywieniowe (Arcaya i in., 2015; Vandecandelaere i in., 2009). Badając osoby z danego kraju lub regionu, możemy uzyskać wiedzę o populacji eksponowanej na te same uwarunkowania: od lokalnych polityk zdrowotnych i odległości do struktur handlowych, po specyficzne normy kulturowe i ekonomiczne (Bambra i in., 2019). Czynniki geograficzne mogą być jednymi z kluczowych czynników kontekstualnych, współdeterminujących spożywanie APF: ich rolę podkreśla między innymi model CICI (Pfadenhauer i in., 2017).

Systemy złożone w analizie systemów żywnościowych (*complex system approach models applied to food systems*)

Zmiany w zachowaniach żywieniowych, takie jak wybór białek ze zrównoważonych źródeł, mogą inicjować szersze zmiany w systemie żywnościowym poprzez wpływ na działania innych interesariuszy w systemie (np. producentów czy sprzedawców) (HLPE [*High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*], 2017; Willett i in., 2019). Podkreśla się przy tym rolę konsumentów jako aktywnych uczestników kształtujących system żywnościowy, co przekłada się na rosnące zainteresowanie determinantami ich zachowań (Boer i Aiking, 2022). W podejściu systemów złożonych w analizie systemów żywnościowych (*complex system approach models applied to food systems*) zmiana zapoczątkowana przez jednego aktora może prowadzić do dalszych zmian w całym systemie poprzez reakcje innych interesariuszy w systemie (Hovmand, 2013; Meadows, 2008). Perspektywa ta uzupełnia społeczno-ekologiczne modele zachowania, które choć podkreślają rolę interakcji między czynnikami na różnych poziomach, rzadko uwzględniają szczegółowe relacje między determinantami. Perspektywa systemów złożonych traktuje zachowania jako efekt dynamicznych i współzależnych procesów. Zmiany w jednym elemencie systemu mogą wpływać na inne jego części, a powiązania między czynnikami tworzą sprzężenia zwrotne, które mogą wzmacniać lub stabilizować określone wzorce zachowań (Hovmand, 2013; Meadows, 2008).

Modele Teoretyczne: Podsumowanie

Przedstawione modele teoretyczne tworzą kompleksową, wielopoziomową ramę analityczną, która umożliwia systematyczne badanie determinantów czy korelatów wyboru alternatywnych źródeł białka (APF). Model COM-B oraz modele społeczno-ekologiczne pozwalają identyfikować determinanty działające na poziomie jednostki — takie jak wiedza,

motywacja czy kompetencje — a także uwzględniać szerszy kontekst środowiska społecznego i fizycznego (możliwości). Taksonomie środowiska żywieniowego uszczegóławiają ten kontekst, opisując konkretne struktury fizycznego środowiska zbudowanego (np. sklepy, restauracje, stołówki szkolne i uczelniane) oraz ich poszczególne charakterystyki, które mogą ułatwiać lub utrudniać wybór APF przez konsumentów. Jednostki geograficzne takie jak kraje, regiony, obszary wiejskie i miejskie, stanowią z kolei poziom makro, na którym kształtują się kulturowe, ekonomiczne i polityczne uwarunkowania tych wyborów. Model CICI dostarcza narzędzi do analizy jak implementować interwencje w konkretnych settingach i kontekstach, co wzbogaca wiedzę z poprzednich modeli. Wreszcie perspektywa złożonych systemów żywieniowych integruje wszystkie te poziomy, ujmując determinanty nie jako izolowane czynniki, lecz jako elementy dynamicznej sieci wzajemnych zależności i sprzężeń zwrotnych. Takie ujęcie pozwala analizować, w jaki sposób zmiany na jednym poziomie (np. modyfikacja środowiska żywieniowego), mogą poprzez pętle sprzężenia zwrotnego wpływać na wybór APF przez konsumentów oraz działania innych interesariuszy w systemie żywnościowym.

Cele badań własnych oraz ich uzasadnienie

Prezentowana rozprawa doktorska ma formę cyklu publikacji opartych na czterech badaniach. Ich wspólnym celem jest identyfikacja psychospołecznych oraz środowiskowych uwarunkowań włączania do diety alternatywnych źródeł białka.

Poszczególne badania koncentrują się na różnych aspektach tego zagadnienia: (1) identyfikacji psychospołecznych determinantów włączania do diety alternatywnych źródeł białka wśród konsumentów, (2) analizy barier i czynników sprzyjających włączania do diety alternatywnych źródeł białka w kontekście fizycznego środowiska zbudowanego, (3) identyfikacji różnic i podobieństw między krajami europejskimi w zakresie włączania do diety alternatywnych źródeł białka, (4) identyfikacji kluczowych punktów interwencji (ang.

leverage points) i pętli sprzężeń zwrotnych (ang. feedback loops) w systemie determinantów włączania do diety APF z perspektywy interesariuszy systemu żywnościowego (m.in. producentów żywności, specjalistów ds. żywienia oraz konsumentów). W szczególności sformułowano następujące cele:

Cel Badania 1:

- Synteza wyników badań oryginalnych dotyczących związków między (1) psychospołecznymi determinantami na poziomie jednostki ujętymi w modelu COM-B obejmującymi zdolności (Capability), możliwości (Opportunity) oraz motywacje (Motivation), a także socjodemograficznymi czynnikami kontekstowymi wyróżnionymi w społeczno-ekologicznych modelach zmiany zachowania (Bronfenbrenner, 1979), takimi jak wiek, płeć, wykształcenie i dochód, a (2) wskaźnikami wyboru alternatywnych źródeł białka (APF) przez konsumentów, takimi jak intencja do spożycia APF oraz aktualne spożycie APF.

Cel Badania 2:

- Identyfikacja charakterystyk poszczególnych struktur zbudowanego środowiska żywieniowego, które mogą stanowić bariery bądź czynniki sprzyjające (facylitatory) wyborom produktów z APF. Analizie poddano zarówno struktury nieformalne (np. targi ze świeżą żywnością, sprzedawcy uliczni, kioski, punkty mobilne), jak i formalne (supermarkety, hipermarkety, sklepy spożywcze, restauracje, instytucje publiczne oraz sklepy online).

Cel Badania 3:

- Synteza wyników badań oryginalnych dotyczących czynników związanych z kontekstem geograficznym jako źródłem zróżnicowania wyborów produktów z alternatywnych źródeł białka (APF) przez konsumentów. W analizie uwzględniono: (1) różnice i podobieństwa

między konsumentami w zależności od kraju europejskiego, który zamieszkują, (2) różnice między konsumentami mieszkającymi na obszarach miejskich i wiejskich w krajach europejskich, (3) związki między postrzeganą „lokalnością" produktów z APF w krajach europejskich a wskaźnikami ich wyboru przez konsumentów.

Cel Badania 4:

- Stworzenie mapy systemu determinantów zachowań żywieniowych jednostki w zakresie włączania APF do codziennej diety oraz eksploracja związków między tymi determinantami. Cel ten obejmuje: (1) identyfikację determinantów z perspektywy głównych interesariuszy systemu żywnościowego, takich jak producenci żywności, przetwórcy, dystrybutorzy i sprzedawcy, specjaliści ds. żywienia, pracownicy sektora edukacji, twórcy polityk oraz konsumenci; (2) analizę powiązań między zidentyfikowanymi determinantami; (3) identyfikację powtarzających się sekwencji determinantów ujawniających się w pętlach sprzężenia zwrotnego wskazanych przez interesariuszy. W niniejszej pracy używane jest słowo „determinant", jednakże oznacza ono przyczynę spostrzeganą przez osoby badane, nie zaś determinant w rozumieniu przyczyny dowiedzionej w badaniach eksperymentalnych.

Badanie 1

(Zaleskiewicz, H., Siwa, M., Banik, A., Szczuka, Z., Kulis, E., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2024). Psychosocial determinants of alternative protein choices: a meta-review. *Health Psychology Review, 19*(1), 1–26. https://doi.org/10.1080/17437199.2024.2412630)

Cele Badania

Celem tego meta-przeglądu (rozumianego jako przegląd systematyczny przeglądów systematycznych; Hennessy i in., 2019) była synteza wyników badań dotyczących relacji między dwiema grupami zmiennych. Pierwszą z nich stanowiły psychospołeczne uwarunkowania na poziomie indywidualnym (zgodnie z modelem COM-B: zdolności, możliwości i motywacja) oraz czynniki socjodemograficzne wynikające z modeli społeczno-ekologicznych (Bronfenbrenner, 1979), takie jak wiek, płeć, wykształcenie i dochód. Drugą grupą były wskaźniki wyboru alternatywnych źródeł białka (APF) przez konsumenta.

. W badaniu eksplorowano różnice między rodzajami determinantów powiązanych z wyborem białek pochodzenia roślinnego w porównaniu z determinantami wyboru białek na bazie insektów. Komponent „możliwości" z modelu COM-B (Opportunity) był analizowany przez pryzmat subiektywnej percepcji środowiska oraz przekonań jednostki na temat jej otoczenia społecznego i fizycznego.

Metoda Badania 1

Przeprowadzono meta-przegląd integrujący dane empiryczne z istniejących przeglądów systematycznych. Badanie zrealizowano zgodnie z wytycznymi PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Page i in., 2021) i zostało ono prerejestrowane w bazie PROSPERO (nr CRD42023388694).

Przegląd systematyczny obejmował 11 baz danych czasopism recenzowanych (Academic Search Ultimate, PsycInfo, PsycArticles, Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier oraz Academic Research Source eJournals). Po zakończeniu głównego etapu

przeszukiwania dodatkowo uwzględniono bazy Web of Science, Scopus, CORDIS oraz Open Research Europe (ORE). Do przeglądu włączono artykuły opublikowane do marca 2023 roku. W tym systematycznym przeglądzie zastosowano trzy grupy słów kluczowych, które odnosiły się do (1) wskaźników wyborów APF lub kategorii (np., accept* OR preference*) lub wskaźników determinantów na poziomie indywidualnym (np. behavio* OR belief*); (2) wskaźników alternatywnych źródeł białka (np., seaweed* OR alga* OR insect*) oraz (3) nazw odnoszących się do przeglądu jako do metody badan (np., meta-synthesis OR meta-review). Te słowa kluczowe zostały wybrane na bazie istniejących przeglądów systematycznych na temat APF (Mancini i in., 2019; Nguyen i in., 2022; Onwezen i in., 2021) i badań, w których aplikowany był model COM-B (Nguyen i in., 2022) oraz model CICI (Pfadenhauer i in., 2017). Zbiór słów kluczowych zaproponowanych przez Hennessy i in. (2019) został wykorzystany do identyfikacji przeglądów.

Zastosowano następujące kryteria włączenia: (1) systematyczne, zakresowe (*scoping review*) oraz realistyczne (*realist review*) przeglądy badań ilościowych lub jakościowych; (2) przeglądy dotyczące alternatywnych źródeł białka (APF) z dowolnych źródeł, w tym białek na bazie roślin, grzybów, bakterii, owadów lub kryla, a także produktów hybrydowych łączących mięso z białkiem roślinnym; (3) opracowania analizujące związki między determinantami na poziomie jednostki a wskaźnikami wyboru APF (np. intencja zakupu, intencja spożycia, rzeczywiste spożycie, faktyczny zakup czy włączenie do diety); (4) przeglądy opublikowane w języku angielskim.

Wyniki Badania 1

W meta-przeglądzie uwzględniono łącznie 28 przeglądów, obejmujących wyniki 1014 badań oryginalnych pochodzących z Europy, Ameryki Północnej oraz Australii i Nowej Zelandii.

Ocena ryzyka przy użyciu narzędzia ROBIS wykazała, że 53,6% przeglądów (k = 15) uzyskało niskie ryzyko błędu we wszystkich pięciu kryteriach, po 3,6% (k = 1) — w czterech i trzech kryteriach. Pozostałe 39,3% przeglądów (k = 11) charakteryzowało się niejasnym ryzykiem błędu w co najmniej trzech kryteriach.

Wyniki dla domeny Zdolności z modelu COM-B

Wyniki, które określono jako spójne (dla > 66% uwzględnionych badań, dotyczących danej zależności stwierdzono pozytywne związki oraz jednoczenie badania te omawiano w k ≥ 3 przeglądach badań.) zostały uzyskane dla 3 zmiennych domeny Zdolności z modelu COM-B: umiejętności kulinarne, wiedza formalna, wiedza nieformalna rozumiana jako wielokrotna ekspozycja.

W szczególności, wszystkie włączone przeglądy (5 przeglądów systematycznych, w tym 6 badań w tych przeglądach wskazywało na istotne zależności [2.45%]) analizujące umiejętności kulinarne konsumentów wskazują, że ich wyższy poziom wiąże się z większą intencją i spożyciem roślinnych APF. Wiedza formalna (dotycząca wartości odżywczych oraz naukowo potwierdzonych efektów spożycia białka dla zdrowia i środowiska) wykazuje niejednoznaczne związki z intencją do zakupu, gotowością do zapłaty oraz włączeniem do diety roślinnych APF. W odniesieniu do APF na bazie insektów większość przeglądów wskazuje na pozytywny związek między wiedzą formalną (znajomość wartości odżywczych produktów, wpływu spożywania białka na zdrowie jednostki oraz na środowisko; Eckl i in., 2021) a intencją zakupu, włączeniem do diety oraz deklarowanym włączaniem tych produktów do diety, choć pojedyncze wyniki pozostają niespójne. Jednocześnie sama wiedza może zwiększać intencję zakupu, jednak przy niskiej przeciętnej intencji spożycia, efekt wiedzy na rzeczywiste włączenie produktów na bazie insektów do codziennej diety jest prawdopodobnie ograniczony.

Z kolei wiedza nieformalna, rozumiana jako wielokrotna ekspozycja na produkt i rosnąca znajomość, wykazuje konsekwentnie pozytywne związki z wyborami APF zarówno roślinnych, jak i na bazie insektów. Wszystkie analizowane przeglądy dotyczące roślinnych APF oraz APF z różnych źródeł wskazują, że większa osobista znajomość/częstsza ekspozycja wiąże się z wyższą intencją zakupu, jednorazowym spożyciem i regularnym włączaniem do diety. Podobne zależności obserwuje się dla produktów na bazie grzybów oraz dla APF na bazie insektów. Jednocześnie, choć ekspozycja i znajomość mogą sprzyjać pierwszej próbie produktu, niekoniecznie wystarczają do regularnego wdrożenia ich do diety.

Pozostałe wyniki zostały opisane w Tabeli 1 oraz Publikacji 1.

Dyskusja Badania 1

Badanie to przedstawia syntezę wiedzy na temat zależności między psychospołecznymi determinantami uwzględnionymi w modelu COM-B a wskaźnikami intencji i spożywania APF. W domenie Zdolności kluczowymi korelatami okazały się częsta ekspozycja na produkt i poczucie jego znajomości — wspólne dla żywności roślinnej i na bazie insektów — oraz umiejętności kulinarne, istotne wyłącznie dla żywności roślinnej. W domenie Możliwości uzyskano spójne dowody dla roli norm społecznych i kulturowych: tradycje spożycia produktów zwierzęcych stanowią barierę dla włączenia do diety żywności na bazie insektów, a poziom regularnego włączenia do diety różni się między krajami europejskimi, co sugeruje moderującą rolę lokalnych uwarunkowań kulturowych i politycznych. W domenie Motywacji dominują automatyczne procesy regulacyjne — dla żywności na bazie insektów kluczowe są zarówno negatywne emocje (neofobia, nieufność, postrzegane ryzyko), jak i pozytywne (ciekawość, poszukiwanie wrażeń), natomiast dla żywności roślinnej — przekonania proekologiczne i empatia wobec zwierząt. Istotnym

ograniczeniem jest przewaga badań nad intencjami i akceptacją przy niedostatecznej liczbie badań dotyczących rzeczywistego spożycia APF.

Tabela 1.
Podsumowanie wyników meta-przeglądu dla indywidualnych determinantów wyboru APF przez konsumentów.

Indywidualne determinanty wyboru APF (domeny zgodne z modelem COM-B i CICI)	Wyniki: rodzaj wskaźnika behawioralngo	Rodzaj alternatywnych źródeł białka: Białka roślinne	Rodzaj alternatywnych źródeł białka: Białko na bazie insektów	Rodzaj alternatywnych źródeł białka: różne źródła (w tym rośliny, insekty, grzyby, białka z pozostałych źródeł)
COM-B: ZDOLNOŚCI (CAPABILITIES)				
Umiejętności kulinarne	Ogólne poparcie	**Wyniki spójne +**		
	Intencja		+ (Onwezen, 2021 L)	
	Spożycie	+ (Eckl, 2021 L); + (Graça, 2019 L); + (He, 2020 H)		+ (Nguyen, 2022 L)
Łatwość i wygoda w zastąpieniu mięsa	Ogólne poparcie		**Wyniki wstępne +**	
	Intencja		+ (Onwezen, 2021 L); 0 (Wassmann, 2021 L);	+ (Siddiqui, Bahmid, 2023 L)
	Spożycie	+ (Graça, 2019 L)	+ (Florença, 2022 L)	
Aktywizm zakupowy	Ogólne poparcie			
	Intencja		+ (Kröger, 2022 L)	
	Spożycie			
Trening uważności (mindfulness)	Ogólne poparcie		**Wyniki wstępne 0**	
	Intencja		0 (Dagevos, 2020 H); 0 (Kröger, 2022 L)	
	Spożycie			
Wiedza formalna	Ogólne poparcie	**Wyniki wstępne 0**	**Wyniki spójne +**	
	Intencja	0 (Baiano, 2020 H); + (Eckl, 2021 L)	+ (Ardoin i Prinyawiwatkul, 2021 H); + (Batat i Peter, 2020 H); + (Dagevos, 2020 H); + (Kauppi, 2019 H); + (Mancini, 2019 L); + (Mina, 2023 L); + (Siddiqui, Alvi, 2022 H); + (Weinrich, 2019 L); 0 (Wendin i Nyberg, 2021 H)	+ (produkty na bazie grzybów - De Cianni, 2023 L); 0 (żywność innowacyjna – Giordano, 2017 L)
	Spożycie		+ (Eckl, 2021 L); + (Florença, 2022 L)	
	Ogólne poparcie	**Wyniki spójne +**	**Wyniki spójne +**	**Wyniki spójne +**

Wielokrotna ekspozycja na APF, spostrzegana znajomość	Intencja	+(Baiano, 2020 H); + (He, 2020 H); + (Onwezen, 2021 L); + (Szenderák, 2022 L)	+ (Ardoin i Prinyawiwatkul, 2021 H); + (Dagevos, 2020 H); + (Hartmann i Siegrist, 2017 L); + (Kauppi, 2019 H); + (Kröger, 2022 L); + (Mancini, 2019 L); + (Mina, 2023 L); + (Onwezen, 2021; L); + (Toti, 2020 H); 0 (Wassmann, 2021 L); + (Wendin i Nyberg, 2021 H);	+ (produkty na bazie grzybów - De Cianni 2023 L); + (Hartmann i Siegrist, 2017 L); + (Siddiqui, Bahmid, 2023 L); + (Siddiqui, Zannou, 2022 H)
	Spożycie	+ (Graça, 2019 L)	+ (Florença 2022 L)	+ (Nguyen, 2022 L)
COM-B: MOŻLIWOŚCI (OPPORTUNITIES)				
Pozytywne normy społeczne	Ogólne poparcie	**Wyniki wstępne +**	**Wyniki spójne +**	**Wyniki spójne +**
	Intencja	+ (Graça, 2019 L); + (Onwezen, 2021 L)	+ (Ardoin i Prinyawiwatkul, 2021 H); + (Kauppi, 2019 H); + (Kröger, 2022 L); + (Mancini, 2019 L); + (Mina, 2023 L); + (Onwezen, 2021 L); + (Siddiqui, Alvi, 2022 H); + (Wassmann 2021 L); + (Wendin i Nyberg, 2021 H)	+ (produkty na bazie grzybów; De Cianni, 2023 L); + (produkty na bazie grzybów; Eckl, 2021 L); + (Giordano, 2017 L); + (Nguyen, 2022 L); + (Siddiqui, Bahmid, 2023 L)
	Spożycie		+ (Florença 2022 L)	
Wsparcie społeczne od rodziny i przyjaciół	Ogólne poparcie			
	Intencja			
	Spożycie	+ (Graça, 2019 L)		
Pozytywny obraz społeczny i spostrzegana towarzyska rola spożywania mięsa	Ogólne poparcie			
	Intencja			+ (Nguyen, 2022 L)
	Spożycie			
Jedzenie mięsa jako pozytywna norma społeczna	Ogólne poparcie			
	Intencja	- (He, 2020 H)		- (Nguyen, 2022 L)
	Spożycie			

Pozytywne spostrzegane normy kulturowe	Ogólne poparcie		**Wyniki spójne +**	**Wyniki spójne +**
	Intencja		+ (Batat i Peter, 2020 H); + (innowacyjna żywność na bazie insektów– Giordano, 2017 L); + (Hartmann i Siegrist, 2017 L); + (Kauppi, 2019 H); + (Mancini, 2019 L); + (Onwezen, 2021 L); + (Siddiqui, Alvi, 2022 H); + (Toti, 2020 H); + (Wendin i Nyberg, 2021 H)	+ (produkty na bazie grzybów; De Cianni, 2023 L); + (Nguyen, 2022 L); + (Siddiqui, Zannou, 2022 H)
	Spożycie		+ (Florença, 2022 L); + (Toti, 2020 H)	
Spostrzegane niedopasowanie z lokalną żywnością	Ogólne poparcie			?
	Intencja			
	Spożycie			- (Weinrich, 2019 L)
Brak zaufania do technologii używanej w produkcji APF	Ogólne poparcie	**Wyniki wstępne -**	**Wyniki spójne -**	**Wyniki spójne -**
	Intencja	- (Onwezen, 2021 L); – (Szenderák, 2022 L)	- (Kröger, 2022 L); -(Wassmann, 2021 L)	- (Eckl, 2021 L); - (Giordano, 2017 L); - (Siddiqui, Zannou, 2022 H)
	Spożycie		- (Florença, 2022 L); – (Wendt i Weinrich, 2023 L)	
Spostrzegany brak bezpieczeństwa produkcji, sprzedaży i przechowywania jedzenia	Ogólne poparcie			
	Intencja	- (Baiano, 2020 H)	0 (Wendin i Nyberg, 2021 H)	- (Siddiqui, Zannou, 2022 H)
	Spożycie			
Wysoki poziom zaufania/niska niepewność w stosunku do badań, nauki, niezależnych organizacji promujących żywność	Ogólne poparcie			**Wyniki wstępne +**
	Intencja	+ (Onwezen, 2021 L)	+ (Onwezen, 2021 L)	+(Giordano, 2017 L); + (Siddiqui, Zannou, 2022 H)
	Spożycie			

COM-B: MOTYWACJE (MOTIVATIONS)				
Spostrzegane korzyści zdrowotne	Ogólne poparcie	**Wyniki spójne +**	**Wyniki spójne +**	**Wyniki spójne +**
	Intencja	- (Baiano, 2020 H); + (Onwezen, 2021 L); + (Szenderák, 2022 L); + (tylko białka na baize alg - Wang, 2023 H)	+ (Dagevos, 2020 H); 0 (Kröger, 2022 L); + (Onwezen, 2021 L); + (Toti, 2020 H); 0 (Wassmann, 2021 L); + (Wendin i Nyberg, 2021 H)	+ (Nguyen, 2022 L); + (Onwezen, 2021 L); + (Siddiqui, Bahmid, 2023 L)
	Spożycie	+ (Eckl, 2021 L); + (Graça, 2019 L); + (Siddiqui, Alvi, 2022 H); + (Weinrich, 2019 L)	+ (Florença, 2022 L)	+ (produkty na bazie grzybów; De Cianni, 2023)
Spostrzegana wysoka wartość odżywcza	Ogólne poparcie			
	Intencja	+ (Wang, 2023 H)	0 (Wang, 2023 H); + (Wendin i Nyberg, 2021 H)	
	Spożycie			
Ryzyko zdrowotne	Ogólne poparcie		**Wyniki spójne -**	
	Intencja		- (Batat i Peter, 2020 H); - (Onwezen, 2021 L); - (Siddiqui, Alvi, 2022 H); - (Wassmann, 2021 L)	+ (Giordano, 2017 L)
	Spożycie	- (He, 2020 H)	- (Florença 2022 L)	
Prośrodowiskowe i zrównoważone dla środowiska (sustainability) korzyści	Ogólne poparcie	**Wyniki spójne +**	**Wyniki wstępne +**	**Wyniki spójne +**
	Intencja	+ (Onwezen, 2021 L); 0 (Szenderák, 2022 L)	0 (Dagevos, 2020 H); 0 (Kröger, 2022 L); + (Mancini, 2019 L); 0 (Mina, 2023 L); + (Onwezen, 2021 L); + (Siddiqui, Alvi, 2022 H); + (Toti, 2020 H); + (Wassmann, 2021 L); 0 (Weinrich, 2019 L); 0 (Wendin i Nyberg, 2021 H)	+ (produkty na bazie grzybów – De Cianni, 2023); 0 (Nguyen, 2022 L); + (Siddiqui, Bahmid, 2023 L)
	Spożycie	+ (Eckl, 2021 L); + (Graça, 2019 L); 0 (Szenderák, 2022 L)	+ (Florença, 2022 L); + (Siddiqui, Alvi, 2022 H); + (Toti, 2020 H)	+ (Eckl, 2021 L); 0 (Nguyen, 2022 L); + (Siddiqui, Bahmid, 2023 L); + (Weinrich, 2019 L)
	Ogólne poparcie			
	Intencja			

Sceptycyzm w stosunku do zmian klimatycznych	Spożycie	- (Graça, 2019 L)		
Dobrostan zwierząt/empatia wobec zwierząt	Ogólne poparcie	**Wyniki spójne +**		
	Intencja	+ (Eckl, 2021 L); + (Siddiqui, Bahmid, 2023 L)		
	Spożycie	+ (Graça, 2019 L)	+ (Florença, 2022 L)	
Dystans moralny	Ogólne poparcie			
	Intencja	- (Graça, 2019 L)	+ (Wassmann, 2021 L)	
	Spożycie			
Moralne i etyczne motywy	Ogólne poparcie			
	Intencja	+ (Onwezen, 2021 L)		
	Spożycie			
Konserwatywny światopogląd	Ogólne poparcie	**Wyniki wstępne 0**		
	Intencja			- (Onwezen, 2021 L)
	Spożycie	0 (Graça, 2019 L); 0 (Szenderák, 2022 L)		
Religijność	Ogólne poparcie			
	Intencja		0 (Kröger, 2022 L)	
	Spożycie			
Poczucie przygody, odwagi, ekscytacji towarzyszące poszukiwaniu wrażeń	Ogólne poparcie		**Wyniki spójne +**	
	Intencja		+ (Ardoin i Prinyawiwatkul, 2021 H); + (Dagevos, 2020 H); + (Kauppi, 2019 H); + (Kröger, 2022 L); + (Siddiqui, Alvi, 2022 H); + (Wassmann, 2021 L); + (Wendin i Nyberg, 2021 H)	
	Spożycie		+ (Florença, 2022 L)	
Ciekawość	Ogólne poparcie		**Wyniki spójne +**	

	Intencja		+ (Ardoin i Prinyawiwatkul, 2021 H); + (Dagevos, 2020 H); + (Onwezen, 2021 L); + (Wendin i Nyberg, 2021 H)	
	Spożycie		+ (Florença, 2022 L); + (Toti, 2020 H)	
Neofilia (lubienie nowych produktów żywnościowych)	Ogólne poparcie		**Wyniki wstępne +**	
	Intencja		+ (Dagevos, 2020 H); + (Kröger 2022 L)	
	Spożycie			
Przywiązanie i pozytywne emocje względem spożywania mięsa	Ogólne poparcie	**Wyniki wstępne -**		
	Intencja	- (Szenderák, 2022 L)		
	Spożycie	- (Graça, 2019 L); - (He, 2020 H); 0 0 (Szenderák, 2022 L)	0 (Kröger, 2022 L)	- (Nguyen, 2022; L)
Zamartwianie się lub poczucie winy związane z jedzeniem mięsa	Ogólne poparcie			
	Intencja			
	Spożycie	+ (Graça, 2019 L)		+ (Nguyen, 2022 L)
Neofobia żywieniowa	Ogólne poparcie	**Wyniki wstępne -**	**Wyniki spójne -**	**Wyniki wstępne -**
	Intencja	- (Onwezen, 2021 L)	- (Ardoin i Prinyawiwatkul, 2021 H); - (Batat i Peter, 2020 H); - (Dagevos, 2020 H); - (Kröger, 2022 L); - (Mina, 2023 L); - (Nguyen, 2022 L); - (Onwezen, 2021 L); - (Siddiqui, Alvi, 2022 H); - (Toti, 2020 H); - (Wassmann, 2021 L); - (Wendin i Nyberg, 2021 H)	- (Eckl, 2021 L); - (Siddiqui, Zannou, 2022 H)
	Spożycie	- (Graça, 2019 L); 0 (Szenderák, 2022 L)	- (Florença, 2022 L); - (Siddiqui, Alvi, 2022 H); - (Toti, 2020 H);	
Wstręt	Ogólne poparcie		**Wyniki spójne -**	
	Intencja	- (Onwezen, 2021 L)	- (Ardoin i Prinyawiwatkul, 2021 H); - (Batat i Peter, 2020 H); - (Deroy, 2015 H); - (Kröger 2022 L); - (Mina, 2023 L) - (Onwezen, 2021 L); - (Siddiqui, Alvi,	

			2022 H); - (Toti, 2020 H); - (Wassmann, 2021 L); - (Wendin i Nyberg, 2021 H)	
	Spożycie		- (Florença, 2022 L)	
Poczucie własnej skuteczności	Ogólne poparcie		**Wyniki wstępne +**	**Wyniki wstępne +**
	Intencja		+ (Ardoin i Prinyawiwatkul, 2021 H); + (Kröger, 2022 L)	+ (Onwezen, 2021 L)
	Spożycie	+ (Graça, 2019 L)		+ (Giordano, 2017 L)
Otwartość na doświadczenie	Ogólne poparcie			
	Intencja		+ (Kröger, 2022 L)	+ (Nguyen, 2022 L)
	Spożycie			+ (Nguyen, 2022 L)
Neurotyczność	Ogólne poparcie			
	Intencja		0 (Kröger, 2022 L)	
	Spożycie			
Ugodowość	Ogólne poparcie			
	Intencja		0 (Kröger, 2022 L)	
	Consumption			
ZMIENNE SPOŁECZNO-DEMOGRAFICZNE				
Płeć żeńska	Ogólne poparcie	**Wyniki wstępne +**	**Wyniki spójne -**	**Wyniki wstępne 0**
	Intencja	+ (Graça, 2019 L); 0 (Szenderák, 2022 L)	- (Dagevos, 2020 H); - (Kauppi, 2019 H); - (Kröger, 2022 L); 0 (Mancini, 2019 L); - (Mina, 2023 L); - (Siddiqui, Alvi, 2022 H); - (Siddiqui, Bahmid, 2023 L); 0 (Toti, 2020 H); - (Wassmann, 2021 L); - (Wendin i Nyberg, 2021 H)	
	Spożycie	+ (Siddiqui, Alvi, 2022 H); + (Siddiqui, Bahmid, 2023 L); 0 (Nguyen, 2022 L); 0 (Szenderák, 2022 L)	- (Florença, 2022 L); 0 (Nguyen, 2022 L); - (Weinrich, 2019 L)	0 (produkty na bazie grzybów - De Cianni, 2023); 0 (produkty na bazie grzybów - Eckl, 2021 L)
Młodszy wiek	Ogólne poparcie	**Wyniki spójne +**	**Wyniki spójne +**	**Wyniki wstępne 0**

	Intencja	0 (Graça, 2019 L); 0 (Nguyen, 2022 L); + (Szenderák, 2022 L)	+ (Dagevos, 2020 H); + (Eckl, 2021 L); 0 (Kröger, 2022 L); - (u dzieci - Kröger 2022 L); + (Mina, 2023 L); + (Toti, 2020 H); 0 (Wassmann, 2021 L); + (Weinrich, 2019 L); + (Wendin i Nyberg, 2021 H)	0 (produkty na bazie grzybów - De Cianni, 2023); + (produkty na bazie grzybów - Eckl, 2021 L); 0 (Nguyen, 2022 L)
	Spożycie	+ (Siddiqui, Alvi, 2022 H); + (Siddiqui, Bahmid, 2023 L); + (Szenderák, 2022 L)	+ (Florença, 2022 L)	
Wykształcenie	Ogólne poparcie	**Wyniki spójne +**	**Wyniki spójne 0**	**Wyniki wstępne 0**
	Intencja	+ (Graça, 2019 L); + (wyższe spożycie produktów roślinnych- Siddiqui, Bahmid, 2023 L); + (spożycie - Szenderák, 2022 L); 0 (intencja do zapłaty - Szenderák, 2022 L)	+ (Dagevos, 2020 H); 0 (Eckl, 2021 L); 0 (Kauppi, 2019 H); 0 (Kröger, 2022 L); + (Mina, 2023 L); 0 (Wassmann, 2021 L); + (Wendin i Nyberg, 2021 H)	0 (produkty na bazie grzybów - De Cianni, 2023); 0 (produkty na bazie grzybów - Eckl, 2021 L); 0 (Nguyen, 2022 L)
	Spożycie	+ (Szenderák, 2022 L)		
Dochód	Ogólne poparcie	**Wyniki wstępne +**		
	Intencja	+ (Graça, 2019 L)		0 (produkty na bazie grzybów - Eckl, 2021 L)
	Spożycie	+ (Siddiqui, Bahmid, 2023 L); 0 (Szenderák, 2022 L)	+ (Florença, 2022 L)	

Nota. APF = alternatywne źródła białka; Produkty na bazie grzybów = przeglądy badające tylko alternatywne źródła białka na bazie grzybów Intencja = przeglądy badające intencję, aprobatę, włączenie do diety APF jako wskaźniki wyboru APF; Spożycie = przeglądy badające behawioralne wskaźniki wyboru APF, takie jak spożycie lub zakup.

0 – przegląd dostarcza albo (1) mieszanych wyników, np., wskazuje, że niektóre badania oryginalne pokazały istotne pozytywne związki, podczas gdy inne pokazały brak związku; (2) nieistotne wyniki, t.j. włączone badania oryginalne wskazały na brak istotnych wyników; - przegląd dostarcza wyników dla negatywnych związków, t.j., istnieje negatywny związek między determinantem na poziomie indywidualnym i wskaźnikiem wyboru APF; + - przegląd dostarcza wyników dla pozytywnych związków, t.j., istnieje istotny pozytywny związek między determinantami na poziomie indywidualnym a wskaźnikiem wyboru APF.
H = przegląd z ogólnie wysokim ryzykiem błędu; L = przegląd z niskim ryzykiem błędu, ocena została wykonana przy użyciu narzędzia ROBIS.

Wyniki spójne + = wyniki wskazują na spójne poparcie w > 66% pozytywnych związków w przeglądach (k ≥ 3; np., 3 z 3, 3 z 4 itd.); Wyniki spójne - = wyniki wskazują na spójne poparcie w > 66% negatywnych związków w przeglądach (k ≥ 3; np., 3 z 3, 3 z 4 itd.); Wyniki wstępne + = wyniki wskazują na wstępne poparcie między 51% a 66% przeglądów pokazujących pozytywne związki (k ≥ 3, np., 2 z 3, 4 z 6; lub 2 z 2 wskazujących na pozytywne związki); Wyniki wstępne - = wyniki wskazują na wstępne poparcie między 51% a 66% przeglądów pokazujących negatywne związki = (k ≥ 3, np., 2 z 3, 4 z 6; lub 2 z 2 wskazujących na negatywne związki); Wyniki spójne 0 = wyniki wskazują na spójne poparcie mieszanych lub braku związków dla ≥ 51% przeglądów (k ≥ 4, np., 3 z 4, 3 z 5; lub 3 z 3 braku/mieszanych związków); Wyniki wstępne 0 = wyniki wskazują na wstępne poparcie dla braku związków (dla 2 z 3 przeglądów, lub 2 z 2 przeglądów wskazujących na brak/mieszane związki);

Badanie 2

(Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., Luszczynska, A. (2024). Types of built food environment and their characteristics associated with alternative protein choices by consumers: Systematic review and evidence-based typology. *International Journal of Behavioral Nutrition and Physical Activity*, *21*(1). https://doi.org/10.1186/s12966-024-01606-6.)

Cele Badania

Celem badania była identyfikacja cech struktur zbudowanego środowiska żywnościowego, które mogą stanowić bariery lub czynniki sprzyjające wyborowi produktów z APF. Zbadano: (a) nieformalne środowiska żywieniowe (targi, uliczni sprzedawcy, kioski oraz sprzedawcy mobilni) oraz (b) formalne środowiska żywieniowe (supermarkety, hipermarkety, sklepy detaliczne, targi rolnicze, restauracje, instytucjonalne placówki, sprzedawcy mobilni oraz sprzedawcy internetowi).

Metoda Badania 2

Badanie zostało przeprowadzone zgodnie ze standardami PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) i zostało prerejestrowane w bazie PROSPERO (nr. #CRD42023388700).

Przeprowadzono przegląd systematyczny 11 baz danych zawierających recenzowane czasopisma z dziedzin ekonomii, biznesu, rolnictwa, nauk medycznych i społecznych, dostępnych za pośrednictwem platformy EBSCO (Academic Search Ultimate, PsycInfo, PsycArticles, Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier oraz Academic Research

Source eJournals). Dodatkowo przeszukano bazy Web of Science oraz SCOPUS, CORDIS i Open Research Europe (ORE). Wyszukiwanie obejmowało artykuły opublikowane do marca 2023 roku. Ocena ryzyka błędu została przeprowadzona za pomocą narzędzia Joanna Briggs Institute Critical Appraisal Tools.

Strategia przeszukiwania opierała się na trzech grupach słów kluczowych: (1) alternatywne źródła białka (np. "seaweed*" OR "alga*" OR "insect*") (2) fizyczne środowisko zbudowane (np. "shop*" OR "retail*" OR "cater*" OR "restaurant*") oraz (3) słowa kluczowe związane z konsumentami i zachowaniem (np. "intake" OR "food" OR "consume*" OR "eat"). Słowa kluczowe dobrano na podstawie istniejących przeglądów dotyczących APF oraz typologii środowiska żywnościowego według Downs i in. (2020), a ich trafność została skonsultowana z zespołem konsorcjum projektu „From niche to mainstream: alternative proteins for everybody and everywhere – LIKE-A-PRO," nr projektu 10108396; Horizon Europe.

Zastosowano następujące kryteria włączenia: (1) ilościowe lub/i jakościowe badania oryginalne opublikowane w recenzowanych czasopismach w języku angielskim; (2) badania dotyczące żywności opartej na alternatywnych białkach, w tym białka na bazie roślin, grzybów, bakterii lub innych alternatywnych źródeł białka, takich jak kryl, a także kombinacji białka mięsnego i roślinnego; oraz (3) badania analizujące zbudowane i/lub fizyczne struktury środowiskowe – zgodnie z typologią zbudowanego środowiska żywnościowego według Downs i in. (2020) – w których europejscy konsumenci dokonywali wyborów dotyczących produktów z APF. Badania oryginalne włączano do przeglądu, jeżeli (4) omawiały jakikolwiek rodzaj powiązania między cechami środowiska żywnościowego a (a) wskaźnikami wyborów konsumentów, takimi jak postrzegana ekspozycja/sposoby prezentacji żywności w środowisku zbudowanym, zamiar zakupu, zamiar spożycia, rzeczywiste spożycie

oraz rzeczywista sprzedaż, lub (b) wskaźnikami dostępności żywności w danym środowisku żywnościowym.

Kryteria wykluczenia były następujące: (1) badania nie uwzględniające oryginalnych danych; (2) rozprawy doktorskie, protokoły, materiały konferencyjne lub rozdziały książek; (3) badania koncentrujące się wyłącznie na ograniczeniu spożycia mięsa bez włączania APF do diety; (4) badania dotyczące zwiększenia spożycia owoców lub warzyw bez szczegółowych danych na temat roślinnych źródeł białka; (5) badania dotyczące wyłącznie środowiska fizycznego w Azji, Afryce lub Ameryce Południowej, obejmujące lokalnie pozyskiwane owady oraz ich lokalne spożycie lub lokalny handel; (6) badania dotyczące żywności innowacyjnej bez informacji o tym, czy jest ona wyprodukowana z alternatywnych źródeł białka lub z ich udziałem; (7) badania dotyczące wyborów konsumentów w odniesieniu do mięsa in vitro, bez dodatku alternatywnych źródeł białka; (8) badania koncentrujące się na czynnikach geograficznych, takich jak różnice między krajami lub regionami; oraz (9) badania analizujące produkty APF jako suplementy diety lub pasze dla zwierząt.

Wyniki Badania 2

Łącznie do przeglądu systematycznego włączono *k*=36 badań oryginalnych. Prawie połowa badań miała charakter ilościowy i przekrojowy (*k* = 15, 41,6%), *k* = 11 (30,5%) badań było badaniami eksperymentalnymi, *k* = 9 (25%) – badaniami jakościowymi, natomiast *k* = 2 (5,5%) stanowiły badania z wykorzystaniem tzw. mixed methods. Wyniki pokazały, że 24 spośród włączonych publikacji charakteryzowały się niskim ryzykiem błędu, trzy badania – umiarkowanym ryzykiem, a cztery – wysokim ryzykiem błędu (ocenianego narzędziem Joanna Briggs Institute CAT).

Zakodowane dane zostały przyporządkowane do następujących kategorii: (a) rodzaj fizycznej struktury zbudowanego środowiska, zgodnie z taksonomią Downs i in. (2020), oraz (b) rodzaj charakterystyk danego środowiska, tj. poziom mezo (np. dostępność, lokalizacja produktów oraz stosowane strategie promocji) oraz poziom mikro (np. postrzeganie dostępności przez interesariuszy, normy społeczne, nawyki zakupowe, preferencje dotyczące lokalizacji oraz okazje do spożycia produktów APF) (Pfadenhauer, 2017). Wyniki dotyczące różnych rodzajów APF (produktów roślinnych, na bazie insektów oraz innych źródeł APF) podzielono w celu określenia potencjalnych różnic.

Supermarkety

Liczba produktów APF w supermarketach systematycznie rośnie — w latach 2014–2021 podwoiła się, przy czym roślinne zamienniki mięsa odnotowały wzrost o 150% (Aerni i in., 2011). Roślinne APF są jednak umieszczane w mniej eksponowanych miejscach, rzadziej opatrzone oznaczeniami promocyjnymi i postrzegane przez konsumentów jako „ukryte" (Brooker i in., 2022). Sprzedawcy oczekują wyraźnych sygnałów popytu przed wprowadzeniem nowych produktów APF i obawiają się, że lokowanie ich w działach mięsnych obniży zyski supermarketu (Brooker i in., 2022). Koncentracja sprzedawców na kanałach internetowych zamiast na sprzedaży w supermarketach może być przez konsumentów postrzegane jako bariera (Gravely i Fraser, 2018). Aby zwiększyć zaufanie konsumentów, zaleca się szeroką dystrybucję produktów APF na bazie insektów w supermarketach i innych sklepach spożywczych (Gravely i Fraser, 2018). Konsumenci wskazują ponadto, że brak dostępności tego rodzaju produktów (APF oparte o białka z insektów) w supermarketach stanowi barierę dla zamiaru ich spożycia (Menozzi i in., 2017).

Restauracje

Eksperci przewidują, że zarówno roślinne APF, jak i te na bazie insektów staną się silnym trendem w europejskich restauracjach. Oczekuje się również kontynuacji trendu wykorzystywania lokalnie pozyskiwanych składników, przy malejącej roli produktów pochodzących z dalszych regionów (Schwark i in., 2020). Postrzegana dostępność produktów APF w restauracji została zidentyfikowana jako czynnik determinujący decyzje konsumentów o ich zakupie. Przykładowo, przekonanie konsumentów o łatwości znalezienia roślinnych APF w menu restauracji wiązało się z większą gotowością do zapłaty za tego rodzaju żywność (Palmieri i Forleo, 2022).

Większa częstotliwość jedzenia w restauracjach wiązała się z większą gotowością do zapłaty za roślinne alternatywy mięsa (Ortega i in., 2022). Wśród kobiet wyższa częstotliwość odwiedzania restauracji z przyjaciółmi i rodziną była związana z postrzeganiem żywności na bazie mikroalg jako zdrowej, zrównoważonej i odżywczej, natomiast wśród mężczyzn wiązała się z negatywnym postrzeganiem tych produktów, np. jako mało zdrowych lub o niskiej wartości odżywczej (Weinrich i Elshiewy, 2023). Wyniki dotyczące różnic płciowych są zbieżne z wcześniejszymi badaniami wskazującymi, że wyższy poziom męskości wiąże się z mniejszą akceptacją społecznych sytuacji jedzenia w restauracjach obejmujących spożycie produktów bezmięsnych (Bogueva i in., 2022).

Badania podkreślają znaczenie norm społecznych i kontekstu społecznego w spożyciu roślinnych APF w restauracjach wegetariańskich/wegańskich (Bogueva i in., 2022). Młodzi mężczyźni jedzący mięso częściej decydowali się na roślinne burgery APF w restauracjach wegetariańskich pod wpływem określonych sygnałów społecznych, takich jak obecność innych mężczyzn czekających w kolejce po burgera wegetariańskiego lub spożywanie posiłku w towarzystwie partnerki romantycznej (Bogueva i in., 2022). Z kolei odwiedzanie takich restauracji i prezentowanie się w mediach społecznościowych jako osoba jedząca w restauracji wegetariańskiej było postrzegane jako zagrożenie dla męskości (Bogueva i in.,

2022). Ponadto, osoby jedzące mięso i fleksitarianie deklarowali niską akceptację spożywania roślinnych APF podczas jedzenia w restauracjach lub biznesowych lunchów ze współpracownikami (Michel i in., 2021).

Restauracje zostały wskazane jako drugie najbardziej preferowane miejsce, w którym konsumenci chcieliby wypróbować różne rodzaje żywności innowacyjnej, w tym APF na bazie insektów i roślinne (festiwale żywności były miejscem najbardziej preferowanym, natomiast domy, kawiarnie, puby i bary – miejscami mniej preferowanymi) (Motoki i in., 2022).

Włączone badania pokazują, że widoczna obecność insektów (tj. widoczny jest cały owad) w daniach restauracyjnych obniża chęć zakupu, oczekiwaną smakowitość i atrakcyjność potraw w porównaniu z daniami, w których insekty są niewidoczne lub opisane niejednoznacznie (Baker i in., 2016). Dlatego restauracje stosują strategie, takie jak niejasne nazwy potraw czy podanie maskujące składniki, aby zmniejszyć neofobię żywieniową (Cai i in., 2021). Brak widocznych insektów wiąże się z niższym postrzeganym ryzykiem i mniejszym lękiem podczas jedzenia tych dań, co zwiększa chęć ponownego odwiedzenia takich restauracji (Ali i Ali, 2022).

Sprzedawcy online

Cztery badania analizowały czynniki związane z wyborami konsumentów dotyczącymi APF na bazie insektów (Porretta i in., 2019; Herbert i Beacom, 2021; Reverberi, 2021; Pippinato i in., 2020).

Dostępność tych produktów opiera się głównie na sprzedaży internetowej – europejscy producenci APF korzystają z e-commerce znacznie częściej niż z tradycyjnych punktów sprzedaży (Pippinato i in., 2020). Może to jednak ograniczać zaufanie konsumentów do APF, dlatego podkreśla się potrzebę szerszej obecności tych produktów w supermarketach i lokalnych sklepach (Reverberi, 2021). Konsumenci nie zgadzają się, aby żywność na bazie

owadów była dostępna wyłącznie online – preferują jej obecność w różnych punktach sprzedaży (Porretta i in., 2019; Herbert i Beacom, 2021).

Pozostałe wyniki barier i facylitatorów dla danych struktur fizycznego środowiska zbudowanego zostały szerzej opisane w Tabeli 2 oraz w Publikacji 2.

Dyskusja Badania 2

Kluczowym, uniwersalnym czynnikiem sprzyjającym jest dostępność (faktyczna i postrzegana). Wykazano również determinanty specyficzne dla konkretnych struktur fizycznych, w których sprzedawana jest żywność typu APF, sposób ekspozycji produktów (supermarkety), rutyny zakupowe (sklepy spożywcze) oraz niedopasowanie działań sprzedawców do oczekiwań konsumentów(e-commerce). Istotne jest, że związek danego czynnika z wyborem APF zależy od rodzaju białka – np. normy społeczne dotyczące męskości stanowią barierę dla produktów roślinnych w restauracjach, lecz nie mają takiego znaczenia w przypadku białka z insektów.

Tabela 2
Rodzaj struktur środowiska zbudowanego oraz czynniki związane z wyborem APF przez konsumentów.

Rodzaj struktury środowiska zbudowanego	Rodzaj alternatywnych źródeł białka	Bariery i facylitatory w środowisku zbudowanym związane z wyborami poszczególnych APF przez konsumentów
Supermarkety	**APF na bazie roślin**	**Bariery:** 1. APF są postrzegane przez konsumentów jako trudne do znalezienia (umieszczane w mniej widocznych miejscach, niespójności w ekspozycji między supermarketami, krótsza ważność). 2. Bariery w dostępności mogą wynikać z przekonań sprzedawców: (a) lepiej poczekać na wyraźny wzrost popytu przed zwiększeniem dostępności, (b) włączenie APF do działów z mięsem lub nabiałem może obniżyć zyski supermarketu, (c) umieszczenie APF z dala od działów mięsnych może odpowiadać preferencjom wegetarian. 3. Konsumenci są skłonni zapłacić więcej za APF w międzynarodowych sieciach niż w dyskontach krajowych (postrzegana niższa jakość w dyskontach stanowi barierę).
	APF na bazie insektów	**Bariery:** 1. Wykorzystywanie przez sprzedawców e-commerce (zamiast zwiększania dostępności w supermarketach) może stanowić barierę dla wzrostu spożycia. 2. Postrzegany brak dostępności w supermarketach jest barierą dla intencji konsumentów do spożywania tych produktów. **Facylitatory:** 1. Zaufanie konsumentów do APF może być wyższe, jeśli produkty te są szeroko dostępne w supermarketach (zamiast być sprzedawane głównie przez e-commerce).
Sklepy spożywcze/inne miejsca sprzedaży	**APF na bazie roślin**	**Bariery:** 1. Sprzedaż APF w działach wegetariańskich lub z produktami roślinnymi wiąże się z niższą sprzedażą, natomiast umieszczanie ich w działach mięsnych – z wyższą sprzedażą. 2. Kluczową barierą wskazywaną przez konsumentów chcących spróbować/jeść APF jest: „APF nie są dostępne tam, gdzie zwykle robię zakupy spożywcze” (uwaga: osoby niezdecydowane rzadziej wskazują tę barierę). 3. Dostępność APF jest ograniczona głównie do sklepów specjalistycznych i sprzedaży internetowej. **Facylitatory:**

Tabela 2
Rodzaj struktur środowiska zbudowanego oraz czynniki związane z wyborem APF przez konsumentów.

Rodzaj struktury środowiska zbudowanego	Rodzaj alternatywnych źródeł białka	Bariery i facylitatory w środowisku zbudowanym związane z wyborami poszczególnych APF przez konsumentów
		1. Sprzedaż produktów z APF prezentowanych obok produktów mięsnych (w tych samych lodówkach) wiąże się z wyższą sprzedażą APF; lodówki widoczne od wejścia do sklepu: wyższa sprzedaż APF. 2. Częste zakupy produktów „bio" wiążą się z wyższą skłonnością do płacenia. 3. Częste zakupy w sklepach ze zdrową/ekologiczną żywnością wiążą się z włączeniem do diety APF. 4. Dostępność produktów APF w różnych kanałach sprzedaży detalicznej (nie tylko w sklepach specjalistycznych lub online) jest zgodna z preferencjami konsumentów. 5. Zakup produktów APF jest bardziej prawdopodobny wśród studentów robiących zakupy poza kampusem w porównaniu z tymi, którzy kupują żywność głównie na terenie kampusu.
	APF na bazie insektów	**Charakterystyki neutralne** 1. Podobna (niska) intencja zakupu oraz postrzegana atrakcyjność niezależnie od rodzaju opakowania (z widocznymi insektami vs. proszek z insektów + nazwa łacińska).
Targi	**APF na bazie roślin**	**Bariery:** 1. Konsumenci rzadziej dokonują zakupów na małych targach rolniczych niż w popularnych, większych sklepach spożywczych (np. w drodze z pracy do domu, przy lub w pobliżu przystanku transportu publicznego).
	APF na bazie insektów	**Facylitatory** 1. Starsi konsumenci są skłonni kupować produkty APF, jeśli są one dostępne od lokalnych producentów na lokalnych targach rolniczych.
Restauracje	**APF na bazie roślin**	**Bariery:** 1. Młodzi mężczyźni jedzący mięso: bycie postrzeganym jako konsument APF w restauracji wegetariańskiej może stanowić zagrożenie dla męskości; ustawianie się w kolejce razem z innymi mężczyznami lub odwiedzanie restauracji z partnerką romantyczną może zmniejszać tę barierę. 2. Przekonania o niskiej akceptacji społecznej jedzenia APF stanowią barierę dla akceptacji spożywania APF w restauracjach lub podczas lunchów biznesowych.

Tabela 2
Rodzaj struktur środowiska zbudowanego oraz czynniki związane z wyborem APF przez konsumentów.

Rodzaj struktury środowiska zbudowanego	Rodzaj alternatywnych źródeł białka	Bariery i facylitatory w środowisku zbudowanym związane z wyborami poszczególnych APF przez konsumentów
		3. Wśród mężczyzn częste jadanie poza domem w restauracjach z przyjaciółmi (wyniki dla mężczyzn z Holandii i Niemiec, ale nie z Francji) może stanowić barierę. **Facylitatory:** 1. Prognozy ekspertów haute cuisine: APF będzie silnym trendem w restauracjach w UE (razem z żywnością lokalną). 2. Tworzenie wizerunku społecznego restauracji jako promującej innowacyjną żywność; dyskurs szefów kuchni dotyczący zrównoważonego rozwoju i autentyczności. 3. Jedzenie APF uznawane jest za bardziej odpowiednie w sytuacjach nieformalnych (w porównaniu z bardziej formalnymi, uroczystymi okazjami). 4. Łatwość znalezienia APF w menu przez konsumentów wiąże się z wyższą skłonnością do płacenia. 5. Restauracje są najbardziej preferowanym lub drugim najbardziej preferowanym miejscem, w którym konsumenci są skłonni spróbować APF (w porównaniu z kawiarniami, pubami, barami i domem). 6. Wyższa częstotliwość jedzenia poza domem w restauracjach wiąże się z wyższą skłonnością do płacenia.
	APF na bazie insektów	**Bariery:** 1. Większość (68%) konsumentów uważała, że insekty nie są serwowane w restauracjach typu gourmet. **Facylitatory:** 1. Restauracje wskazywane jako najbardziej preferowane środowisko do spróbowania APF na bazie insektów. Najlepiej „z ekspertem" oraz „z kimś, kto potrafi je przygotować". 2. Wizerunek restauracji jako podmiotu promującego ochronę środowiska. 3. Insekty niewidoczne w potrawie (w przeciwieństwie do insektów widocznych), niejednoznaczna nazwa, celowe upiększenie i dekorowanie potrawy wiążą się z niższym

Tabela 2

Rodzaj struktur środowiska zbudowanego oraz czynniki związane z wyborem APF przez konsumentów.

Rodzaj struktury środowiska zbudowanego	Rodzaj alternatywnych źródeł białka	Bariery i facylitatory w środowisku zbudowanym związane z wyborami poszczególnych APF przez konsumentów
		poziomem lęku przy próbowaniu nowego APF, wyższą atrakcyjnością oraz większym prawdopodobieństwem zakupu i spożycia APF.
Szkoły	**APF na bazie roślin**	**Bariery:** 1. Szkoły publiczne nie oferują APF podczas lunchu.
Sprzedawcy online	**APF na bazie insektów**	**Bariery:** 1. E-commerce jest 5 razy częściej wskazywany przez producentów jako kanał dystrybucji (w porównaniu z fizycznymi miejscami sprzedaży, np. sklepami spożywczymi). 2. Preferencje konsumentów wskazują, że APF powinny być dystrybuowane w miejscach, w których zwykle kupują żywność (supermarkety itp.), a nie głównie poprzez e-commerce.
Festiwale kulinarne	**APF na bazie roślin**	**Facylitatory:** 1. Wydarzenia kulinarne lub festiwale żywności postrzegane jako najbardziej odpowiednie środowisko do spróbowania nowego APF (dom, kawiarnie, puby: mniej preferowane). 2. Udział w wydarzeniu gastronomicznym lub wyjeździe.
	APF na bazie insektów	**Facylitatory:** 1. Wydarzenia kulinarne lub festiwale żywności postrzegane jako najbardziej odpowiednie środowisko do spróbowania APF na bazie insektów.
Automaty z jedzeniem	**APF na bazie roślin**	**Facylitatory:** 1. APF sprzedawane jako przekąska w automatach z jedzeniem.

Nota. APF – alternatywne źródła białka

Badanie 3

(Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2024). Geographical context of European consumers' choices of alternative protein food: A systematic review. *Food Quality and Preference*, *117* (11), 105174. https://doi.org/10.1016/j.foodqual.2024.105174)

Cele Badania

Wykorzystując metodę przeglądu systematycznego, Badanie 3 miało na celu syntezę empirycznych dowodów dotyczących czynników kontekstu geograficznego jako źródeł różnic w wyborach dietetycznych konsumentów, w odniesieniu do różnych produktów APF. Analizie podlegają: (i) różnice i podobieństwa między wyborami konsumentów w zależności od kraju europejskiego, w którym mieszkają; (ii) różnice między wyborami APF przez konsumentów mieszkających na obszarach wiejskich i miejskich w krajach europejskich; oraz (iv) związki między „lokalnym" pozycjonowaniem produktów z APF w krajach europejskich a wskaźnikami wyborów konsumenckich.

Metoda Badania 3

Badanie zostało przeprowadzone zgodnie ze standardami PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) i zostało prerejestrowane w bazie PROSPERO (nr. #CRD42023388700).

Przeprowadzono przegląd systematyczny 11 baz danych zawierających recenzowane czasopisma z dziedzin ekonomii, biznesu, rolnictwa, nauk medycznych i społecznych, dostępnych za pośrednictwem platformy EBSCO (Academic Search Ultimate, PsycInfo, PsycArticles, Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing

Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier oraz Academic Research Source eJournals). Dodatkowo przeszukano bazy Web of Science, SCOPUS, CORDIS oraz Open Research Europe (ORE). Wyszukiwanie obejmowało artykuły opublikowane do marca 2023 roku. Ocena ryzyka błędu została przeprowadzona za pomocą narzędzia Joanna Briggs Institute Critical Appraisal Tools.

Wyszukiwanie przeprowadzono z wykorzystaniem kombinacji trzech grup słów kluczowych odnoszących się do: (1) alternatywnych źródeł białka (np. „seaweed*" OR „alga*" OR „insect*") (2) środowiska fizycznego, w tym zmiennych kontekstu geograficznego umożliwiających prowadzenie porównań międzykrajowych lub międzykulturowych, środowiska miejskiego i wiejskiego oraz badania lokalności, a także zmiennych środowiska fizycznego (np. „cross-cultur*" OR „cross-countr*" OR „between-countr*" OR „between-cultur*") oraz (3) zachowań konsumenckich lub związanych z zachowaniem (np. „intake" OR „food" OR „consume*" OR „eat").

Słowa kluczowe zostały wybrane na podstawie istniejących przeglądów dotyczących APF, typologii środowiska żywnościowego opracowanej przez Downs i in. (2020), zmiennych kontekstu geograficznego analizowanych w badaniach nad nierównościami zdrowotnymi, takich jak kraj, region oraz obszary miejskie i wiejskie (por. Arcaya i in., 2015), a także modelu CICI (Pfadenhauer i in., 2017) a ich trafność została skonsultowana z zespołem badawczym pracującym w konsorcjum projektu „From niche to mainstream: alternative proteins for everybody and everywhere – LIKE-A-PRO."

Zastosowano następujące kryteria włączenia: (1) ilościowe lub/i jakościowe badania oryginalne, opublikowane w recenzowanych czasopismach w języku angielskim; (2) badania dotyczące żywności opartej na alternatywnych białkach, w tym białka na bazie roślin, grzybów, bakterii lub innych alternatywnych źródeł białka, takich jak kryl, a także kombinacji białka mięsnego i roślinnego; (3) badania analizujące różnice w wyborach APF w co najmniej

dwóch krajach europejskich, lub badające różnice w obszarach miejskich, podmiejskich i wiejskich, lub analizujące wpływ lokalności produkcji APF na wskaźniki wyborów konsumenckich; (4) badania mierzące wskaźniki wyborów konsumenckich, takie jak postrzegana dostępność produktu, intencja zakupu, intencja spożycia, rzeczywiste spożycie lub rzeczywista sprzedaż."

Kryteria wyłączenia były następujące: (1) badania nie uwzględniające oryginalnych danych; (2) rozprawy doktorskie, protokoły, materiały konferencyjne lub rozdziały książek; (3) badania koncentrujące się wyłącznie na ograniczeniu spożycia mięsa bez włączania APF do diety; (4) badania dotyczące zwiększenia spożycia owoców lub warzyw bez szczegółowych danych na temat roślinnych źródeł białka; (5) badania dotyczące wyłącznie środowiska fizycznego w Azji, Afryce lub Ameryce Południowej, obejmujące lokalnie pozyskiwane owady oraz ich lokalne spożycie lub lokalny handel; (6) badania dotyczące żywności innowacyjnej bez informacji o tym, czy jest ona wyprodukowana z alternatywnych źródeł białka lub z ich udziałem; (7) badania dotyczące wyborów konsumentów w odniesieniu do mięsa in vitro, bez dodatku alternatywnych źródeł białka; (8) badania porównujące wybory konsumentów wyłącznie w jednym kraju europejskim lub z krajem w Azji, Afryce lub Ameryce Południowej (bez porównań między krajami europejskimi) oraz (9) badania analizujące produkty APF jako suplementy diety lub pasze dla zwierząt.

Wyniki Badania 3

Łącznie do przeglądu systematycznego włączono k=25 badań oryginalnych. Badania przeprowadzono w 18 krajach europejskich, przy czym najczęściej analizowano dane z Niemiec (n = 8 badań, 32%), Danii (n = 7, 28%) oraz Wielkiej Brytanii (n = 5, 20%). Trzy badania porównywały 5 krajów, k = 3 obejmowały próby z 4 krajów, k = 3 dotyczyły 3 krajów, a k = 5 porównywało 2 kraje. Większość badań była ilościowa i przekrojowa (k = 23, 92%),

natomiast jedno badanie (4%) miało charakter eksperymentalny, a jedno (4%) – jakościowy. Żadne badanie nie zostało wykluczone na podstawie oceny jakości. Ogółem 23 badania charakteryzowały się niskim ryzykiem błędu, 1 badanie miało umiarkowane ryzyko błędu, a 1 – wysokie ryzyko błędu.

W analizach porównawczych reprezentowane były cztery regiony Europy — dla Północy najczęściej w badaniach oryginalnych uwzględniano Danię i Finlandię, dla Wschodu – Polskę i Czechy, dla Południa – Hiszpanię i Włochy, a dla Zachodu – Niemcy i Wielką Brytanię.

Wyniki dla konsumentów w Europie Północnej

Konsumenci z Danii wykazują pozytywne postawy i przekonania wobec produktów hybrydowych (łączących białka roślinne i mięso) oraz roślinnych APF. Produkty hybrydowe i roślinne oceniano wyżej niż mięso pod względem zdrowotności, etyczności, wpływu na środowisko i wartości odżywczej (Grasso i in., 2022). Podobne wyniki uzyskano wśród konsumentów z Wielkiej Brytanii i Hiszpanii, którzy również oceniali alternatywy mięsa jako zdrowsze, bardziej etyczne i ekologiczne, jednak nie przeprowadzono bezpośrednich porównań między krajami.

Stwierdzono istotny związek między determinantami wyborów (ochrona środowiska, zdrowie, zrównoważony rozwój) a deklarowanym zastępowaniem wieprzowiny i drobiu białkami na bazie roślin strączkowych w Danii, podczas gdy w Polsce związek ten był słabszy (Henn i in., 2022). Inne badanie wykazało podobną świadomość zdrowotną produktów z roślin strączkowych u konsumentów z Danii i Hiszpanii (Banovic i in., 2022).

Pozytywne postawy i przekonania nie zawsze przekładają się na silne intencje. W 3 z 5 badań (60%) dotyczących intencji związanych z APF wykazano, że duńscy konsumenci mają niższe intencje zakupu roślinnych APF lub produktów hybrydowych niż konsumenci z innych

krajów. Przykładowo, intencja zakupu produktów hybrydowych była niższa w Danii niż w Wielkiej Brytanii (Grasso i in., 2022). Podobnie, kobiety z Danii wykazywały słabe do umiarkowanych intencje zakupu APF (M = 3.33), podczas gdy w Rumunii, Niemczech, Finlandii i Islandii były one wyższe (Banovic & Sveinsdóttir, 2021).

Różnice dotyczyły także APF na bazie insektów – Duńczycy częściej niż Włosi deklarowali intencję ich spożycia, a różnice utrzymywały się nawet po interwencji edukacyjnej (Verneau i in., 2016, 2020). Obie grupy jednak zwiększyły swoje intencje po interwencji. Podsumowując, konsumenci z Danii mogą znajdować się na etapie rozważania zmiany: mimo pozytywnych postaw wobec APF ich intencje są często słabsze niż w innych krajach, choć w przypadku APF na bazie insektów wykazują silniejsze intencje niż Włosi.

Wyniki dla konsumentów w Europie Wschodniej

Polscy respondenci mieli niższy poziom wiedzy o innowacyjnej żywności, większą niepewność i rzadziej kupowali takie produkty niż konsumenci z Niemiec (Zabrocki, 2017). Wśród młodych konsumentów odsetek tzw. „innowatorów żywieniowych" (kupowanie nowych produktów od razu, gdy wejdą na rynek) i „wczesnych naśladowców" (kupowanie produktów żywieniowych po wcześniejszym przemyśleniu), wynosił w Niemczech 73%, podczas gdy w Polsce, Czechach i Słowacji tylko 24–36% (Barska, 2014). Silna niechęć do innowacyjnych APF występowała u 13–17% młodych osób z Polski, Czech i Słowacji, a nie była obserwowana u żadnych badanych z Niemiec. Dodatkowo motywy środowiskowe słabiej wiązały się z zastępowaniem mięsa APF w Polsce niż w Danii (Henn i in., 2022).

Podsumowując, konsumenci z Polski cechują się ograniczoną wiedzą o innowacyjnej żywności i relatywną niechęcią do nowych produktów, a ich postawy słabo przekładają się na intencje do zmiany zachowania. Podobne tendencje obserwowano w Czechach, gdzie

konsumenci wykazywali mniejszą chęć włączenia APF do diety (zwłaszcza na bazie insektów) niż w krajach takich jak Szwecja czy Finlandia.

Wyniki dla regionów miejskich vs wiejskich

Większość analizowanych badań (62,5%) nie wykazało istotnych różnic w wyborach APF (roślinnych i na bazie insektów) między tymi obszarami. Miejsce zamieszkania (miasto, wieś, małe miejscowości) nie różnicowało poziomu satysfakcji ze spożywania roślinnych zamienników mięsa w Belgii ani na chęć zastępowania produktów zwierzęcych roślinnymi APF w pięciu krajach europejskich (Dania, Niemcy, Polska, Hiszpania, Wielka Brytania). Podobnie w Portugalii i na Węgrzech nie stwierdzono związku między miejscem zamieszkania a włączeniem insektów do diety. Również w Wielkiej Brytanii nie obserwowano różnic w zakupach APF między obszarami o wysokim i niskim poziomie deprywacji społeczno-ekonomicznej.

Ogólnie, nowsze badania sugerują brak istotnych różnic między obszarami miejskimi i wiejskimi w wyborach APF. Możliwe są natomiast różnice między poszczególnymi miastami europejskimi, np. konsumpcja APF w Paryżu jest stosunkowo wysoka (ze względu na większą populację osób pochodzenia azjatyckiego); podobnie jest w Rennes (lokalna produkcja alg).

Wyniki dla lokalności produktów z APF

W 60% badań dotyczących lokalności produkcji czynnik ten okazała się być istotnym predyktorem intencji i spożywania APF przez konsumentów. Konsumenci z Danii częściej deklarowali spożycie roślinnych APF (z grochu i fasoli), jeśli były one produkowane lokalnie (Aaslyng & Højer, 2021). We Francji, Niemczech i Holandii 79% konsumentów preferowało lokalne zamienniki mięsa na bazie mikroalg (Weinrich & Elshiewy, 2019). W jednym badaniu obszary Francji o wysokiej lokalnej produkcji alg wiązały się z wyższym spożyciem APF, ale

efekt „produkcji krajowej” (vs import) nie był istotny (Lucas i in., 2019). Jedno badanie (Henn i in., 2022) nie wykazało wpływu lokalności na intencję zakupu roślinnych zamienników mięsa w kilku krajach europejskich. Podsumowując, większość badań sugeruje, że lokalność produkcji może różnicować włączanie do diety APF, ale wyniki zależą od definicji „lokalności” i rodzaju produktu.

Pozostałe wyniki zostały przedstawione na Rycinie 1.

Dyskusja Badania 3

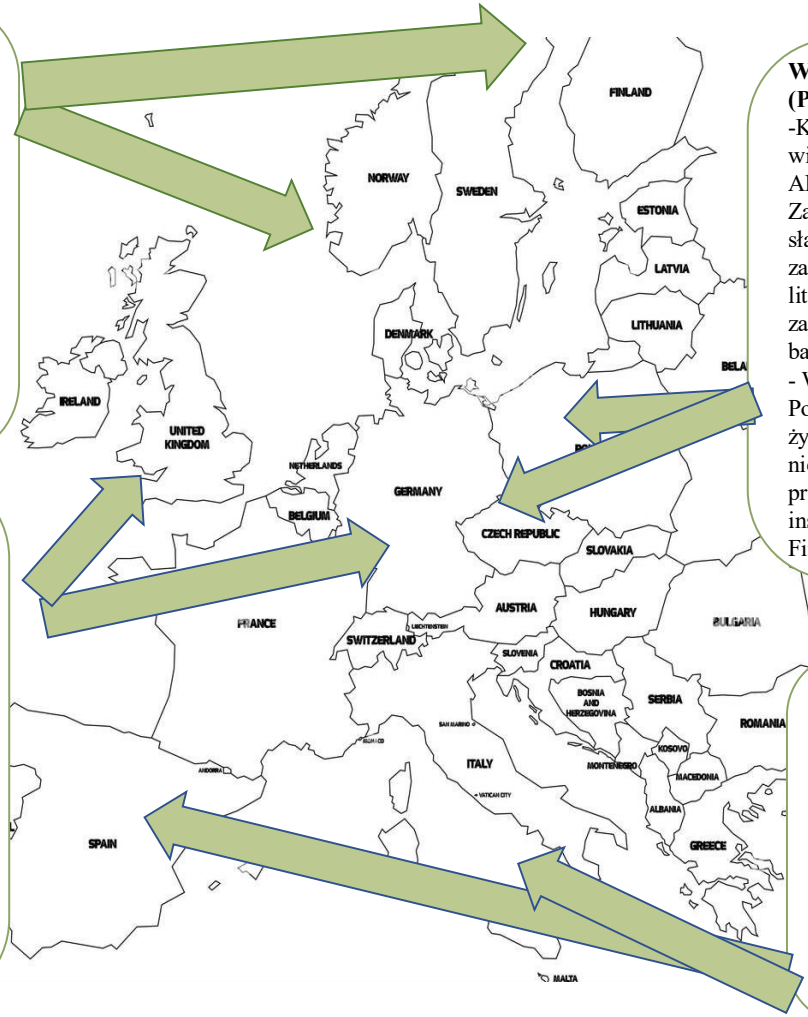
Ogólnie intencja do spożywania, próbowania i zakupu APF jest umiarkowana lub niska. Kluczowe różnice dotyczą włączenia do diety APF na bazie insektów — konsumenci z Danii wykazują wyższą chęć włączenia APF do diety niż konsumenci z Włoch, gdzie silne tradycje kulinarne i wysokie spożycie mięsa mogą utrudniać włączenie tego źródła białka do diety. Konsumenci z Danii reprezentują etap "kontemplacji" — charakteryzują się pozytywnymi postawami, lecz relatywnie niską intencją włączenia roślinnych APF do diety. Z kolei konsumenci z Polski znajdują się w fazie "stagnacji" — przejawiają mniej pozytywne postawy i niską gotowość do większego spożycia APF.

Rycina 1

Podusmowanie wyborów APF przez konsumentów w krajach Europy Północnej, Zachodniej, Wschodniej i Południowej.

Wyniki dla konsumentów z Danii i Finlandii (Przykład Europy północnej):
- Konsumenci z Danii znajdują się na etapie „kontemplacji zmiany", który można scharakteryzować jako pozytywne przekonania i postawy wobec alternatywnych źródeł białka na bazie roślin oraz produktów hybrydowych (mięso + białko roślinne), przy jednocześnie relatywnie niskiej intencji ich spożywania.
- Konsumenci z Finlandii, podobnie jak konsumenci z Danii, wykazują bardziej pozytywne postawy oraz silniejsze intencje włączania roślinnych APF do diety, a także bardziej pozytywne nastawienie do zakupu produktów opartych zarówno na białku roślinnym, jak i na insektach, w porównaniu z konsumentami z innych krajów.

Wyniki dla konsumentów z Niemiec i Wielkiej Brytanii (Przykład Europy zachodniej):
- Wśród konsumentów z Niemiec wskaźniki wyboru roślinnych APF oraz APF na bazie mikroalg były zbliżone do wyników odnotowanych w innych krajach Europy Zachodniej. W przypadku APF na bazie insektów niemieccy konsumenci wykazywali mniejszą gotowość do ich spożywania niż konsumenci z Europy Północnej, lecz większą niż konsumenci z Europy Wschodniej.
- W odniesieniu do produktów hybrydowych wyniki są niejednoznaczne — badania porównujące konsumentów z Wielkiej Brytanii z konsumentami z Hiszpanii i Danii wskazują na rozbieżności, podczas gdy intencje dotyczące spożywania roślinnych APF w tych krajach pozostają zbliżone do wyników obserwowanych w Niemczech.



Wyniki dla konsumentów z Polski i Czech (Przykład Europy wschodniej):
-Konsumenci z Polski wykazują niższy poziom wiedzy na temat żywności innowacyjnej, w tym APF, w porównaniu z konsumentami z Niemiec. Zaobserwowano, że przekonania wobec APF są słabo związane z deklarowaną intencją zastąpienia mięsa białkiem roślinnym. Ponadto literatura dostarcza niespójnych wyników w zakresie intencji zamiany mięsa na produkty bazujące na roślinach strączkowych.
- Wśród konsumentów z Czech, podobnie jak w Polsce, odnotowano ograniczoną wiedzę o żywności innowacyjnej względem grupy niemieckiej. Wykazują oni także mniej przychylne postawy wobec APF na bazie insektów w porównaniu z konsumentami z Finlandii i Szwecji

Wyniki dla konsumentów z Włoch i Hiszpanii (Przykład Europy południowej):
-Konsumenci z Włoch wykazują niższą intencję spożywania produktów na bazie insektów w porównaniu z konsumentami z Europy Północnej i Zachodniej.
-Wśród konsumentów z Hiszpanii wyniki są niespójne i ograniczone, przy czym dotyczą głównie produktów hybrydowych (mięso + białko roślinne); jednocześnie obserwuje się wyraźniejsze preferencje wobec APF na bazie roślin.

Badanie 4

(Zaleskiewicz, H., Kulis, E., Szczuka, Z., Banik, A., Alcat, G., Ávila, C., Cardoso, I., Başak Coşkun, F., Kornafel, A., Mai, L., Kolden Midtbø, L., Misiakowska, J., Oblak, M., Miličić, V., Queiroz, P., Sabbatini, G., Sandvad, B., Siwa, M., Solibakke, P., (...) & Luszczynska, A. (2026). Mapping determinants of alternative protein food intake across 13 European countries: food system stakeholders' perspectives. *International Journal of Behavioral Nutrition and Physical Activity*, *23,* 28. https://doi.org/10.1186/s12966-026-01891-3)

Cele Badania

Celem badania było stworzenie map systemu determinantów włączania APF do codziennej diety w 3 krajach Europy oraz analiza zależności między tymi determinantami. W pierwszym etapie identyfikowano kluczowe czynniki wspólne dla wielu krajów (tzw. kluczowe punkty wpływu; ang. leverage points), uwzględniając perspektywę głównych interesariuszy systemu żywnościowego: producentów, przetwórców żywności, detalistów, specjalistów ds. zdrowia i edukacji, decydentów oraz konsumentów. W drugim etapie analizowano powiązania między determinantami, w tym sekwencje i pętle sprzężeń zwrotnych wskazywane przez interesariuszy.

Metoda Badania 4

Zastosowano podejście *community-based system dynamics (CBSD)* (Hovmand, 2013) jako główną ramę metodologiczną badania; CBSD aktywnie angażuje interesariuszy w analizę problemu i traktuje ich jako „ekspertów" funkcjonowania systemu. Jedną z metod CBSD jest *Group Model Building*, wykorzystujący mapowanie systemu do tworzenia diagramów pętli przyczynowych (ang. causal loop diagrams, CLD), które graficznie

przedstawiają złożoność wzajemnych oddziaływań wśród czynników wpływających na problem (z perspektywy interesariuszy).

Przeprowadzono 17 warsztatów, w wyniku których opracowano 17 map systemu. Warsztaty odbyły się w 13 krajach: Austrii, Czechach, Danii, Francji, Niemczech, Grecji, Włoszech, Norwegii, Portugalii, Słowenii, Hiszpanii i Turcji, przy czym w Polsce zorganizowano 5 warsztatów. Uzyskano zgodę Komisji Etycznej Uniwersytetu SWPS we Wrocławiu (nr. 01/E/03/2023). Dodatkowo zgoda została pozyskana od instytucji MOREFORSKING w Norwegii (nr. 301103, SIKT).

Warsztaty prowadzone były przez przeszkolonych moderatorów, działających według ustandaryzowanej procedury, opisanej we wcześniej przygotowanym podręczniku. Procedura obejmowała pięć etapów: identyfikację determinantów, określenie powiązań między nimi, stworzenie wstępnej mapy systemu, jej weryfikację oraz ostateczne zatwierdzenie przez uczestników. Do wizualizacji map i analizy danych wykorzystano oprogramowanie STICKE 3.0.

Łącznie w warsztatach wzięło udział 166 interesariuszy systemu żywnościowego. Reprezentowali oni różne sektory, m.in. przemysł przetwórstwa żywności (22,7%), sektor naukowy (16,0%), ochronę zdrowia (12,7%, głównie żywienie kliniczne), firmy z branży spożywczej zajmujące się produkcją i technologią (12,0%), młodych konsumentów (8,7%), przemysł surowców spożywczych (6,7%), rolnictwo i akwakulturę (6,0%), handel i gastronomię (5,2%), organizacje pozarządowe (3,3%), instytucje publiczne (3,3%), marketing (2,0%) oraz inne sektory (1,4%). Szczegółowe informacje na temat uczestników znajdują się w Tabeli 3. W każdym kraju uczestniczyli przedstawiciele co najmniej trzech sektorów, z wyjątkiem Włoch (tylko sektor produkcji żywności) oraz Polski (tylko młodzi konsumenci w dwóch warsztatach).

Analiza danych

Pierwszy etap analizy miał na celu identyfikację tzw. kluczowych punktów wpływu (ang. leverage points), czyli zmiennych o wysokim potencjalnym wpływie na inne determinanty i dużym potencjale interwencji. Wykorzystano metodę analizy sieci (network analysis) przeprowadzonej w STICKE 3.0 i obliczono cztery miary centralności: (1) eigenvector – wysoka wartość wskazuje punkty wpływu w systemie; 2) degree – elementy wrażliwe na zmiany; (3) closeness – elementy bardziej odporne na zmianę; oraz (4) betweenness – punkty wejścia do systemu. W analizach omówiono determinanty o wysokiej centralności eigenvector oraz jednocześnie wysokich wartościach closeness i betweenness (Meadows, 1999; Murphy i Jones, 2020). Następnie zidentyfikowane punkty wpływu pogrupowano w szersze kategorie o wspólnych cechach.

W drugim etapie identyfikowano pętle sprzężeń zwrotnych (feedback loops) z wykorzystaniem oprogramowania KUMU. Skupiono się na pętlach obejmujących co najmniej jeden punkt wpływu oraz jego powiązania z innymi determinantami systemu.
Po wstępnej identyfikacji wszystkich pętli sprzężeń zwrotnych zastosowano dwa podejścia: (1) dla map zawierających <50 pętli – ich pełne podsumowanie; (2) dla ≥50 pętli – procedurę redukcji, polegającą na wyodrębnieniu pętli zawierających 10 zmiennych o najwyższych wartościach centralności (eigenvector, closeness, betweenness) oraz usunięciu zmiennych o niższych wartościach. Pozwoliło to na uzyskanie zestawu pętli pokazujących powiązania punktów dźwigni z innymi determinantami oraz identyfikację wspólnych wzorców w systemie.

Wyniki Badania 4

Determinanty zidentyfikowane jako punkty wpływu przedstawiono w Tabeli 4. Każda z 17 map systemu zawierała unikalny zestaw determinant, jednak kilka szerszych kategorii punktów wpływu było wspólnych dla co najmniej trzech map systemowych.

Wiedza konsumentów i edukacja na temat alternatywnych źródeł białka jako punkty wpływu

Interesariusze wskazali, że w ich opinii wiedza i edukacja konsumentów na temat APF mogą stanowić istotne punkty wpływu wiążące się z ich spożyciem. Wiedzę podzielono na trzy typy: (1) konceptualną – rozumienie produktu, jego wartości odżywczej i skutków zdrowotnych; (2) proceduralną – wiedzę o tym, jak przygotowywać i gotować APF; oraz (3) doświadczeniową – wynikającą z osobistych doświadczeń sensorycznych (np. smak, zapach) (Castro i in., 2018; Gorzelsky, 2013).

Determinanty te zidentyfikowano w 8 mapach systemu. Wskazywano na niską wiedzę ogólną w zakresie APF, ograniczoną wiedzę o przygotowaniu oraz słabe rozpowszechnienie informacji. Znajomość produktu pojawiała się w mapach Niemiec i Grecji. W Danii podkreślano znaczenie wiedzy o przygotowaniu APF, łączącej wiedzę formalną i doświadczeniową. W Polsce działania edukacyjne i polityki informacyjne były wskazywane jako punkty wpływu.

Normy społeczne jako punkty wpływu

Ta kategoria obejmuje determinanty związane z akceptacją APF przez otoczenie, ich postrzeganą popularność oraz znaczenie opinii innych. Występowały one w 7 mapach systemu. Przekonania dotyczące nawyków rodzinnych wskazywano we Francji i Danii, normy społeczne w Niemczech, a „trendy” (popularność APF wśród innych) w Portugalii. Zachęty społeczne i postrzeganie jedzenia APF jako normy społecznej zostały uwzględnione przez interesariuszy w 3 mapach z Polski.

Reklama, promocja i działania osób wpływowych jako punkty wpływu

Ta kategoria obejmuje działania i kampanie zachęcające do spożycia APF (inne niż edukacyjne), prowadzone przez osoby (np. influencerów), organizacje, instytucje lub władze publiczne. Zidentyfikowano je w 7 mapach systemu. W 4 mapach wskazano marketing, reklamę i promocję APF jako kluczowe punkty wpływu, a promocja przez influencerów była wskazana przez interesariuszy jako punkt wpływu w 3 mapach.

Spostrzegana zdrowotność, zbilansowanie i bezpieczeństwo produktów z APF jako punkty wpływu

Ta kategoria obejmuje przekonania konsumentów o zdrowotności i bezpieczeństwie APF , ich rzeczywistej wartości odżywczej oraz regulacji dotyczących ich składu. Zidentyfikowano ją w 5 mapach systemu. W 4 mapach wskazano, że skład APF może być postrzegany jako element zdrowej i zbilansowanej diety. Brak obaw o szkodliwość produktu wiązał się z zaufaniem do producentów APF (Portugalia), a kwestie regulacyjne jako punkt wpływu pojawiły się w Norwegii.

Pozytywne i negatywne emocje jako punkty wpływu

Punkty wpływu dotyczące złożonych emocji zidentyfikowano w czterech krajach: Czechach, Niemczech, Włoszech i Polsce. W szczególności wskazano neofobię (lęk przed nową lub nieznaną żywnością) oraz ciekawość jako istotne determinanty włączania do diety produktów z alternatywnymi proteinami.

Analiza pętli sprzężeń zwrotnych (feedback loops)

W pięciu krajach (Czechy, Dania, Francja, Portugalia, Słowenia) mapy zawierały wyłącznie jednokierunkowe powiązania, bez pętli sprzężeń zwrotnych. W trzech mapach (Norwegia, 1x Polska, Hiszpania) zidentyfikowano tylko jedną pętlę na kraj; każda składała się z dwóch wzajemnych powiązań (A↔B). W pozostałych sześciu krajach (Austria, Niemcy, Grecja, Włochy, 4x Polska, Turcja) występowały co najmniej trzy pętle sprzężeń zwrotnych. W analizie pętli sprzężeń zwrotnych z sześciu krajów (Austria, Niemcy, Grecja, Włochy, Polska, Turcja) stwierdzono, że pewne sekwencje powiązań były wspólne dla co najmniej połowy pętli.

Przykładowe wyniki analizy pętli sprzężeń zwrotnych (Włochy i Polska)

Połowa pętli sprzężeń zwrotnych w mapie z Włoch obejmowała potencjalnie wzmacniającą „spiralę wzrostową", która sprzyjała zwiększonemu spożyciu APF. Według włoskich interesariuszy wyższe bezpieczeństwo żywnościowe produktów APF może ułatwiać ich reklamę (np. jako wartościowej żywności), co z kolei zwiększa ciekawość konsumentów lub wzmacnia przekonanie, że APF są zdrowym wyborem, a także sprzyja preferencji produktów o mniejszym wpływie na środowisko i większym znaczeniu dla lokalnego rozwoju i tworzenia miejsc pracy. W ocenie interesariuszy takie procesy mogą następnie prowadzić do obniżenia cen żywności oraz dalszej poprawy bezpieczeństwa żywnościowego.

Dziesięć z 12 pętli sprzężeń zwrotnych w mapie z Polski obejmowało kolejny wzmacniający mechanizm sprzyjający zwiększeniu spożycia APF. W szczególności polscy interesariusze wskazywali, że dalsze badania nad produktami APF, dotyczące np. bezpieczeństwa i wartości odżywczej, mogą wydłużać trwałość tych produktów oraz ułatwiać ich wprowadzanie na rynek. Dłuższy okres przydatności do spożycia i większa atrakcyjność rynkowa mogą z kolei zwiększać zainteresowanie influencerów produktami z APF oraz ciekawość konsumentów i chęć spróbowania nowych, alternatywnych produktów

białkowych. Następnie rosnące zainteresowanie konsumentów i influencerów może dalej napędzać badania nad rozwojem i udoskonalaniem produktów z APF.

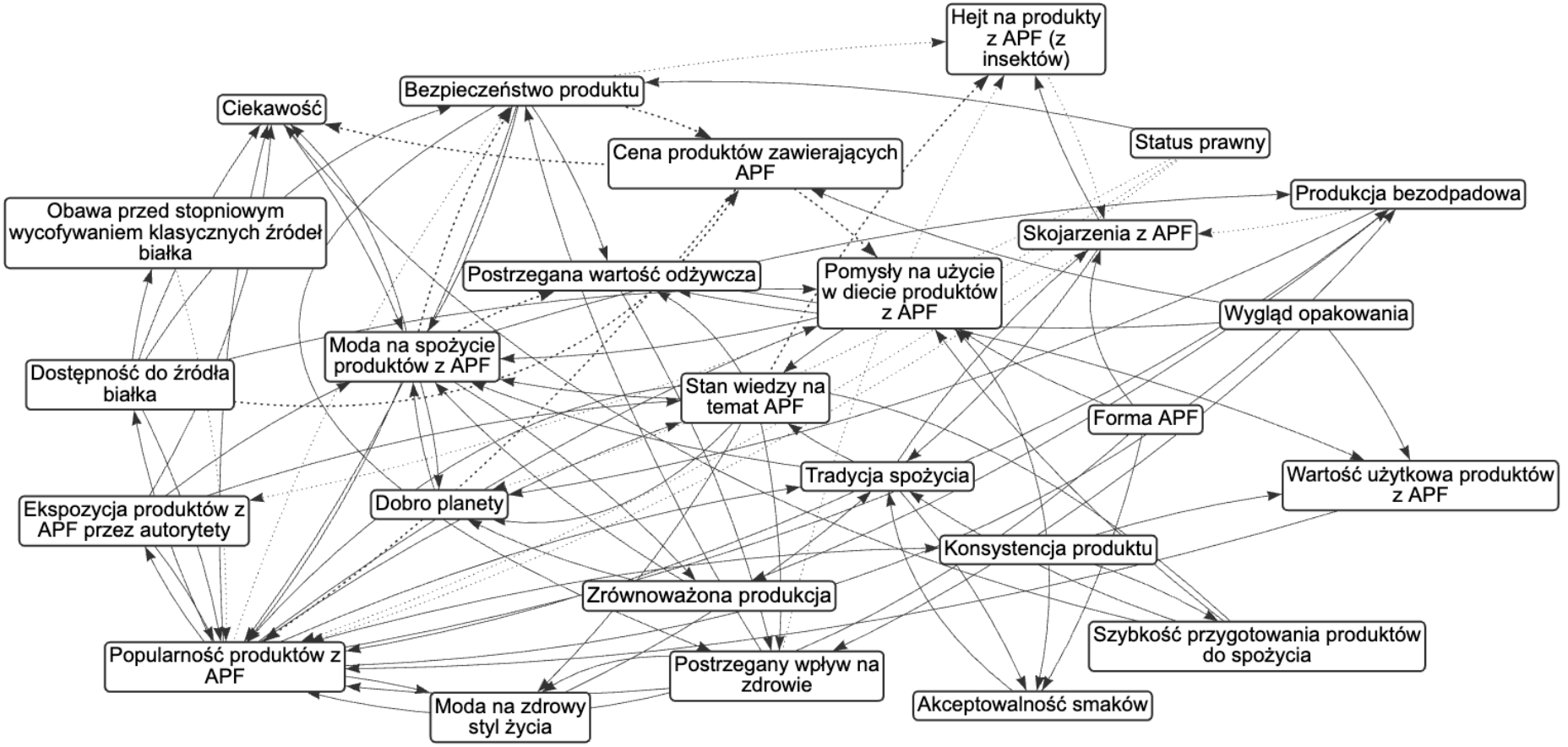
Dyskusja Badania 4

Niniejsze badanie dostarcza nowych wniosków dotyczących złożonych systemów uwarunkowań wyborów APF. Wyniki zgromadzone w analizie map systemu wskazują na rolę indywidualnych cech konsumentów, a także społecznych i fizycznych uwarunkowań środowiskowych na poziomie mezo i makro, wpływających na spożycie APF. Zmiany w tych uwarunkowaniach mogą wywoływać efekty kaskadowe rozprzestrzeniające się w całym systemie. Dlatego też punkty wpływu zidentyfikowane w niniejszym badaniu są potencjalnie najbardziej obiecującymi celami interwencji promujących APF.

Interesariusze uczestniczący w tym badaniu zidentyfikowali kilka pętli sprzężeń zwrotnych, które mogą sprzyjać włączaniu żywności opartej na białkach alternatywnych do codziennej diety. Pętle te mogą zainspirować interesariuszy systemu żywnościowego, w tym producentów żywności, specjalistów ds. marketingu, badaczy oraz konsumentów w całej Europie, do opracowywania nowych interwencji i polityk napędzających zmiany w spożyciu APF.

Rycina 2

Mapa systemu stworzona podczas warsztatów z dietetykami w Polsce



Nota. Strzałki ciągłe reprezentują związek pozytywny (gdy poziom jednej zmiennej rośnie, to poziom drugiej zmiennej rośnie; gdy poziom jednej zmiennej maleje, to poziom drugiej zmiennej maleje); Strzałki przerywane reprezentują związek negatywny (gdy poziom jednej zmiennej rośnie, to poziom drugiej zmiennej maleje; gdy poziom jednej zmiennej maleje, to poziom drugiej zmiennej rośnie). APF = alternatywne źródła białka. Definicje determinantów zidentyfikowanych w trakcie warsztatów mapowania systemu: Moda na zdrowy styl życia = Kojarzenie produktów z APF ze zdrowym stylem życia; Popularność produktów z APF = Wiedza, że spożywanie APF przez jednostkę ma wpływ i zachęca do spożywania APF przez innych; Ekspozycja produktów z APF przez autorytety = Ekspozycja produktów z APF przez istotne, popularne osoby w telewizji lub social mediach. Forma trendu i ciągłej ekspozycji dla konsumenta, który widzi te produkty w telewizji i social mediach; Dostępność do źródła białka = Dostępność produktów lub surowców używanych w produktach z APF; Obawa przed stopniowym wycofywaniem klasycznych źródeł białka = Obawa, że kiedy produkty alternatywne staną się popularne to klasyczne źródła białka zostaną stopniowo wycofane; Ciekawość = Pragnienie próbowania nowych produktów zawierających APF; Bezpieczeństwo produktu = Informacja, czy produkty z APF zawierają pestycydy itp.; Cena produktów zawierających APF = Cena produktów z APF w porównaniu do ceny produktów tradycyjnych; Postrzegana wartość odżywcza = Spostrzegana przez konsumenta wartość odżywcza produktu z APF w porównaniu z produktami tradycyjnymi; Moda na spożycie produktów z APF = Wpływ znanych osób na chęć spożycia produktu z APF niezwiązana z korzyściami zdrowotnymi tego produktu; Dobro planety = Troska o środowisko; Postrzegany wpływ na zdrowie = Sposób, w jakim jednostka postrzega wpływ produktów z APF na jej zdrowie; Zrównoważona produkcja = Pozytywny i bezpieczny wpływ na środowisko; Tradycja spożycia = Tradycja spożywania danego produktu w kraju, regionie, rodzinie; Stan wiedzy na temat APF = Wiedza konsumenta na temat APF; Pomysły na użycie w diecie produktów z APF = Znajomość różnorodnych przepisów, w których można wykorzystać APF; Konsystencja produktu = Preferencja dla konsystencji produktu; Akceptowalność smaków = Atrakcyjność smaku APF dla konsumenta w porównaniu z produktami tradycyjnymi; Szybkość przygotowania produktów do spożycia = Łatwość samodzielnego przygotowania dań z APF w domu; Forma APF = Produkt przetworzony/nieprzetworzony; Wartość użytkowa produktów z APF = Liczba dań, które konsument może zrobić z APF np. danie obiadowe lub deser; Wygląd opakowania = Atrakcyjność opakowania i widoczny skład produktu na opakowaniu; Produkcja bezodpadowa = Produkowanie APF bez wytwarzania odpadów; Status prawny = Legalność wdrożenia nowego produktu żywieniowego; Hejt na produkty z APF (z insektów) = Negatywne publiczne przekonania/opinie/komentarze związane ze spożywaniem APF, szczególnie z insektów.

Tabela 3
Charakterystyki opisowe uczestników warsztatów w 13 krajach

Kraj	N	N uczestników, którzy podali swoje dane (% aktualnego N)	Płeć	Przedział wiekowy	Lata doświadczenia zawodowego
Austria	11	11 (100%)	5M (45.4%); 6K (54.5%)	26-35 – 27% 36-45 – 36% 46-55 – 36%	1-5 – 9% 6-10 – 9% 11-15 – 27% 16-20 – 45% >20 – 9%
Czechy	12	7 (58.3%)	1M (14.2%); 6K (85.7%)	18-25 – 14% 26-35 – 28% 36-45 – 28% 46-55 – 14% 56-65 – 14%	<1 – 42% 1-5 – 14% 11-15 – 14% 16-20 – 14% >20 – 14%
Dania	13	6 (46.2%)	3M (50.0%); 3K (50.0%)	26-35 – 16% 36-45 – 33% 56-65 – 16% >65 – 33%	1-5 – 33% 6-10 – 33% 11-15 – 16% >20 – 16%
Francja	16	16 (100%)	16K (100%)	18-25 – 6% 26-35 – 12% 36-45 – 50% 46-55 – 6% 56-65 – 25%	1-5 – 25% 6-10 – 12% 11-15 – 6% 16-20 – 25% >20 – 31%
Niemcy	8	6 (75.0%)	2M (33.3%); 4K (66.6%)	18-25 – 16% 26-35 – 50% 36-45 – 33%	1-5 – 66% 6-10 – 16% 16-20 – 16%
Grecja	10	10 (100%)	4M (40.0%); 6K (60.0%)	26-35 – 40% 36-45 – 20% 46-55 – 10% 56-65 – 30%	1-5 – 40% 6-10 – 10% 16-20 – 20% >20 – 30%
Włochy	13	13 (100%)	5M (38.4%); 8K (61.5%)	26-35 – 30% 36-45 – 38% 46-55 – 15% 56-65 – 7% >65 – 7%	-
Norwegia	9	9 (100%)	3M (33.3%); 6K (66.6%)	26-35 – 44% 36-45 – 22% 46-55 – 22% >65 – 11%	<1 – 11% 1-5 – 22% 6-10 – 33% >20 – 33%
Polska	38	37 (97.3%)	5M (13.5%); 32K (86.4%)	18-25 – 43% 26-35 – 32% 36-45 – 13% 46-55 – 10%	<1 – 21% 1-5 – 29% 6-10 – 21% 11-15 – 24% >20 – 2%

Portugalia	11	10 (90.9%)	2M (20.0%); 8K (80.-%)	36-45 – 20% 46-55 – 50% 56-65 – 30%	1-5 – 10% 11-15 – 10% 16-20 – 20% >20 – 60%
Słowenia	7	7 (100%)	2M (28.5%); 5K (71.5%)	26-35 – 28% 36-45 – 57% 46-55 – 14%	1-5 – 42% 11-15 – 28% >20 – 28%
Hiszpania	10	10 (100%)	5M (50.0%); 5K (50.0%)	26-35 – 60% 36-45 – 10% 46-55 – 20% 56-65 – 10%	1-5 -60% 6-10 – 10% 11-15 – 10% >20 – 20%
Turcja	8	8 (100%)	2M (25.0%); 6K (75.0%)	26-35 – 50% 36-45 – 25% 46-55 – 25%	1-5 – 25% 6-10 – 37% 11-15 – 37%

Nota. Przeprowadzono 17 warsztatów, w tym 5 w Polsce i 12 w pozostałych 12 krajach; *K* = płeć żeńska, *M* = płeć męska.

Tabela 4
Wyniki Network Analysis dla map systemu determinantów wyboru APF przez konsumentów: determinanty uwzględnione w 17 mapach systemowych z najwyższymi wartościami wskaźnika Eigenvector (t.j. kluczowe punkty wpływu)

Kraj	Determinanty z najwyższymi wskaźnikami centralności (Eigenvector) uwzględnione w mapach systemu
Austria	Nadmierna liczba składników w produktach z APF = 0.49; wpływ produktów z APF na zdrowie = 0.49; wartość odżywcza białek roślinnych (PER) = 0.41; przetworzenie żywności = 0.41
Czechy	Lęk przed nieznanym = 0.58; cena = 0.49; promocja i reklama APF = 0.45
Dania	Dostosowanie do potrzeb rodziny = 0.49; kultura żywieniowa w Danii = 0.38; wiedza dot. przygotowania posiłku = 0.38
Francja	Nawyki i przyzwyczajenia (znajomość kulturowa i tradycji, nawyki rodzinne) = 0.51; wiedza (o tym jak gotować) = 0.45; wizualna prezentacja produktu z APF = 0.35
Niemcy	Znajomość (przeciwieństwo lęku przed nowymi produktami) = 0.32; dostępność = 0.36; normy społeczne = 0.36
Grecja	Zaznajomienie z APF (czynniki związane z kulturą) = 0.47; poziom edukacji (niskie zdolności poznawcze i brak elastyczności) = 0.37; wiek = 0.26
Włochy	Reklama = 0.43; ciekawość = 0.38; wpływ na środowisko = 0.32; spożywanie APF spostrzegane jako zgodne ze zdrową i zbilansowaną dietą = 0.32
Norwegia	Regulacje prawne produktów z APF= 0.28; wpływ produktów z APF na klimat i środowisko= 0.28; stopień przetworzenia APF= 0.26
Polska (1 warsztat)	Różnorodność odżywcza (nawyki żywieniowe związane ze spożywaniem różnych źródeł białka) = 0.35; popularność APF (zachęty, normy społeczne) = 0.35; pozytywne przekonania związane z APF = 0.35
Polska (2 warsztat)	Edukacja konsumentów o APF= 0.44; normy APF w odniesieniu do USP* 0.37; aprobata społeczna = 0.37
Polska (3 warsztat)	Popularrność produktów z APF (zachęty, normy społeczne) = 0.47; moda na spożycie produktów z APF= 0.32; stan wiedzy na temat APF= 0.30
Polska (4 warsztat)	Otwartość na różnorodność kulinarną = 0.37; wstręt = 0.33; dostępność produktu = 0.32
Polska (5 warsztat)	Rozpowszechnienie wiedzy o APF= 0.33; normalizacja wiedzy o APF w mediach = 0.32; troska o dobro zwierząt hodowlanych = 0.26
Portugalia	Zaufanie (konsumentów do produktów z APF) = 0.44; trendy społeczne (popularność próbowania APF) = 0.40; wiedza o APF = 0.36; profil odżywczy APF = 0.35
Słowenia	Smak = 0.39; wpływ influencerów = 0.30; reklama = 0.32

Hiszpania	Promowanie konsumpcji APF = 0.50; brak wiedzy = 0.37; spostrzegane przetworzenie produktu = 0.28
Turcja	Wybór APF przez wgląd na zdrowie, środowisko i etykę = 0.49; marketing = 0.35; smak = 0.30

Nota. APF = alternatywne źródła białka; ***** USP to unikalność produktu (unikalna propozycja sprzedaży; istota tego, co sprawia, że produkt jest lepszy od konkurencji)

Konkluzje dla Badań 1–4

Podsumowując, wyniki Badania 1 pozwoliły na zidentyfikowanie psychospołecznych determinantów wyboru alternatywnych źródeł białka przez konsumentów. Wyniki Badań 2 i 3 dostarczają wniosków na temat związku kontekstu środowiskowego – fizycznego środowiska zbudowanego oraz geograficznego – z wyborem poszczególnych APF przez jednostki. Perspektywa uzyskana w Badaniu 4 łączy się z wiedzą zdobytą w poprzednich badaniach, ukazując nowe spojrzenie na potencjalne determinanty spożycia APF: pokazuje, w jaki sposób interesariusze postrzegają indywidualne, środowiskowe i kontekstualne uwarunkowania spożycia APF, a wyniki analiz tego badania wskazują, które zmienne – w perspektywie interesariuszy – mogą mieć największe znaczenie dla wdrażania i/lub efektywności interwencji oddziałujących na cały system.

Wybory dotyczące alternatywnych źródeł białka są uwarunkowane wielopoziomowo — przez czynniki indywidualne, społeczno-kulturowe i środowiskowe — które wzajemnie na siebie oddziałują, tworząc złożony system sprzężeń zwrotnych. Skuteczne interwencje promujące APF muszą zatem uwzględniać ten systemowy charakter zależności i być ukierunkowane na kluczowe punkty wpływu, takie jak ekspozycja na produkt, normy społeczne czy dostępność, ponieważ zmiany w tych obszarach mogą wywoływać efekty kaskadowe prowadzące do trwałych zmian w zachowaniach żywieniowych na poziomie całego systemu. Dobrze dobrane interwencje uwzględniające wszystkie wymienione wyżej konteksty mogą przynieść pozytywne korzyści zarówno na poziomie jednostki jak i na poziomie środowiska.

Bibliografia

1. Aaslyng, M. D., & Højer, R. (2021). Introducing tempeh as a new plant-based protein food item on the Danish market. *Foods*, *10*(11), 2865. https://doi.org/10.3390/foods10112865
2. Aerni, P., Scholderer, J., & Ermen, D. (2011). How would Swiss consumers decide if they had freedom of choice? Evidence from a field study with organic, conventional and GM corn bread. *Food Policy*, *36*(6), 830–838. https://doi.org/10.1016/j.foodpol.2011.08.002
3. Ali, L., & Ali, F. (2022). Perceived risks related to unconventional restaurants: A perspective from edible insects and live seafood restaurants. *Food Control*, *131*, 108471. https://doi.org/10.1016/j.foodcont.2021.108471
4. Arcaya, M. C., Arcaya, A. L., & Subramanian, S. V. (2015). Inequalities in health: Definitions, concepts, and theories. *Global Health Action*, *8*(1). https://doi.org/10.3402/gha.v8.27106
5. Baker, M. A., Shin, J. T., & Kim, Y. W. (2016). An exploration and investigation of edible insect consumption: The impacts of image and description on risk perceptions and purchase intent. *Psychology & Marketing*, *33*(2), 94–112. https://doi.org/10.1002/mar.20847
6. Bambra, C., Smith, K. E., & Pearce, J. (2019). Scaling up: The politics of health and place. *Social Science & Medicine*, *232*, 36–42. https://doi.org/10.1016/j.socscimed.2019.04.036

7. Banovic, M., Barone, A. M., Asioli, D., & Grasso, S. (2022). Enabling sustainable plant-forward transition: European consumer attitudes and intention to buy hybrid products. *Food Quality and Preference*, *96*, 104440. https://doi.org/10.1016/j.foodqual.2021.104440
8. Banovic, M., & Sveinsdóttir, K. (2021). Importance of being analogue: Female attitudes towards meat analogue containing rapeseed protein. *Food Control*, *123*, 107833. https://doi.org/10.1016/j.foodcont.2020.107833
9. Barska, A. (2014). Attitudes of young consumers towards innovations on the food market. *Management*, *18*(1), 419–431. https://doi.org/10.2478/manment-2014-0031
10. Bianchi, F., Garnett, E., Dorsel, C., Aveyard, P., & Jebb, S. A. (2018). Restructuring physical micro-environments to reduce the demand for meat: A systematic review and qualitative comparative analysis. *The Lancet Planetary Health*, *2*(9), 384–397. https://doi.org/10.1016/S2542-5196(18)30188-8
11. de Boer, J., & Aiking, H. (2022). Do EU consumers think about meat reduction when considering to eat a healthy, sustainable diet and to have a role in food system change? *Appetite*, *170*, 105880. https://doi.org/10.1016/j.appet.2021.105880
12. Bogueva, D., Marinova, D., & Bryant, C. (2022). Meat me halfway: Sydney meat-loving men's restaurant experience with alternative plant-based proteins. *Sustainability*, *14*(3). https://doi.org/10.3390/su14031290
13. Brooker, P. G., Hendrie, G. A., Anastasiou, K., & Colgrave, M. L. (2022). The range and nutrient profile of alternative protein products sold in Australian supermarkets between 2014 and 2021. *International Journal of Food Sciences and Nutrition*, *73*(8), 1067–1079. https://doi.org/10.1080/09637486.2022.2137786
14. Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design.* Harvard University Press.

15. Cai, C.H., Ding, A., & Legendre, T.S. (2021). Exploring persuasive sales techniques to improve customer acceptance of sustainable but unfamiliar menu in restaurants. *International Journal of Contemporary Hospitality Management*, *33*(10), 3093–3114. https://doi.org/10.1108/IJCHM-08-2020-0924

16. Cane, J., O'Connor, D., & Michie, S. (2012). Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*, *7*(1), 37. https://doi.org/10.1186/1748-5908-7-37

17. Castro, E. M., Van Regenmortel, T., Sermeus, W., & Vanhaecht, K. (2018). Patients' experiential knowledge and expertise in health care: A hybrid concept analysis. *Social Theory & Health*, *17*(3), 307–330. https://doi.org/10.1057/s41285-018-0081-6

18. Chevance, G., Fresán, U., Hekler, E., Edmondson, D., Lloyd, S. J., Ballester, J., Litt, J., Cvijanovic, I., Araújo-Soares, V., &Bernard, P. (2023). Thinking health-related behaviors in a climate change context: A narrative review. *Annals of Behavioral Medicine*, *57*(3), 193–204. https://doi.org/10.1093/abm/kaac039

19. Downs, S. M., Ahmed, S., Fanzo, J., & Herforth, A. (2020). Food environment typology: Advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. *Foods*, *9*(4), 532. https://doi.org/10.3390/foods9040532

20. EAT. (2022). *EAT-Lancet Commission summary report*. https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/

21. Eckl, M. R., Biesbroek, S., van't Veer, P., & Geleijnse, J. M. (2021). Replacement of meat with non-meat protein sources: A review of the drivers and inhibitors in developed countries. *Nutrients*, *13*(10), 3602. https://doi.org/10.3390/nu13103602

22. Glanz, K., Sallis, J. F., Saelens, B. E., & Frank, L. D. (2005). Healthy nutrition environments: concepts and measures. *American journal of health promotion*, *19(*5), 330–ii. https://doi.org/10.4278/0890-1171-19.5.330

23. Gorzelsky, G. (2013). Experiential knowledge: How literacy practices seek to mediate personal and systemic change. *College English*, *75*(4), 398–419. https://doi.org/10.58680/ce201322955

24. Grasso, S., Asioli, D., & Smith, R. (2022). Consumer co-creation of hybrid meat products: A cross-country European survey. *Food Quality and Preference*, *100*, 104586. https://doi.org/10.1016/j.foodqual.2022.104586

25. Gravely, E., & Fraser, E. (2018). Transitions on the shopping floor: Investigating the role of Canadian supermarkets in alternative protein consumption. *Appetite*, *130*, 146–156. https://doi.org/10.1016/j.appet.2018.08.018

26. Grossmann, L., & Weiss, J. (2021). Alternative protein sources as technofunctional food ingredients. *Annual Review of Food Science and Technology*, *12*(1), 93–117. https://doi.org/10.1146/annurev-food-062520-093642

27. Hagger, M. S., Cameron, L. D., Hamilton, K., Hankonen, N., & Lintunen, T. (2020). Changing behavior: A theory- and evidence-based approach. In M. S. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (1st ed., pp. 1–14). Cambridge University Press. https://doi.org/10.1017/9781108677318.001

28. Henn, K., Bøye Olsen, S., Goddyn, H., & Bredie, W. L. P. (2022). Willingness to replace animal-based products with pulses among consumers in different European countries. *Food Research International*, *157*, 111403. https://doi.org/10.1016/j.foodres.2022.111403

29. Hennessy, E. A., Johnson, B. T., & Keenan, C. (2019). Best practice guidelines and essential methodological steps to conduct rigorous and systematic meta-reviews. *Applied Psychology: Health and Well-Being*, *11*(3), 353–381. https://doi.org/10.1111/aphw.12169

30. Herbert, M., & Beacom, E. (2021). Exploring consumer acceptance of insect-based snack products in Ireland. *Journal of Food Products Marketing*, *27*(6), 267–290. https://doi.org/10.1080/10454446.2021.1994080

31. HLPE (2017). *Nutrition and food systems: A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security,* Rome.

32. Hovmand, P. (2013). *Community based systems dynamics*. New York: Springer.

33. Huang, J., Liao, L. M., Weinstein, S. J., Sinha, R., Graubard, B. I., & Albanes, D. (2020). Association between plant and animal protein intake and overall and cause-specific mortality. *JAMA Internal Medicine*, *180*(9), 1173. https://doi.org/10.1001/jamainternmed.2020.2790

34. Lucas, S., Gouin, S., & Lesueur, M. (2019). Seaweed consumption and label preferences in France. *Marine Resource Economics*, *34*(2), 143–162. https://doi.org/10.1086/704078

35. Mancini, S., Moruzzo, R., Riccioli, F., & Paci, G. (2019). European consumers' readiness to adopt insects as food. A review. *Food Research International*, *122*, 661–678. https://doi.org/10.1016/j.foodres.2019.01.041

36. McKinnon, R.A., Reedy, J., Morrissette, M.A., Lytle, L.A., Yaroch, A.L. (2009). Measures of the food environment: A compilation of the literature, 1990–2007. *American Journal of Preventive Medicine*, *36*(4), 124–33. https://doi.org/10.1016/j.amepre.2009.01.012

37. Meadows, D.H. (2008). *Thinking in systems: a primer.* Sustainability Institute.

38. Menozzi, D., Sogari, G., Veneziani, M., Simoni, E., & Mora, C. (2017). Eating novel foods: An application of the theory of planned behaviour to predict the consumption of an insect-based product. *Food Quality and Preference*, *59*, 27–34. https://doi.org/10.1016/j.foodqual.2017.02.001

39. Michel, F., Hartmann, C., & Siegrist, M. (2021). Consumers' associations, perceptions and acceptance of meat and plant-based meat alternatives. *Food Quality and Preference*, *87*, 104063. https://doi.org/10.1016/j.foodqual.2020.104063

40. Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterizing and designing behaviour change interventions. *Implementation Science*, *6(*1), 42. https://doi.org/10.1186/1748-5908-6-42

41. Motoki, K., Park, J., Spence, C., & Velasco, C. (2022). Contextual acceptance of novel and unfamiliar foods: Insects, cultured meat, plant-based meat alternatives, and 3D printed foods. *Food Quality and Preference*, *96*, 104368. https://doi.org/10.1016/j.foodqual.2021.104368

42. Mylan, J., Andrews, J., & Maye, D. (2023). The big business of sustainable food production and consumption: Exploring the transition to alternative proteins, *Proceedings of the National Academy of Sciences*, *120*(47), e2207782120, https://doi.org/10.1073/pnas.2207782120.

43. Murphy, R., Jones, P. Leverage analysis (2020). *Form Akademisk*,*13*, 1–25. https://doi.org/10.7577/formakademisk.3384.

44. Nguyen, J., Ferraro, C., Sands, S., & Luxton, S. (2022). Alternative protein consumption: A systematic review and future research directions. *International Journal of Consumer Studies*, *46*(5), 1691–1717. https://doi.org/10.1111/ijcs.12797

45. Onwezen, M. C., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, *159*, 105058. https://doi.org/10.1016/j.appet.2020.105058

46. Ortega, D. L., Sun, J., & Lin, W. (2022). Identity labels as an instrument to reduce meat demand and encourage consumption of plant based and cultured meat alternatives in China. *Food Policy*, *111*, 102307. https://doi.org/10.1016/j.foodpol.2022.102307

47. Palmieri, N., & Forleo, M. B. (2021). An explorative study of key factors driving italian consumers' willingness to eat edible seaweed. *Journal of International Food & Agribusiness Marketing*, *34*(4), 433–455. https://doi.org/10.1080/08974438.2021.1904082

48. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. https://doi.org/10.1136/bmj.n71

49. Papies, E. K., Nielsen, K. S., & Soares, V. A. (2024). Health psychology and climate change: Time to address humanity's most existential crisis. *Health Psychology Review*, *19,* 1–31. https://doi.org/10.1080/17437199.2024.2309242

50. Pfadenhauer, L. M., Gerhardus, A., Mozygemba, K., Lysdahl, K. B., Booth, A., Hofmann, B., Wahlster, P., Polus, S., Burns, J., Brereton, L., & Rehfuess, E. (2017). Making sense of complexity in context and implementation: The context and

implementation of complex interventions (CICI) framework. *Implementation Science*, *12*(21). https://doi.org/10.1186/s13012-017-0552-5

51. Pippinato, L., Gasco, L., Di Vita, G., & Mancuso, T. (2020). Current scenario in the European edible-insect industry: A preliminary study. *Journal of Insects as Food and Feed*, *6*(4), 371–381. https://doi.org/10.3920/JIFF2020.0008
52. Porretta, S., Gere, A., Radványi, D., & Moskowitz, H. (2019). Mind Genomics (Conjoint Analysis): The new concept research in the analysis of consumer behaviour and choice. *Trends in Food Science & Technology*, *84*, 29–33. https://doi.org/10.1016/j.tifs.2018.01.004
53. Reverberi, M. (2021). The new packaged food products containing insects as an ingredient. *Journal of Insects as Food and Feed*, *7*(5), 901–908. https://doi.org/10.3920/JIFF2020.0111
54. Schwark, N., Tiberius, V., & Fabro, M. (2020). How will we dine? prospective shifts in international haute cuisine and innovation beyond kitchen and plate. *Foods, 9*(10), 1369. https://doi.org/10.3390/foods9101369
55. Stiles, G., Collins, J., & Beck, K. L. (2022). effectiveness of strategies to decrease animal-sourced protein and/or increase plant-sourced protein in foodservice settings: A systematic literature review. *Journal of the Academy of Nutrition and Dietetics*, *122*(5), 1013–1048. https://doi.org/10.1016/j.jand.2021.12.010
56. Vandecandelaere, E., Arfini, F., Belletti, G., Marescotti, A., Allaire, G., Cadilhon, J. J., Casabianca F., Damary, P., Esteve, M., Hilmi, M., Jull, C., Coent, A. L., Lecourtois, E., Mounsey, J. P., Perret, A. O., Sautier, D., Tartanac, F., Mottet, E., & Wallet, F. (2009). *Linking people, places and products.* Food and Agriculture Organization of the United Nations (FAO) and SINER-GI. https://www.fao.org/3/i1760e/i1760e.pdf.

57. Verneau, F., La Barbera, F., Kolle, S., Amato, M., Del Giudice, T., & Grunert, K. (2016). The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy. *Appetite*, *106*, 30–36. https://doi.org/10.1016/j.appet.2016.02.006

58. Verneau, F., La Barbera, F., Amato, M., Riverso, R., & Grunert, K. G. (2020). Assessing the role of food related lifestyle in predicting intention towards edible insects. *Insects*, *11*(10), 660. https://doi.org/10.3390/insects11100660

59. Weinrich, R., & Elshiewy, O. (2023). A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption. *Algal Research*, *70*, 102999. https://doi.org/10.1016/j.algal.2023.102999

60. West, R., & Michie, S. (2020). A brief introduction to the COM-B model of behaviour and the PRIME theory of motivation. *Qeios*. https://doi.org/10.32388/WW04E6

61. Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., Afshin, A., … Murray, C. J. L. (2019). Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet*, *393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

62. Zabrocki, R. (2017). A comparative analysis of the determinants of behaviours of Polish and German consumers aged 55+in the innovative food market. *Handel Wewnętrzny*, *1*(366), 413–423.

Oświadczenia współautorów publikacji dotyczącej Badania 1

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Publication: Zaleskiewicz, H., Siwa, M., Banik, A., Szczuka, Z., Kulis, E., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2025). Psychosocial determinants of alternative protein choices: a meta-review. *Health Psychology Review*, *19*(1), 97–122. https://doi.org/10.1080/17437199.2024.2412630.

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

Statement indicating the candidate's contribution to the publication: The candidate contributed to the conception of the study, participated in its design and data collection, led the interpretation of the data, led data analysis, and drafted the manuscript.

The contribution of co-authors: The co-authors contributed to the conception of the study, participated in data collection, contributed to interpretation of the data, and contributed to drafting and revising the manuscript.

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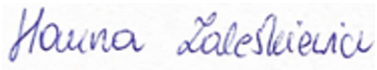

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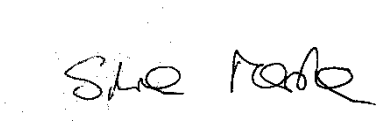

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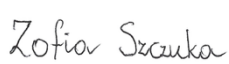

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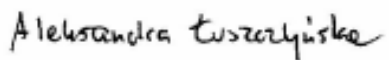

Oświadczenia współautorów publikacji dotyczącej Badania 1

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Siwa, M., Banik, A., Szczuka, Z., Kulis, E., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2025). Psychosocial determinants of alternative protein choices: a meta-review. *Health Psychology Review*, *19*(1), 97–122. https://doi.org/10.1080/17437199.2024.2412630.

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

Statement indicating the candidate's contribution to the publication: The candidate contributed to the conception of the study, participated in its design and data collection, led the interpretation of the data, led data analysis, and drafted the manuscript.

The contribution of co-authors: The co-authors contributed to the conception of the study, participated in data collection, contributed to interpretation of the data, and contributed to drafting and revising the manuscript.

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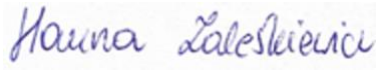
Date:
Signature:



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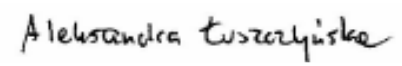

Oświadczenia współautorów publikacji dotyczącej Badania 1

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Siwa, M., Banik, A., Szczuka, Z., Kulis, E., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2025). Psychosocial determinants of alternative protein choices: a meta-review. *Health Psychology Review*, *19*(1), 97–122. https://doi.org/10.1080/17437199.2024.2412630.

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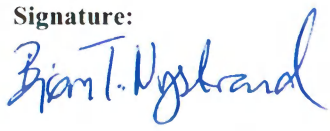

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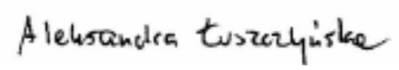

Oświadczenia współautorów publikacji dotyczącej Badania 2

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2024). Geographical Context of European Consumers' Choices of Alternative Protein Food: A Systematic Review. *Food Quality and Preference, 117*(11), 105174. https://doi.org/10.1016/j.foodqual.2024.105174.

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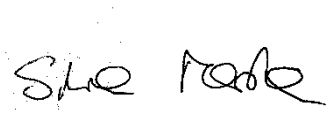

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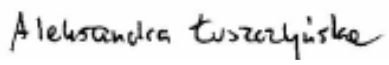

Oświadczenia współautorów publikacji dotyczącej Badania 2

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2024). Geographical Context of European Consumers' Choices of Alternative Protein Food: A Systematic Review. *Food Quality and Preference, 117*(11), 105174. https://doi.org/10.1016/j.foodqual.2024.105174.

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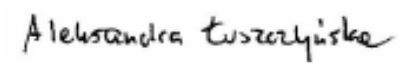

Oświadczenia współautorów publikacji dotyczącej Badania 2

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2024). Geographical Context of European Consumers' Choices of Alternative Protein Food: A Systematic Review. *Food Quality and Preference, 117*(11), 105174. https://doi.org/10.1016/j.foodqual.2024.105174.

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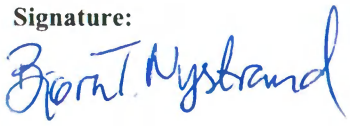

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Oświadczenia współautorów publikacji dotyczącej Badania 2

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2024). Geographical Context of European Consumers' Choices of Alternative Protein Food: A Systematic Review. *Food Quality and Preference, 117*(11), 105174. https://doi.org/10.1016/j.foodqual.2024.105174.

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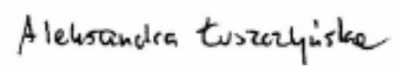

Oświadczenia współautorów publikacji dotyczącej Badania 3

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., Luszczynska, A. (2024). Types of Built Food Environment and Their Characteristics Associated with Alternative Protein Choices by Consumers: Systematic Review and Evidence-Based Typology. *International Journal of Behavioral Nutrition and Physical Activity, 21*(1). https://doi.org/10.1186/s12966-024-01606-6.

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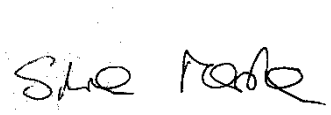

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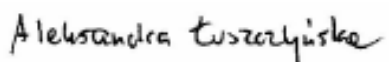

Oświadczenia współautorów publikacji dotyczącej Badania 3

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., Luszczynska, A. (2024). Types of Built Food Environment and Their Characteristics Associated with Alternative Protein Choices by Consumers: Systematic Review and Evidence-Based Typology. *International Journal of Behavioral Nutrition and Physical Activity, 21*(1). https://doi.org/10.1186/s12966-024-01606-6.

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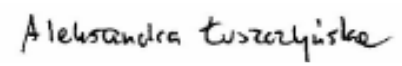

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Oświadczenia współautorów publikacji dotyczącej Badania 3

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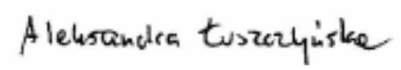

Oświadczenia współautorów publikacji dotyczącej Badania 4

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

Publication: Zaleskiewicz, H., Kulis, E., Szczuka, Z., Banik, A., Alcat, G., Avila, C., Cardoso, I., Başak-Coşkun, F., Kornafel, A., Mai, L., Kolden Midtbø, L., Misiakowska, J., Oblak, M., Miličic, V., Queiroz, P., Sabbatini, G., Sandvad, B., Siwa, M., Solibakke, P., Stejnarová, Š., Stollewerk, K., Strube, R., Tsapa, E., Voyatzakis, A., Xaxiri, E., & Luszczynska, A. (2026). Mapping Determinants of Alternative Protein Food Intake Across 13 European Countries: Food System Stakeholders' Perspectives. *International Journal of Behavioral Nutrition and Physical Activity.*

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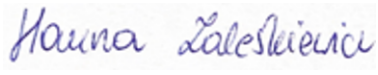

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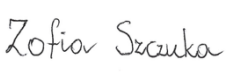

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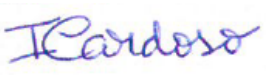

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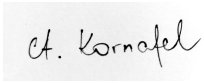

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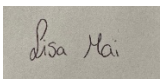

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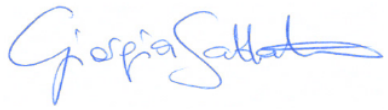

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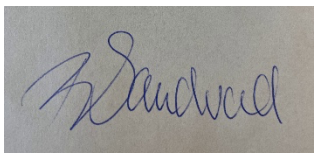

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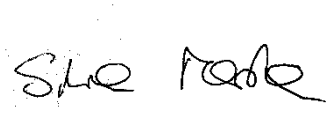

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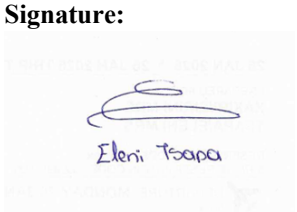

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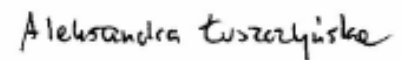

Oświadczenia współautorów publikacji dotyczącej Badania 4

The Co-Authorship Statement

Name of the candidate: Hanna Zaleśkiewicz

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Oświadczenia współautorów publikacji dotyczącej Badania 4

The Co-Authorship Statement

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We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

Statement indicating the candidate's contribution to the publication: The candidate contributed to the conception of the study, participated in its design and data collection, led the interpretation of the data, led data analysis, and drafted the manuscript.

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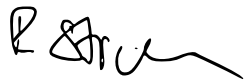

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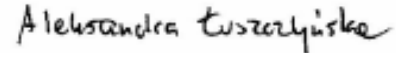

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Hanna Zaleśkiewicz

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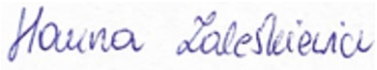
Oświadczenie

Od trzech współautorek (Gabriela Alcat, Concha Àvila, Šarka Stejnarova) wymienionego wyżej artykułu nie udało mi się pozyskać podpisanych (lub przesłanych emailem) oświadczeń o współautorstwie artykułu.
Kontaktowałam się z tymi osobami mailowo trzykrotnie (16.02.2026, 05.03.2026, 18.03.2026) oraz do każdego maila dołączałam moją promotorkę Prof. Łuszczyńską. Są to osoby pracujące na co dzień w organizacjach pozarządowych i istnieje możliwość, że zmieniły pracę i nie są już dostępne pod podanym adresem mailowym i nie kontynuują pracy w projekcie LIKE-A-PRO, w ramach którego powstała ta publikacja.

Hanna Zaleśkiewicz



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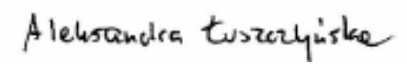

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REVIEW ARTICLE

Psychosocial determinants of alternative protein choices: a meta-review

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ABSTRACT

This meta-review synthesises evidence concerning individual-level psychosocial characteristics associated with alternative protein food (APF) choices. We investigated the associations between: (i) individual-level determinants based on the COM-B model (capabilities, perceived opportunities, motivation), sociodemographic factors, and (ii) indicators of APF choices (e.g., intention to eat, buy, pay, acceptance, intake). Differences in characteristics of APF made from plants, insects, mushrooms, and other APF sources were explored. Thirteen databases were searched in this pre-registered (CRD42023388694) meta-review and 28 reviews were included. The risk of bias was assessed using the ROBIS tool. For *plant-based APF* choices, consistent support was obtained for associations with (i) capabilities, including cooking skills, exposure to/familiarity with APF; (ii) motivations, including perceived health-related, pro-environmental, and sustainability benefits, and animal welfare; (iii) younger age and higher education. For *insect-based APF* choices, consistent support was obtained for (i) capabilities, including formal knowledge about APF, exposure to/familiarity with APF; (ii) perceived opportunities, encompassing positive social and cultural norms, distrust in technology; (iii) motivations, including perceived health benefits, pro-environmental and sustainability benefits, perceived health risks, being adventurous/daring, curiosity, neophilia, disgust; (iv) male gender and younger age. Recognising differences in potential determinants across various APF sources is essential for designing interventions aimed at promoting APF uptake.

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Systematic review; meta review; alternative protein food; motivation; socioeconomic status; COM-B model

Climate-related environmental challenges require a response from health promotion researchers and practitioners, who should address health behaviour change issues in the context of climate change (Chevance et al., 2023; Papies et al., 2024). This can be done by focusing on dietary behaviours which are not only healthy for the individual, but also 'healthy for the planet' (Eat-Lancet Commission, 2022). A high-quality protein diet has well-established beneficial effects on human health, contributing to healthy weight management, improved metabolism, and healthy aging (Rodriguez, 2015). In developed countries, animal products, such as meat, eggs, and dairy, are the

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typical protein choices (Eat-Lancet Commission, 2022). However, meat and dairy production is among the strongest drivers of environmental degradation, threatening climate stability and ecosystems (Eat-Lancet Commission, 2022). Shifting from traditional, animal-based proteins to alternative proteins in daily diet may have positive effects on health: Replacing just 3% of animal protein with plant protein is associated with a decrease in overall mortality (10% in both men and women) and cardiovascular disease mortality (11–12% lower risk; Huang et al., 2020). Alternative protein food (APF) products include protein concentrates obtained during the processing of insects, krill, microbial biomass, mushrooms, fungi, or plants such as peas or rapeseed (Grossmann & Weiss, 2021). APF refers to sources with lower environmental impact compared to traditional protein sources (e.g., beef, pork, poultry, and animal dairy; Grossmann & Weiss, 2021). Thus, APF may exclude cultured meat as its environmental benefits are questioned (Grossmann & Weiss, 2021).

Socio-ecological models suggest that human behaviour, including nutrition behaviour, is influenced by individual-level determinants, socio-environmental factors, and policy factors (Bronfenbrenner, 1979). Michie et al. (2011) proposed the Capability-Opportunity-Motivation (COM-B) model, capturing determinants from the individual-level (psychosocial), the social, and the physical environment. Since its inception, COM-B has been widely used by researchers and specialists from various disciplines (West & Michie, 2020). In accordance with the COM-B model, Capability (C) refers to an individual's physical and psychosocial abilities required to engage in a behaviour, such as nutrition behaviour. Opportunity (O) refers to an individual's physical and social environment, while motivation (M) includes reflective and automatic factors (Michie et al., 2011; West & Michie, 2020). Capability includes knowledge, memory, attention processes, skills, or proficiencies acquired through repeated exposure or practice (Cane et al., 2012; McDonagh et al., 2018; Michie et al., 2011). Opportunity refers to the physical and social environment, social influences, social pressure norms, or perceptions of the built environment (McDonagh et al., 2018; Michie et al., 2011). Finally, motivation includes emotions that represent automatic processes, beliefs about consequences of behaviours, identity, values, or personality factors (Cane et al., 2012; McDonagh et al., 2018). Although the COM-B model addresses social and physical environment, it mainly focuses on individual-level determinants, akin to other behaviour change models, suggesting that these determinants are the most proximal predictors of behaviour change (Hagger et al., 2020; Luszczynska & Schwarzer, 2020). The COM-B model has already been applied in reviews of determinants of APF choices (Graça et al., 2019; Nguyen et al., 2022).

In addition to the predictors included in the COM-B, socio-ecological models of behaviour change also highlight the role of sociodemographic factors, such as age, gender, education, and income (Bronfenbrenner, 1979). Sociodemographic characteristics are also crucial contextual factors to consider when designing health promotion interventions, ensuring the interventions align with the needs of the targeted population (see Context and Implementation of the Complex Interventions model; CICI; Pfadenhauer et al., 2017).

The rapidly increasing number of research on psychosocial determinants of intention and actual purchase or intake of APF resulted in a growing number of reviews on this topic (e.g., Dagevos, 2021; Eckl et al., 2021; Hartmann & Siegrist, 2017; Kauppi et al., 2019; Kröger et al., 2022; Nguyen et al., 2022; Onwezen et al., 2021; Szenderák et al., 2022; Toti et al., 2020; Wang et al., 2023; Weinrich, 2019). Many of these reviews focus on specific APF sources, such as insect-based proteins only (Kröger et al., 2022). Other reviews combine evidence from various protein sources (e.g., Nguyen et al., 2022; Onwezen et al., 2021). Finally, a recent meta-review synthesised studies on meat reduction and alternative protein acceptance, suggesting that several broad classes of determinants, e.g., 'motives' or 'emotions' may be associated with broadly defined reduction of traditional meat intake and an increase of APF or in-vitro/synthetic meat intake (Onwezen & Dagevos, 2024). Yet it remains unclear if determinants are common for dietary choices of APF from different sources, or if the determinants vary depending on the protein source (e.g., plant-based vs. insect-based APF). The existing reviews provide contradictory findings, for instance regarding the presence (or absence of) a significant association between knowledge and indicators of consumer choices of

plant-based APF (e.g., Baiano, 2022; Eckl et al., 2021). Finally, it is important to identify the individual-level psychosocial determinants that have consistent support across various contexts. Although several potential determinants have been identified in reviews, it is unclear which ones are well-supported and require further evidence.

The purpose of this meta-review (a systematic review of systematic, scoping, and realist reviews; Hennessy et al., 2019) was to synthesise the evidence for the associations between (i) the individual-level psychosocial characteristics from the COM-B model (capabilities, perceived opportunities, and motivation) and sociodemographic factors from socio-ecological models of behaviour change (Bronfenbrenner, 1979), such as age, gender, education, and income, and (ii) indicators of the individuals' choices of alternative protein food. First, we investigate characteristics consistently identified in reviews as associated with indicators of consumer choice, suggesting that they can be considered consistently supported. Second, we studied specific and common individual-level characteristics that may be associated with a specific type of APF. We focused on distinguishing between psychosocial characteristics associated with dietary choices of plant-based and insect-based proteins, the two most frequently addressed protein types in APF research. Given that *individual-level psychosocial characteristics* are the focus of this study, our examination of opportunities addresses individuals' perceptions of and beliefs about social and physical environment.

Methods

We conducted a meta-review integrating empirical evidence from existing systematic, realist, and scoping reviews. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021) were applied. The study was pre-registered with the PROSPERO database, no. CRD42023388694.

Search strategy

A systematic search encompassing 11 databases of peer-reviewed journals (Academic Search Ultimate, PsycInfo, PsycArticles, Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals) was conducted using the EBSCO platform. The primary search was followed by searching the Web of Science and SCOPUS. Documents and articles published between the inception of the databases and March 2023 were included.

Furthermore, complementary non-systematic searches of published peer-reviewed papers in Google Scholar were conducted using the same keywords as for databases (for details see Supplemental Material). CORDIS and Open Research Europe (ORE) databases were also searched, using 'alternative protein' keywords (the alteration of the keywords was applied as CORDIS and ORE impose limits for the length of search strings, up to 50 characters). Finally, two researchers (FG, BTN) manually searched reference lists of reviews.

The systematic search applied a string with three groups of keywords that referred to: (1) indicators of APF choices or categories (e.g., accept* OR preference* OR willing* OR buy* OR purchas* OR choice* OR behavio* OR adopt* OR inten*) or indicators of individual-level determinants (e.g., behavio* OR belief* OR percep* OR motiv*); (2) alternative protein indicators (e.g., seaweed* OR alga* OR insect* OR lupin* OR legume* OR bean*); and (3) terms referring to review as a research method (e.g., meta-synthesis OR meta-review OR 'synthesis of data' OR 'critical analysis of the literature' OR metaanaly* OR meta-analy* OR 'meta analy*' OR 'retrospective analysis' OR 'qualitative analysis' OR 'quantitative analysis'). For the full list of keywords, see Supplemental Material 1. The keywords were selected using existing reviews on APF (Mancini et al., 2019; Nguyen et al., 2022; Onwezen et al., 2021) and research applying the COM-B model (Nguyen et al., 2022) and the CICI framework (Pfadenhauer et al., 2017). The list of keywords proposed by

Hennessy et al. (2019) was used to identify reviews. For this meta-review, the chosen strategy was to use a broad, inclusive search string (e.g., applying multiple terms that represent the investigated factors, using only basic operators [AND, OR], and applying no specific limits) that could be used across the databases. The feasibility of the string was pretested across the databases before initiating the search.

Figure 1 presents the details of the data selection process. All identified abstracts were screened by two researchers (randomly assigned from a group of five researchers: HZ, EK, ZS, MS, AB) to elicit potentially relevant studies. Any conflicts related to the potential inclusion of a review were resolved through discussions with a fourth researcher (AL). Next, three researchers (AL and two researchers randomly assigned from a group of five: HZ, EK, ZS, MS, AB) independently read the full texts of the articles and determined their match with the inclusion criteria. The data search and evaluation resulted in the inclusion of 28 reviews.

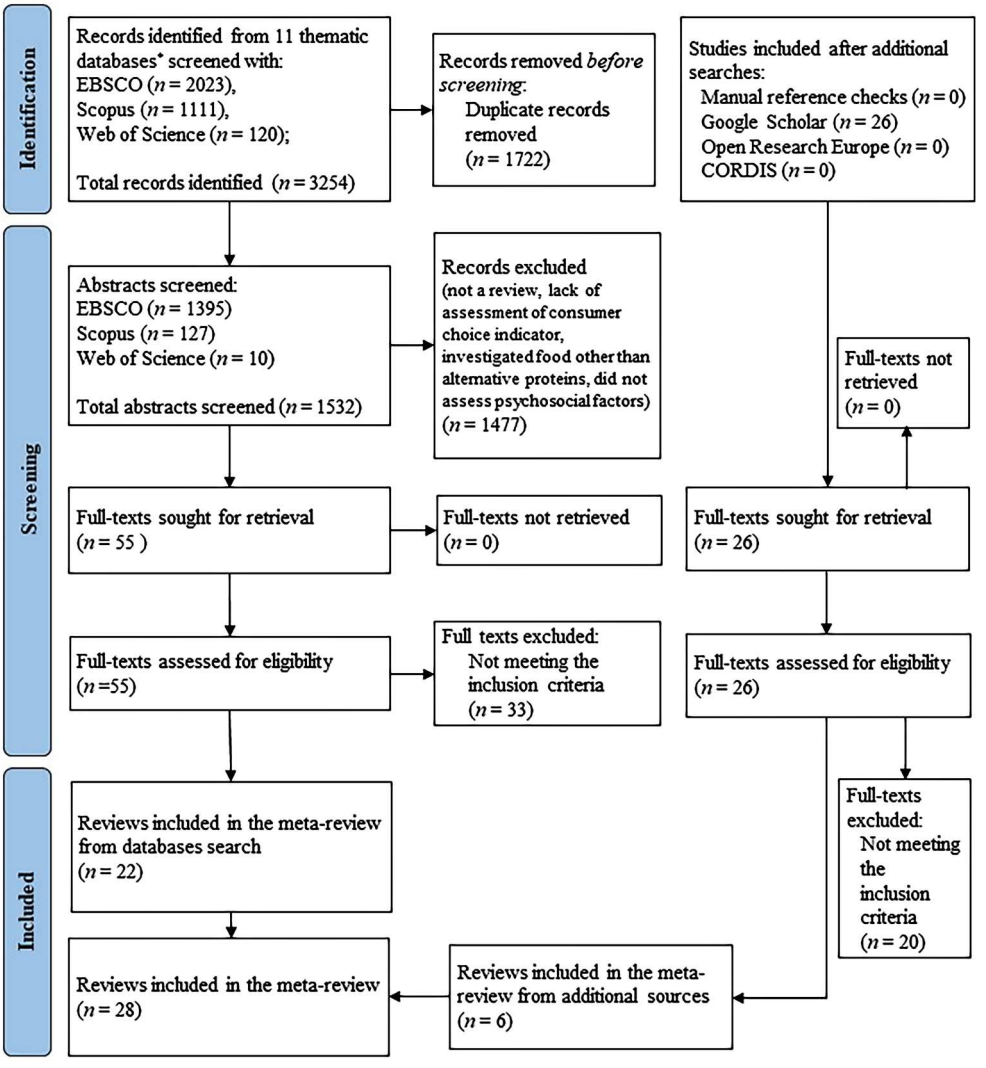

Figure 1. The data selection process.

Note: * Following databases were included when screening with EBSCO search engine: Academic Search Ultimate, PsycInfo, PsycArticles, Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals.

Inclusion and exclusion criteria

The following inclusion criteria were applied: (1) peer-reviewed published systematic, scoping, or realist reviews of quantitative or qualitative studies; (2) reviews addressing APF from any sources, including alternative proteins that are plant-, fungi-, bacteria-, insect-, or krill-based, or addressing products combining meat- and plant-based proteins; (3) reviews testing associations between the individual-level determinants and APF choice indicators (e.g., intention to buy, intention to eat, actual intake, actual purchase, acceptability); and (4) reviews published in English language.

The exclusion criteria were: (1) original studies (i.e., research that focused on reporting new results of an original study), protocols, conference materials, book chapters; (2) unpublished reviews, e.g., reported in dissertations; (3) reviews focusing on the influence of APF intake on health or environmental outcomes, and reviews of policy guidelines; (4) reviews that focused solely on reducing meat intake without addressing the replacement of meat proteins with proteins from alternative sources; (5) reviews that focused on the intake of fruit/vegetable (or on a vegetarian diet), but did not include results related explicitly to APF; (6) reviews focusing solely on alternatively grown beef, poultry, or pork meat (e.g., laboratory-based, in-vitro grown); (7) reviews focusing on product characteristics, such as sustainability, production, packaging, and taste; and (8) reviews focusing solely on alternative proteins as supplements or as animal feed. In case a review focused on any of the latter goals (see points 2–7), but also discussed associations between individual-level characteristics and APF choices, respective sections dealing with links between these characteristics and APF choices were included.

Data extraction and coding

Data necessary for quality evaluation and assessing the risk of bias was extracted and coded by two reviewers (FG and BTN). In case of disagreements during this stage, a third researcher (AB or MS) achieved a resolution through arbitration. The remaining data extraction and coding were conducted by two researchers (HZ and AL). Disagreements were resolved using the consensus method (searching for rating errors, followed by discussion and arbitration by a third researcher, AB [Higgins et al., 2022]).

To address the study objectives, the following data were extracted (see Supplemental Material, Tables S1 and S2): characteristics of reviews included (the number and design of original studies, populations studied, and countries where data were collected), general results of the reviews, types of APF analysed, the APF choice indicators investigated, types of individual-level characteristics investigated in the included review, and the associations between the APF choice indicators and the individual-level characteristics.

For details of the coding process, involving categorising the reviews in terms of the types of APF and the individual-level psychosocial characteristics, see Supplemental Material (Table S2). According to the coding procedure, the *APF choice indicators* included two types of 'cognitions' and two types of 'behaviors': (1) intention to buy, intention to eat, and intention to pay; (2) a broader category of 'acceptance' of APF (cf. Onwezen et al., 2021), used to capture intentions, approval, acceptance, and intake; (3) self-reported behaviour, including self-reported intake, self-reported purchase, or 'adoption' of APF. The term 'adoption' is used in research rooted in the diffusion of innovation approach (Kapoor et al., 2014). In this approach, 'adoption' is an equivalent of self-reported consumption and it is defined as including respective foods into one's own diet, occasionally or on a regular basis (Kapoor et al., 2014); (4) the 'objective' measure of behaviour, such as purchasing or eating the APF product during the experiment.

Reviews were *coded as providing evidence for the association* (see reviews coded as '+' or '−'; Supplemental Material, Table S2) if the results of the included review reported significant associations between the choice indicator (e.g., intention to buy, pay, or eat, acceptability, and adoption) and individual-level characteristic (e.g., emotions such as curiosity). In case the results reported in the

review were indicated as significant for some original studies, but not significant for other studies, the reviews were coded as providing mixed/non-significant evidence (see reviews coded as '0'; Supplemental Material, Table S2). The included reviews did not report findings from correlational studies separately from findings from experimental studies (comparing an experimental manipulation condition with a control condition). Thus, the causal vs. correlational character of the association was not coded. As 23 (out of 28) reviews did not provide information on the effect sizes or the strength of associations between a determinant and an APF choice indicator, this information was not coded either.

Risk of bias assessment, data analysis methods

The risk of bias and quality assessment of the included reviews was performed independently by two researchers (FG and BTN or AB and MS), using the ROBIS tool. ROBIS allows to evaluate the bias across four domains of systematic reviews: study eligibility criteria; identification and selection of studies; data collection procedures and study appraisal; data synthesis strategies and reporting the findings (Whiting et al., 2016). Next, based on limitations identified in the four domains and a bias in the interpretation of findings, the overall risk of bias is determined (Whiting et al., 2016). Thresholds for categorising reviews as having low, moderate, or high risk of bias were defined following Whiting et al. (2016). The weighted Cohen's κ was calculated to assess inter-rater reliability. The values of κ indicated good agreement between raters, with $\kappa = 0.88$ (95 CI: [0.74, 1.00]).

We used a narrative synthesis method to analyse collected data based on the four cornerstones for the narrative synthesis developed by the UK Economic and Social Research Council (Campbell et al., 2019). For details, see Supplemental Material.

The obtained results were summarised as *providing preliminary support* or *providing consistent support*. We used similar thresholds to those applied in previous meta-reviews addressing nutrition behaviours (e.g., Horodyska et al., 2015). In case the individual-level characteristics were addressed in $k \geq 3$ reviews and at least between ≥51% and ≤66% of included reviews indicated a significant association (in the same direction), then the association was considered *preliminarily supported* by the analysed data. The associations were also coded as providing preliminary support when only two included reviews addressed the respective associations, with both indicating consistent significant associations (in the same direction). The association between an individual-level characteristic and an APF choice indicator was considered *consistently supported* if >66% of included reviews ($k \geq 3$) indicated a significant association in the same direction (e.g., three out of four reviews studying respective associations indicated positive links between the two indices). If a review discussed studies addressing associations between one individual-level determinant (e.g., cooking skills) and several indicators of one type of APF choices (e.g., studies on intention to eat plant-based APF, studies on acceptance of plant-based APF), then the review was counted only once when summarising results as providing preliminary or consistent support for this individual-level determinant. However, if a review provided information on several individual-level determinants (e.g., cooking skills, curiosity, neophobia), then a review was counted as providing preliminary/consistent support once for each individual-level determinant (e.g., once as supporting the role of curiosity and once as supporting neophobia).

Results

Preliminary results

A total of $k = 28$ reviews were included. The reviews reported findings from 1014 original studies (six reviews did not provide information about the number of included studies). Supplemental Material (Tables S1 and S2) presents the details of the populations analysed, designs, APF investigated, and psychosocial characteristics associated with APF choices. The analysis of reviews providing

information about the design of original studies indicated that only 13.6% of original research was experimental while the remaining applied a correlational design.

The majority of included reviews synthesised data collected in Europe, North America, and Australia/New Zealand ($k = 21$, 75% out of 28). Seven reviews (25% out of 28) did not provide information regarding the countries of origin. The screening of included references suggests that these reviews provided data from developed countries (including European countries, North American countries, Australia, New Zealand, and Japan).

The risk of bias scores obtained using ROBIS are reported in Supplemental Material, Table S3. Out of the total number of reviews included, 53.6% ($k = 15$) were evaluated as representing a low risk of bias across five criteria of ROBIS, 3.6% ($k = 1$) was considered to represent low risk across four criteria, and 3.6% ($k = 1$) had low risk in three criteria (see Table 1). The remaining 39.3% ($k = 11$) of the reviews were of unclear risk in ≥3 criteria.

Main findings

COM-B capabilities: skills and formal and informal knowledge

Skills. Four out of four (100%) reviews focusing on consumers' *cooking skills*, found that higher perceived cooking skills were associated with a higher level of acceptance or adoption of *plant-based APF* (Eckl et al., 2021; Graça et al., 2019; He et al., 2020; Onwezen et al., 2021). Additionally, one review addressing *APF from various sources* also reported similar findings (Nguyen et al., 2022).

A capability to replace proteins from animal sources with APF, in particular, *perceived easiness and convenience of replacing meat with APF*, were associated with higher intention to buy and acceptance of *APF from various sources* (Siddiqui et al., 2023) and a higher likelihood of self-reported intake adopting *plant-based APF* (Graça et al., 2019). However, the findings referring to *insect-based APF* were mixed, with one review of high quality yielding null results for intention to buy/pay/eat *insect-based APF* (Wassmann et al., 2021), and two out of three reviews (66%) indicating associations between acceptance, self-reported intake, and adoption (Florença et al., 2022; Onwezen et al., 2021).

Purchase activism, defined as the willingness to take action that impacts the marketplace and affects the food system via active food choices, was associated with the intention to buy *insect-based APF* in one review (Kröger et al., 2022).

Two reviews that investigated if *mindfulness* practices (practising an ability to be in the present moment through non-judgmental attention and awareness) are associated with the acceptance of *insect-based APF* indicated null or inconsistent findings in the original research (Dagevos, 2021; Kröger et al., 2022).

Formal knowledge (education-related) and informal knowledge (sense of familiarity, related to previous exposure). *Formal knowledge* (knowing nutrition values, evidence-based effects of protein intake on individual health and environment; cf. Eckl et al., 2021) exhibits inconsistent associations with the intention to buy/pay or acceptance of *plant-based APF* (two reviews; Baiano, 2022; Eckl et al., 2021). Furthermore, formal knowledge was unrelated or inconsistently related to the acceptance of *APF from various sources* (Giordano et al., 2018). One review addressing *mushroom/fungi APF* (De Cianni et al., 2023) indicated positive associations between formal knowledge and acceptance of APF.

In case of *insect-based APF*, 9 out of 10 (90%) reviews suggest that there is a positive association between formal knowledge and intention to buy/pay/try, acceptance, and adoption of insects as diet components (Ardoin & Prinyawiwatkul, 2021; Batat & Peter, 2020; Eckl et al., 2021; Florença et al., 2022; Kauppi et al., 2019; Mancini et al., 2019; Mina et al., 2023; Siddiqui, Alvi, et al., 2022; Weinrich, 2019). One review suggests mixed effects or no association between formal knowledge and acceptance of insect-based APF (Wendin & Nyberg, 2021). Importantly, formal knowledge may increase the intention to buy, but as the intention to eat is still low, it is unlikely that mere formal knowledge will prompt people to actually adopt insect-based APF into a daily diet (Ardoin & Prinyawiwatkul, 2021).

Table 1. Summary of the meta-review findings for individual-level determinants of alternative protein food (APF) choices by consumers.

Individual determinants of APF choice (domains according to the COM-B model and the CICI framework)	Outcome: type of behavioural indicator	Type of alternative protein food: plant-based	Type of alternative protein food: insect-based	Type of alternative protein food: various sources, (including plants, insects, mushroom/fungi, proteins from other sources)
COM-B: capabilities				
Cooking skills	Overall support	**Consistent +**		
	Intention		+ (Onwezen, 2021 **L**)	
	Consumption	+ (Eckl, 2021 **L**); + (Graça, 2019 **L**); + (He, 2020 **H**)		+ (Nguyen, 2022 **L**)
Easiness to replace meat and convenience to replace meat	Overall support		**Preliminary +**	
	Intention		+ (Onwezen, 2021 **L**); 0 (Wassmann, 2021 **L**); + (Florença, 2022 **L**)	+ (Siddiqui, Bahmid, 2023 **L**)
	Consumption	+ (Graça, 2019 **L**)		
Purchase activism	Overall support			
	Intention		+ (Kröger, 2022 **L**)	
	Consumption			
Mindfulness training	Overall support		**Preliminary 0**	
	Intention		0 (Dagevos, 2020 **H**); 0 (Kröger, 2022 **L**)	
	Consumption			
Formal knowledge	Overall support	**Preliminary 0**	**Consistent +**	
	Intention	0 (Baiano, 2020 **H**); + (Eckl, 2021 **L**)	+ (Ardoin & Prinyawiwatkul, 2021 **H**); + (Batat & Peter, 2020 **H**); + (Dagevos, 2020 **H**); + (Kauppi, 2019 **H**); + (Mancini, 2019 **L**); + (Mina, 2023 **L**); + (Siddiqui, Alvi, 2022 **H**); + (Weinrich, 2019 **L**); 0 (Wendin & Nyberg, 2021 **H**)	+ (mushroom-based products – De Cianni, 2023 **L**); 0 (novel food – Giordano, 2017 **L**)
	Consumption		+ (Eckl, 2021 **L**); + (Florença, 2022 **L**)	
Multiple exposures to APF, perceived familiarity	Overall support	**Consistent +**	**Consistent +**	**Consistent +**
	Intention	+(Baiano, 2020 **H**); + (He, 2020 **H**); + (Onwezen, 2021 **L**); + (Szenderák, 2022 **L**)	+ (Ardoin & Prinyawiwatkul, 2021 **H**); + (Dagevos, 2020 **H**); + (Hartmann & Siegrist, 2017 **L**); + (Kauppi, 2019 **H**); + (Kröger, 2022 **L**); + (Mancini, 2019 **L**); + (Mina, 2023 **L**); + (Onwezen, 2021; **L**); + (Toti, 2020 **H**); 0 (Wassmann, 2021 **L**); + (Wendin & Nyberg, 2021 **H**);	+ (mushroom-based products – De Cianni 2023 **L**); + (Hartmann & Siegrist, 2017 **L**); + (Siddiqui, Bahmid, 2023 **L**); + (Siddiqui, Zannou, 2022 **H**)
	Consumption	+ (Graça, 2019 **L**)	+ (Florença 2022 **L**)	+ (Nguyen, 2022 **L**)
COM-B: opportunities				
Positive social norms	Overall support	**Preliminary +**	**Consistent +**	**Consistent +**
	Intention	+ (Graça, 2019 **L**); + (Onwezen, 2021 **L**)	+ (Ardoin & Prinyawiwatkul, 2021 **H**); + (Kauppi, 2019 **H**); + (Kröger, 2022 **L**); + (Mancini, 2019 **L**); + (Mina, 2023 **L**); + (Onwezen, 2021 **L**); + (Siddiqui, Alvi, 2022 **H**); + (Wassmann 2021 **L**); + (Wendin & Nyberg, 2021 **H**)	+ (mushroom-based products; De Cianni, 2023 **L**); + (mushroom-based product; Eckl, 2021 **L**); + (Giordano, 2017 **L**); + (Nguyen, 2022 **L**); + (Siddiqui, Bahmid, 2023 **L**)

	Consumption		+ (Florença 2022 **L**)	
Social support from family and friends	Overall support			
	Intention			
	Consumption	+ (Graça, 2019 **L**)		
Positive social image and perceived high sociability of eating meat	Overall support			
	Intention			+ (Nguyen, 2022 **L**)
	Consumption			
Eating meat as a positive social norm	Overall support			
	Intention	− (He, 2020 **H**)		− (Nguyen, 2022 **L**)
	Consumption			
Positive perceived cultural norms	Overall support		**Consistent +**	**Consistent +**
	Intention		+ (Batat & Peter, 2020 **H**); + (novel insect-based food − Giordano, 2017 **L**); + (Hartmann & Siegrist, 2017 **L**); + (Kauppi, 2019 **H**); + (Mancini, 2019 **L**); + (Onwezen, 2021 **L**); + (Siddiqui, Alvi, 2022 **H**); + (Toti, 2020 **H**); + (Wendin & Nyberg, 2021 **H**)	+ (mushroom-based products; De Cianni, 2023 **L**); + (Nguyen, 2022 **L**); + (Siddiqui, Zannou, 2022 **H**)
	Consumption		+ (Florença, 2022 **L**); + (Toti, 2020 **H**)	
Perceived incompatibility with local food	Overall support			
	Intention			
	Consumption			− (Weinrich, 2019 **L**)
Distrust in technology used in APF development	Overall support	**Preliminary −**	**Consistent −**	**Consistent −**
	Intention	− (Onwezen, 2021 **L**); − (Szenderák, 2022 **L**)	− (Kröger, 2022 **L**); −(Wassmann, 2021 **L**)	− (Eckl, 2021 **L**); − (Giordano, 2017 **L**); − (Siddiqui, Zannou, 2022 **H**)
	Consumption		− (Florença, 2022 **L**); − (Wendt & Weinrich, 2023 **L**)	
Perceived unsafety of the food production, retail, storage	Overall support			
	Intention	− (Baiano, 2020 **H**)	0 (Wendin & Nyberg, 2021 **H**)	− (Siddiqui, Zannou, 2022 **H**)
	Consumption			
High trust in/low uncertainty of research, science, independent food promoters or organisations	Overall support			**Preliminary +**
	Intention	+ (Onwezen, 2021 **L**)	+ (Onwezen, 2021 **L**)	+(Giordano, 2017 **L**); + (Siddiqui, Zannou, 2022 **H**)
	Consumption			
COM-B: motivations				
Perceived health benefits/ healthiness	Overall support	**Consistent +**	**Consistent +**	**Consistent +**
	Intention	− (Baiano, 2020 **H**); + (Onwezen, 2021 **L**); + (Szenderák, 2022 **L**); + (algae-based only − Wang, 2023 **H**)	+ (Dagevos, 2020 **H**); 0 (Kröger, 2022 **L**); + (Onwezen, 2021 **L**); + (Toti, 2020 **H**); 0 (Wassmann, 2021 **L**); + (Wendin & Nyberg, 2021 **H**)	+ (Nguyen, 2022 **L**); + (Onwezen, 2021 **L**); + (Siddiqui, Bahmid, 2023 **L**)
	Consumption	+ (Eckl, 2021 **L**); + (Graça, 2019 **L**); + (Siddiqui, Alvi, 2022 **H**); + (Weinrich, 2019 **L**)	+ (Florença, 2022 **L**)	+ (mushroom-based products; De Cianni, 2023)
Perceived high nutritional value	Overall support			
	Intention	+ (Wang, 2023 **H**)	0 (Wang, 2023 **H**); + (Wendin & Nyberg, 2021 **H**)	
	Consumption			

(*Continued*)

Table 1. Continued.

Individual determinants of APF choice (domains according to the COM-B model and the CICI framework)	Outcome: type of behavioural indicator	Type of alternative protein food: plant-based	Type of alternative protein food: insect-based	Type of alternative protein food: various sources, (including plants, insects, mushroom/fungi, proteins from other sources)
Health risk	Overall support		**Consistent −**	
	Intention		− (Batat & Peter, 2020 **H**); − (Onwezen, 2021 **L**); − (Siddiqui, Alvi, 2022 **H**); − (Wassmann, 2021 **L**)	+ (Giordano, 2017 **L**)
	Consumption	− (He, 2020 **H**)	− (Florença 2022 **L**)	
Pro-environmental and sustainability benefit	Overall support	**Consistent +**	**Preliminary +**	**Consistent +**
	Intention	+ (Onwezen, 2021 **L**); 0 (Szenderák, 2022 **L**)	0 (Dagevos, 2020 **H**); 0 (Kröger, 2022 **L**); + (Mancini, 2019 **L**); 0 (Mina, 2023 **L**); + (Onwezen, 2021 **L**); + (Siddiqui, Alvi, 2022 **H**); + (Toti, 2020 **H**); + (Wassmann, 2021 **L**); 0 (Weinrich, 2019 **L**); 0 (Wendin & Nyberg, 2021 **H**)	+ (mushroom-based products − De Cianni, 2023); 0 (Nguyen, 2022 **L**); + (Siddiqui, Bahmid, 2023 **L**)
	Consumption	+ (Eckl, 2021 **L**); + (Graça, 2019 **L**); 0 (Szenderák, 2022 **L**)	+ (Florença, 2022 **L**); + (Siddiqui, Alvi, 2022 **H**); + (Toti, 2020 **H**)	+ (Eckl, 2021 **L**); 0 (Nguyen, 2022 **L**); + (Siddiqui, Bahmid, 2023 **L**); + (Weinrich, 2019 **L**)
Climate change scepticism	Overall support			
	Intention			
	Consumption	− (Graça, 2019 **L**)		
Animal welfare/empathy towards animals	Overall support	**Consistent +**		
	Intention	+ (Eckl, 2021 **L**); + (Siddiqui, Bahmid, 2023 **L**)		
	Consumption	+ (Graça, 2019 **L**)	+ (Florença, 2022 **L**)	
Moral disengagement	Overall support			
	Intention	− (Graça, 2019 **L**)	+ (Wassmann, 2021 **L**)	
	Consumption			
Moral and ethical motives	Overall support			
	Intention	+ (Onwezen, 2021 **L**)		
	Consumption			
Worldview conservatism	Overall support	**Preliminary 0**		
	Intention			− (Onwezen, 2021 **L**)
	Consumption	0 (Graça, 2019 **L**); 0 (Szenderák, 2022 **L**)		
Religiousness	Overall support			
	Intention		0 (Kröger, 2022 **L**)	
	Consumption			
Feeling adventurous, daring, excitement accompanying sensation-seeking	Overall support		**Consistent +**	
	Intention		+ (Ardoin & Prinyawiwatkul, 2021 **H**); + (Dagevos, 2020 **H**); + (Kauppi, 2019 **H**); + (Kröger, 2022 **L**); + (Siddiqui, Alvi, 2022 **H**); + (Wassmann, 2021 **L**); + (Wendin & Nyberg, 2021 **H**)	
	Consumption		+ (Florença, 2022 **L**)	
Curiosity	Overall support		**Consistent +**	

	Intention		+ (Ardoin & Prinyawiwatkul, 2021 **H**); + (Dagevos, 2020 **H**); + (Onwezen, 2021 **L**); + (Wendin & Nyberg, 2021 **H**)	
	Consumption		+ (Florença, 2022 **L**); + (Toti, 2020 **H**)	
Neophilia (liking new food)	Overall support		**Preliminary +**	
	Intention		+ (Dagevos, 2020 **H**); + (Kröger 2022 **L**)	
	Consumption			
Attachment and positive emotions towards meat	Overall support	**Preliminary −**		
	Intention	− (Szenderák, 2022 **L**)		
	Consumption	− (Graça, 2019 **L**); − (He, 2020 **H**); 0 (Szenderák, 2022 **L**)	0 (Kröger, 2022 **L**)	− (Nguyen, 2022; **L**)
Worry or guilt towards eating meat	Overall support			
	Intention			
	Consumption	+ (Graça, 2019 **L**)		+ (Nguyen, 2022 **L**)
Food neophobia	Overall support	**Preliminary −**	**Consistent −**	**Preliminary −**
	Intention	− (Onwezen, 2021 **L**)	− (Ardoin & Prinyawiwatkul, 2021 **H**); − (Batat & Peter, 2020 **H**); − (Dagevos, 2020 **H**); − (Kröger, 2022 **L**); − (Mina, 2023 **L**); − (Nguyen, 2022 **L**); − (Onwezen, 2021 **L**); − (Siddiqui, Alvi, 2022 **H**); − (Toti, 2020 **H**); − (Wassmann, 2021 **L**); − (Wendin & Nyberg, 2021 **H**)	− (Eckl, 2021 **L**); − (Siddiqui, Zannou, 2022 **H**)
	Consumption	− (Graça, 2019 **L**); 0 (Szenderák, 2022 **L**)	− (Florença, 2022 **L**); − (Siddiqui, Alvi, 2022 **H**); − (Toti, 2020 **H**);	
Disgust	Overall support		**Consistent −**	
	Intention	− (Onwezen, 2021 **L**)	− (Ardoin & Prinyawiwatkul, 2021 **H**); − (Batat & Peter, 2020 **H**); − (Deroy, 2015 **H**); − (Kröger 2022 **L**); − (Mina, 2023 **L**) − (Onwezen, 2021 **L**); − (Siddiqui, Alvi, 2022 **H**); − (Toti, 2020 **H**); − (Wassmann, 2021 **L**); − (Wendin & Nyberg, 2021 **H**)	
	Consumption		− (Florença, 2022 **L**)	
Self-efficacy	Overall support		**Preliminary +**	**Preliminary +**
	Intention		+ (Ardoin & Prinyawiwatkul, 2021 **H**); + (Kröger, 2022 **L**)	+ (Onwezen, 2021 **L**)
	Consumption	+ (Graça, 2019 **L**)		+ (Giordano, 2017 **L**)
Openness	Overall support			
	Intention		+ (Kröger, 2022 **L**)	+ (Nguyen, 2022 **L**)
	Consumption			+ (Nguyen, 2022 **L**)
Neuroticism	Overall support			
	Intention		0 (Kröger, 2022 **L**)	
	Consumption			
Agreeableness	Overall support			
	Intention		0 (Kröger, 2022 **L**)	
	Consumption			

(*Continued*)

Table 1. Continued.

Individual determinants of APF choice (domains according to the COM-B model and the CICI framework)	Outcome: type of behavioural indicator	Type of alternative protein food: plant-based	Type of alternative protein food: insect-based	Type of alternative protein food: various sources, (including plants, insects, mushroom/fungi, proteins from other sources)
Sociodemographic determinants				
Female gender	Overall support	**Preliminary +**	**Conisistent −**	**Preliminary 0**
	Intention	+ (Graça, 2019 **L**); 0 (Szenderák, 2022 **L**)	− (Dagevos, 2020 **H**); − (Kauppi, 2019 **H**); − (Kröger, 2022 **L**); 0 (Mancini, 2019 **L**); − (Mina, 2023 **L**); − (Siddiqui, Alvi, 2022 **H**); − (Siddiqui, Bahmid, 2023 **L**); 0 (Toti, 2020 **H**); − (Wassmann, 2021 **L**); − (Wendin & Nyberg, 2021 **H**)	
	Consumption	+ (Siddiqui, Alvi, 2022 **H**); + (Siddiqui, Bahmid, 2023 **L**); 0 (Nguyen, 2022 **L**); 0 (Szenderák, 2022 **L**)	− (Florença, 2022 **L**); 0 (Nguyen, 2022 **L**); − (Weinrich, 2019 **L**)	0 (mushroom-based products − De Cianni, 2023); 0 (mushroom-based products − Eckl, 2021 **L**)
Younger age	Overall support	**Consistent +**	**Consistent +**	**Preliminary 0**
	Intention	0 (Graça, 2019 **L**); 0 (Nguyen, 2022 **L**); + (Szenderák, 2022 **L**)	+ (Dagevos, 2020 **H**); + (Eckl, 2021 **L**); 0 (Kröger, 2022 **L**); − (in children − Kröger 2022 **L**); + (Mina, 2023 **L**); + (Toti, 2020 **H**); 0 (Wassmann, 2021 **L**); + (Weinrich, 2019 **L**); + (Wendin & Nyberg, 2021 **H**)	0 (mushroom-based products − De Cianni, 2023); + (mushroom-based products − Eckl, 2021 **L**); 0 (Nguyen, 2022 **L**)
	Consumption	+ (Siddiqui, Alvi, 2022 **H**); + (Siddiqui, Bahmid, 2023 **L**); + (Szenderák, 2022 **L**)	+ (Florença, 2022 **L**)	
Education	Overall support	**Consistent +**	**Consistent 0**	**Preliminary**
	Intention	+ (Graça, 2019 **L**); + (higher plant intake − Siddiqui, Bahmid, 2023 **L**); + (intake − Szenderák, 2022 **L**); 0 (intention to pay − Szenderák, 2022 **L**)	+ (Dagevos, 2020 **H**); 0 (Eckl, 2021 **L**); 0 (Kauppi, 2019 **H**); 0 (Kröger, 2022 **L**); + (Mina, 2023 **L**); 0 (Wassmann, 2021 **L**); + (Wendin & Nyberg, 2021 **H**)	0 (mushroom-based products − De Cianni, 2023); 0 (mushroom-based products − Eckl, 2021 **L**); 0 (Nguyen, 2022 **L**)
	Consumption	+ (Szenderák, 2022 **L**)		
Income	Overall support	**Preliminary +**		
	Intention	+ (Graça, 2019 **L**)		0 (mushroom-based products − Eckl, 2021 **L**)
	Consumption	+ (Siddiqui, Bahmid, 2023 **L**); 0 (Szenderák, 2022 **L**)	+ (Florença, 2022 **L**)	

Note: APF = alternative protein food; Mushroom-based products – the reviews addressing mushroom and fungi-based alternative proteins only. Intention = research addressing intention, approval, acceptability of APF as an indicator of APF choices. Consumption = research addressing a behavioural indicator of APF choices, such as intake or purchase. 0 – the review is providing either (1) mixed evidence, e.g., indicating that some original studies yielded significant positive associations while others yielded no associations; (2) non-significant evidence, that is included original research suggested no significant evidence; − the review is providing evidence for the negative association, i.e., there is a significant negative link between the individual-level determinant and the indicator of APF choices; + the review is providing evidence for the positive association, i.e., there is a significant positive link between the individual-level determinant and the indicator of APF choices. H = a review with an overall high risk of bias; L = a review with a low risk of bias, estimated using the ROBIS tool. Consistent + = results indicating consistent support with > 66% of positive association reviews ($k \geq 3$; e.g., 3 out of 3, 3 out of 4 etc.); Consistent − = results indicating consistent support for > 66% of negative association reviews ($k \geq 3$, e.g., 3 out of 3, 3 out of 4 etc.); Preliminary + = results indicating preliminary support between 51% and 66% of reviews show positive association ($k \geq 3$, e.g., 2 out of 3, 4 out of 6; or 2 out of 2 indicating positive association); Preliminary − = results indicate preliminary support with 51–66% of reviews show negative association ($k \geq 3$, e.g., 2 out of 3, 4 out of 6; or 2 out of 2 yielding negative association); Consistent 0 = consistent support of mixed or no associations for ≥51% reviews ($k \geq 4$, e.g., 3 out of 4, 3 out of 5; or 3 out of 3 null/mixed association); Preliminary 0 = results indicate preliminary support for null associations (for 2 out of 3 reviews, or 2 out of 2 reviews indicating null/mixed findings).

Additionally, one review suggests no direct effects of formal knowledge, but a moderated association, with beliefs about health or sustainability benefits of APF choices operating as the moderator (Dagevos, 2021). Specifically, formal knowledge (e.g., an education intervention) may influence insect-based APF intake, but only for consumers who are interested in the nutritional, health, or sustainability benefits of APF (Dagevos, 2021).

The process of acquiring *informal knowledge* (defined as multiple exposures to the product, resulting in perceived familiarity, cf. Eckl et al., 2021) seems to be consistently associated with APF choices. Five out of five reviews (100%) addressing *plant-based APF* suggested that acquiring informal knowledge is associated with intention to buy, acceptance, self-reported intake, or adoption (Baiano, 2022; Graça et al., 2019; He et al., 2020; Onwezen et al., 2021; Szenderák et al., 2022). Four out of four (100%) reviews addressing acceptance or adoption of *APF from various sources* also suggest a positive association with perceived familiarity/exposure (Hartmann & Siegrist, 2017; Nguyen et al., 2022; Siddiqui, Zannou, et al., 2022; Siddiqui et al., 2023). Significant positive associations were also found for *mushroom-based APF* (one review; De Cianni et al., 2023).

Furthermore, 12 out of 12 (100%) reviews suggest that informal knowledge is associated with intention to buy, pay, try, acceptance, self-reported intake, and adoption of *insect-based APF* (Ardoin & Prinyawiwatkul, 2021; Dagevos, 2021; Florença et al., 2022; Hartmann & Siegrist, 2017; Kauppi et al., 2019; Kröger et al., 2022; Mancini et al., 2019; Mina et al., 2023; Onwezen et al., 2021; Toti et al., 2020; Wassmann et al., 2021; Wendin & Nyberg, 2021). However, three reviews indicated some limitations for these associations. For example, the type of product may be important: Including insect-based proteins to develop popular food products (hamburgers) may be the most effective strategy to increase acceptance (Mancini et al., 2019). The association with insect-based APF acceptance may be significant for the number of exposures, whereas it may be non-significant for feelings of familiarity (Wassmann et al., 2021). Familiarity and exposure may be sufficient triggers to try insect-based APF, but not sufficient to maintain it as a regular food habit (Dagevos, 2021).

COM-B opportunities: perceptions of the environment

Perceptions of social norms and cultural norms. *Positive social norms* (beliefs that APF is accepted by their peers, family, or important others) were consistently associated with APF choices across included reviews. Two out of two (100%) reviews addressing social norms and *plant-based APF* indicated that positive social norms are associated with intention to eat and acceptance of these types of foods (Graça et al., 2019; Onwezen et al., 2021). Furthermore, these associations were also positive and significant across three out of three reviews (100%) addressing acceptance of *APF from various sources* (Giordano et al., 2018; Nguyen et al., 2022; Siddiqui et al., 2023) and in two out of two (100%) reviews addressing *mushroom/fungi-based APF* (De Cianni et al., 2023; Eckl et al., 2021).

Regarding *insect-based APF*, 12 out of 12 (100%) reviews indicated significant associations between positive social norms and higher intention to try and to eat (Ardoin & Prinyawiwatkul, 2021; Kauppi et al., 2019; Mina et al., 2023; Wassmann et al., 2021; Wendin & Nyberg, 2021), acceptance of (Kröger et al., 2022; Mancini et al., 2019; Mina et al., 2023; Onwezen et al., 2021; Siddiqui, Alvi, et al., 2022; Wendin & Nyberg, 2021), or adoption of a diet including such proteins (Florença et al., 2022).

Three reviews indicated that other psychosocial characteristics were consistently positively associated with APF choices. *Social support from family and friends* to follow a specific diet was associated with higher self-reported intake of *plant-based APF* (one review; Graça et al., 2019). Having a *positive social image and perceived high sociability of eating meat* was associated with lower intention to eat *APF from various sources* (one review; Nguyen et al., 2022). Additionally, perceiving *eating meat as a positive social norm* was associated with a lower intake *of plant-based APF* (He et al., 2020) and *various* APF (Nguyen et al., 2022).

Perceived cultural norms, referring to the perception that APF fits the cuisine of a region or food culture/dietary patterns typical of a region, were associated with stronger intention to try, acceptance, self-reported intake, and adoption of a diet including *insect-based APF* (Batat & Peter, 2020;

Florença et al., 2022; Giordano et al., 2018; Hartmann & Siegrist, 2017; Kauppi et al., 2019; Mancini et al., 2019; Onwezen et al., 2021; Siddiqui, Alvi, et al., 2022; Toti et al., 2020; Wendin & Nyberg, 2021). In sum, 10 out of 10 (100%) reviews suggest significant associations. The same was true in the case of three reviews on *APF from various sources* (De Cianni et al., 2023; Nguyen et al., 2022; Siddiqui, Zannou, et al., 2022). In line with these findings, *perceived incompatibility with local food* was associated with a lower likelihood of adopting *APF from various sources* (Weinrich, 2019).

Safety and trust in the APF food system stakeholders. *Distrust in technology used in the development of food products* (also known as food technology neophobia) is associated with a lower level of intention to buy and acceptance of *plant-based APF* (two reviews; Onwezen et al., 2021; Szenderák et al., 2022). Additionally, distrust in technology is negatively associated with intention to buy/pay, acceptance, and adoption of *insect-based APF* (four reviews; Florença et al., 2022; Kröger et al., 2022; Wassmann et al., 2021; Wendt & Weinrich, 2023). Three other reviews that addressed *APF from various sources* also found negative associations between distrust in technology and intention to buy and acceptance (Eckl et al., 2021; Giordano et al., 2018; Siddiqui, Zannou, et al., 2022).

Perceived safety of food production, retail, storage, etc. is another belief that has been investigated in the context of APF. Three reviews addressing this issue indicated that lower perceived safety was associated with lower acceptance of either *insect-based APF* (Wendin & Nyberg, 2021), *plant-based APF* (Baiano, 2022), or *APF from various sources* (Siddiqui, Zannou, et al., 2022).

Finally, three reviews concluded that *low trust in/uncertainty of research, science, independent food promoters, or organisations* is associated with lower acceptance of *algae-based* APF (Onwezen et al., 2021), *insect-based* APF (Onwezen et al., 2021), and *APF from various sources* (Giordano et al., 2018; Siddiqui, Zannou, et al., 2022).

COM-B motivation: beliefs, attitudes, emotions

Beliefs about health benefits and health risks of alternative proteins. All reviews (seven out of seven, 100%) referring to *health benefits as a motive* in consumers' decisions to choose *plant-based APF* products indicate positive associations. Individuals reporting higher beliefs in the healthiness of APF, and positive health consequences of eating *plant-based APF*, reported stronger intentions to buy and consume, declared acceptance or adoption of *plant-based APF* (Eckl et al., 2021; Graça et al., 2019; Onwezen et al., 2021; Siddiqui, Alvi, et al., 2022; Szenderák et al., 2022; Wang et al., 2023; Weinrich, 2019). *Perceiving high nutritional value* of plant-based food was associated with higher acceptance of *plant-based APF* (one review; Wang et al., 2023). Beliefs that switching to a meatless plant-only diet is *a health risk* were related to a lower likelihood of an adoption of *plant-based APF* (one review; He et al., 2020). Finally, *beliefs about the unhealthiness of novel food* were associated with lower acceptability of novel *plant-based APF* (one review; Baiano, 2022).

Regarding *mushroom-based APF*, only one review addressed this issue and found that consumers' beliefs about positive health consequences were associated with higher intake of respective APF (De Cianni et al., 2023).

In case of *insect-based APF*, two high-quality reviews indicated mixed or non-significant associations between *perceived health benefits* and intention to pay/eat and acceptance of insect-based APF (Kröger et al., 2022; Wassmann et al., 2021). Five out of eight (62.5%) reviews suggest significant associations between perceived health benefits and *insect-based APF choices* (Dagevos, 2021; Florença et al., 2022; Onwezen et al., 2021; Toti et al., 2020; Wendin & Nyberg, 2021). Furthermore, two reviews addressing the *perceived nutritional value* of APF indicated mixed/non-significant associations between perceptions of nutritional value and acceptance of insect-based APF (Wang et al., 2023; Wendin & Nyberg, 2021). The mixed results for links between perceived healthiness and insect-based APF are consistent with associations reported for beliefs that intake of insect-based food constitutes a *health risk*. Five out of five (100%) reviews suggested that perceiving *insect intake-related health risks* was related to lower levels of intention to buy/pay, acceptance, and

adoption of an *insect-based APF* (Batat & Peter, 2020; Florença et al., 2022; Onwezen et al., 2021; Siddiqui, Alvi, et al., 2022; Wassmann et al., 2021).

Three reviews that addressed *various types of APF* indicated that perceived healthiness or *perceived health benefits* are associated with intention to buy, intention to eat, and acceptability of APF (Nguyen et al., 2022; Onwezen et al., 2021; Siddiqui et al., 2023). Similarly, *perceived health risks* were indicated as a barrier to the intake of various types of novel APF products (Giordano et al., 2018). *Beliefs* about the *healthiness of meat* were a barrier to intention to eat various APF (one review; Nguyen et al., 2022).

Beliefs about environmental impact, sustainability, and animal welfare. *Pro-environmental and sustainability-related beliefs* and motives were studied as correlates of plant-based and mushroom/fungi-based APF choices. Three in four (75%) reviews indicated that such reasons are related to higher intention to try/eat, acceptance, and self-reported intake of the *plant-based APF* (Eckl et al., 2021; Graça et al., 2019; Onwezen et al., 2021), one showed mixed findings for intention to buy, eat, and try (Szenderák et al., 2022). One review indicated positive associations for intention to buy, eat, and try *mushroom/fungi-based APF* (De Cianni et al., 2023). Regarding *various APF*, including plants and insect-based, three reviews yielded positive associations with pro-environmental/sustainability motives and intention to eat, try, acceptance, and self-reported intake (Eckl et al., 2021; Siddiqui et al., 2023; Weinrich, 2019) and one indicated mixed/null findings for intention to try, eat, and self-reported intake (Nguyen et al., 2022). Nguyen et al. (2022) suggested that the potential explanation for inconsistent results may refer to the weakness of the associations with self-reported intake indicators, which do not translate to the actual purchase.

High *climate change scepticism* was related to a lower likelihood of self-reported intake and adoption of *plant-based APF* (one review; Graça et al., 2019).

Regarding *pro-environmental and sustainability beliefs*, the pattern of associations is mixed for the *insect-based APF*. Six reviews concluded that there are positive associations between environment/sustainability-related beliefs and intention to buy and try, acceptance, self-reported intake, and adoption of insect-based APF (Florença et al., 2022; Mancini et al., 2019; Onwezen et al., 2021; Siddiqui, Alvi, et al., 2022; Toti et al., 2020; Wassmann et al., 2021). Five reviews indicated mixed, inconclusive findings (Dagevos, 2021; Kröger et al., 2022; Mina et al., 2023; Weinrich, 2019; Wendin & Nyberg, 2021) for intention to pay and try, and acceptance. In sum, 6 out of 11 reviews (54.5%) supported the associations.

Animal welfare, ethical and moral motives, conservative values, and religion. Regarding *concerns about animal welfare and empathy* towards animals three out of three (100%) reviews consistently showed that welfare beliefs are related to a higher likelihood of adoption of *plant-based APF* (Eckl et al., 2021; Graça et al., 2019). An association between animal welfare concerns and higher self-reported intake/adoption of *insect-based APF* was indicated in one review only (Florença et al., 2022).

Regarding reviews investigating *more general moral and ethical motives* (i.e., not only related to animal welfare), reviews suggested that *moral disengagement* was related to a lower likelihood of adopting *plant-based APF* (Graça et al., 2019). Furthermore, indicating moral and ethical motives as guiding dietary choices were related to the acceptance of plant-based APF (Onwezen et al., 2021) and to a stronger intention to pay, eat, and adopt *insect-based APF* (Wassmann et al., 2021).

Following conservative views or values and being religious were unrelated to the adoption *of plant-based APF* in nutrition behaviours in two reviews (Graça et al., 2019; Szenderák et al., 2022). *Religiousness* was unrelated to acceptance of *insect-based APF*, except for findings from India (probably related to beliefs about the holiness of certain animals; Kröger et al., 2022). In contrast, Onwezen et al. (2021) suggested associations between stronger conservative beliefs and weaker acceptance of *APF from various sources*. The discrepancy may result from different conceptualizations of

conservativeness, e.g., either as a construct closer to following religious codes of conduct or as a construct related to environmental scepticism, which in turn may be related to lower acceptance of APF.

Emotion-related factors. Reviews addressing positive emotions focused entirely on *insect-based APF*. *Feeling adventurous*, *daring*, *excitement accompanying sensation seeking*, *and positive emotion excitement* were consistently associated with intention to eat and try, acceptance, and adoption of *insect-based APF*, as indicated in eight out of eight (100%) reviews (Ardoin & Prinyawiwatkul, 2021; Dagevos, 2021; Florença et al., 2022; Kauppi et al., 2019; Kröger et al., 2022; Siddiqui, Alvi, et al., 2022; Wassmann et al., 2021; Wendin & Nyberg, 2021). One review highlighted that these associations may be typical for young men (Kauppi et al., 2019). In six out of six (100%) reviews, *curiosity* showed positive associations with the intention to try, acceptance, and adoption of *insect-based APF* (Ardoin & Prinyawiwatkul, 2021; Dagevos, 2021; Florença et al., 2022; Onwezen et al., 2021; Toti et al., 2020; Wendin & Nyberg, 2021).

Food neophilia (liking new types of food) was associated with the acceptance of *insect-based APF* in two out of two (100%) reviews (Dagevos, 2021; Kröger et al., 2022).

Attachment and positive emotions towards meat were related to lower intention to eat, the likelihood of a purchase, self-reported intake, and adoption of *plant-based APF* in two out of three (66%) reviews addressing this type of protein (Graça et al., 2019; He et al., 2020), and in one review addressing *APF from various sources* (Nguyen et al., 2022). One review addressing the intention to eat, the likelihood of actual purchase, or the adoption of *plant-based APF* yielded inconclusive results (Szenderák et al., 2022). Only one review, albeit of high quality, tested associations between meat attachment and adoption of *insect-based APF*, concluding that findings are inconsistent (Kröger et al., 2022).

Other meat-related emotions, namely *worry and guilt towards eating meat* were associated with higher self-reported intake or adoption of *plant-based APF* (Graça et al., 2019) or *APF from various sources* (Nguyen et al., 2022).

Food neophobia, which refers to aversion or anxiety experienced when exposed to novel food, was addressed in three reviews of *plant-based APF*. Overall, the results suggest food neophobia may be relevant, with two out of three (66%) reviews yielding conclusions about negative associations with acceptance and self-reported intake of plant-based APF (Graça et al., 2019; Onwezen et al., 2021) and one indicating non-significant or inconsistent relationships with self-reported intake (Szenderák et al., 2022). Two reviews that addressed acceptance of *APF from various sources* suggested that APF acceptance is associated with lower levels of food neophobia (Eckl et al., 2021; Siddiqui, Zannou, et al., 2022). Regarding *insect-based APF*, the findings consistently show significant associations (twelve out of twelve reviews, 100%) between low neophobia and intention to pay, try, eat, acceptance, self-reported intake, and early adoption of this type of APF (Ardoin & Prinyawiwatkul, 2021; Batat & Peter, 2020; Dagevos, 2021; Florença et al., 2022; Kröger et al., 2022; Mina et al., 2023; Nguyen et al., 2022; Onwezen et al., 2021; Siddiqui, Alvi, et al., 2022; Toti et al., 2020; Wassmann et al., 2021; Wendin & Nyberg, 2021).

Disgust, including the general emotion of disgust, food disgust, and insect disgust, is related to lower intention to pay or try, acceptance, and adoption of *insect-based APF*. The associations were consistent and found in 11 out of 11 reviews (Ardoin & Prinyawiwatkul, 2021; Batat & Peter, 2020; Deroy et al., 2015; Florença et al., 2022; Kröger et al., 2022; Mina et al., 2023; Onwezen et al., 2021; Siddiqui, Alvi, et al., 2022; Toti et al., 2020; Wassmann et al., 2021; Wendin & Nyberg, 2021). Only one review addressed acceptance of *plant-based APF* (algae) and indicated negative associations with disgust (Onwezen et al., 2021).

Self-efficacy and personality. *Self-efficacy beliefs* and perceived behavioural control are two closely related constructs that refer to individual's beliefs about the ability to act and control one's own behaviour (Bandura, 1997). Higher self-efficacy or beliefs about behavioural control were associated with self-reported intake or adoption of *plant-based APF* in one review (Graça et al., 2019). Higher

self-efficacy was related to self-reported intake and acceptance of *APF from various sources* (two out of two reviews; Giordano et al., 2018; Onwezen et al., 2021), and a higher intention to try, buy, and acceptance of *insect-based APF* (two out of two reviews; Ardoin & Prinyawiwatkul, 2021; Kröger et al., 2022).

Only two reviews provide information on any personality traits that are associated with consumers' APF choices. *Openness,* referring to intellectual curiosity, and challenging authority, was related to the intention to try and initial adoption of *APF from various sources* (Nguyen et al., 2022). *Openness and extraversion* were also related to the intention to pay and eat *insect-based APF* products (Kröger et al., 2022). However, in the case of *neuroticism* and *agreeableness*, mixed or null findings between intention to pay and eat were observed for *insect-based APF* (one review; Kröger et al., 2022).

Individual-level context determinants: the role of sociodemographic characteristics

Gender. Three out of five (60%) reviews suggested that *women* are more likely to report an intention to eat, higher acceptability, or greater intake of *plant-based APF* (Graça et al., 2019; Siddiqui, Alvi, et al., 2022; Siddiqui et al., 2023). Two reviews suggested inconclusive findings for the intention to buy or pay and acceptance for plant-based APF, depending on gender (Nguyen et al., 2022; Szenderák et al., 2022). Mixed or non-significant associations were also reported in two out of two (100%) reviews addressing the intake of *fungi or mushroom-based APF* (De Cianni et al., 2023; Eckl et al., 2021). Two reviews suggested that gender operates forming interactions with age: (i) acceptance of plant-based APF is higher only among older women (Szenderák et al., 2022); (ii) educational interventions may be effective in influencing intention to adopt plant-based APF among younger women only (Nguyen et al., 2022).

Regarding *insect-based APF*, the results are more consistent. In 9 out of 12 reviews *men* were more willing to pay or eat, reported higher acceptance, and were more likely to adopt *insect-based APF* (Dagevos, 2021; Florença et al., 2022; Kauppi et al., 2019; Mina et al., 2023; Siddiqui, Alvi, et al., 2022; Siddiqui et al., 2023; Wassmann et al., 2021; Weinrich, 2019; Wendin & Nyberg, 2021). No associations or mixed effects were found in three reviews, addressing intention to eat and acceptance of insect-based APF (Mancini et al., 2019; Nguyen et al., 2022; Toti et al., 2020). Additionally, three reviews suggested that gender forms interactions with other psychosocial characteristics predicting choices of insect-based APF: (i) its effect on acceptance depends on the type of insects or the types of food processing involved (Kröger et al., 2022); (ii) the effect of education interventions on intention to adopt a diet may be significant among younger men (Kauppi et al., 2019).

Age. Regarding *plant-based APF*, *younger age* was associated with higher intake and more frequent trying APF in three out of five (60%) reviews (Siddiqui, Alvi, et al., 2022; Siddiqui et al., 2023; Szenderák et al., 2022), while two reviews reported mixed or non-significant findings for intention to try and acceptance of plant-based APF (Graça et al., 2019; Nguyen et al., 2022). Similarly, mixed or non-significant findings with age were reported in two out of two (100%) reviews addressing acceptance and intake of *mushroom/fungi-based APF* (De Cianni et al., 2023; Eckl et al., 2021). Finally, one review addressing acceptance of *APF from various sources* indicated mixed results with age (Nguyen et al., 2022).

Regarding *insect-based APF*, significant associations with younger age were reported in the majority (7 out of 10, 70%) of the reviews, addressing acceptance, trying, and adoption of such diet (Dagevos, 2021; Eckl et al., 2021; Florença et al., 2022; Mina et al., 2023; Toti et al., 2020; Weinrich, 2019; Wendin & Nyberg, 2021). However, two reviews indicated mixed or non-significant associations between intention to pay or eat and acceptance (Kröger et al., 2022; Wassmann et al., 2021). One review highlighted that among adolescents, older are more likely to try insect-based APF than younger adolescents/children (Kröger et al., 2022).

Education. Three out of three (100%) reviews suggested that *higher education* is associated with indicators of acceptance and self-reported intake of *plant-based APF* (Graça et al., 2019; Siddiqui et al., 2023; Szenderák et al., 2022). One review addressing *various types of APF*, including plant- and insect-based indicated mixed or non-significant results (Nguyen et al., 2022). Notably the associations may be negative (higher education-less likely APF choices) in developing countries in Africa or Asia (Szenderák et al., 2022). Reviews on acceptance of *mushroom/fungi-based APF* and education yielded mixed findings or no association (two out of two reviews, 100%; De Cianni et al., 2023; Eckl et al., 2021).

Regarding *insect-based APF*, only three out of seven reviews addressing this issue showed that higher education is associated with acceptance or early adoption of insect-based APF (Dagevos, 2021; Mina et al., 2023; Wendin & Nyberg, 2021). Four reviews suggested mixed or non-significant findings for intention to buy or pay, or acceptance of this type of APF (Eckl et al., 2021; Kauppi et al., 2019; Kröger et al., 2022; Wassmann et al., 2021).

Income. Regarding *higher income* levels, two out of three (66%) reviews found significant correlations between this characteristic and the adoption of *plant-based APF* (Graça et al., 2019; Siddiqui et al., 2023). One review indicated no associations with intention to pay or intake of plant-based APF (Szenderák et al., 2022). There were no associations between income and acceptance of *mushroom/fungi-based APF* (one review; Eckl et al., 2021). One review suggested that the adoption of *insect-based APF* is associated with higher income (Florença et al., 2022).

Psychosocial predictors of plant-based APF versus predictors of insect-based APF

Table 1 provides a synthesis of findings coded as suggesting (1) preliminary support (51–66% of $k \geq 3$ reviews addressing the respective associations indicated significant effects) or (2) consistent support (>66% of $k \geq 3$ reviews addressing the respective associations indicated significant effects) for the relationships between individual-level characteristics and APF choice indicators.

Preliminary or consistent support was obtained for the relationships between *plant-based APF* choices and the individual-level characteristics from the COM-B model, including (1) Capabilities, such as cooking skills, exposure to APF and related familiarity; (2) perceived Opportunities, including positive social norms, low distrust in technology used in the development of APF; (3) Motivations, such as perceived health benefits, pro-environmental and sustainability benefits, animal welfare/empathy towards animals, low attachment towards meat, low food neophobia. Female gender, younger age, higher education, and higher income also obtained preliminary consistent support as characteristics associated with *plant-based APF* choices (Table 1). For characteristics that received *consistent support*, see Figure 2, the top panel.

Across studies included in reviews addressing plant-based APF, the majority focused on intention or 'acceptance' (a broader construct, encompassing intention and acceptability) (see Table 1, rows reporting intention/acceptance). Thus, for many individual characteristics, the preliminary/consistent support was obtained based on research on intention (or 'acceptance') rather than behaviour itself. Consistent support for associations between individual characteristics and intake/purchase of plant-based APF was obtained only for cooking skills, perceived health benefits, meat attachment, and younger age (Table 1), while preliminary support was obtained for pro-environmental and sustainability benefits as well as female gender.

Regarding *insect-based APF* choices, *preliminary support or consistent support* was obtained for associations with COM-B-based individual-level characteristics: (i) Capabilities referring to formal knowledge about APF, exposure to APF, and related familiarity; (ii) Perceived Opportunities, referring to positive social norms, perceived positive cultural norms accepting APF, and low distrust in technology used in development of APF; (iii) Motivations, such as perceived health benefits, pro-environmental and sustainability benefits, low perceived health risks, feelings of being adventurous, daring,

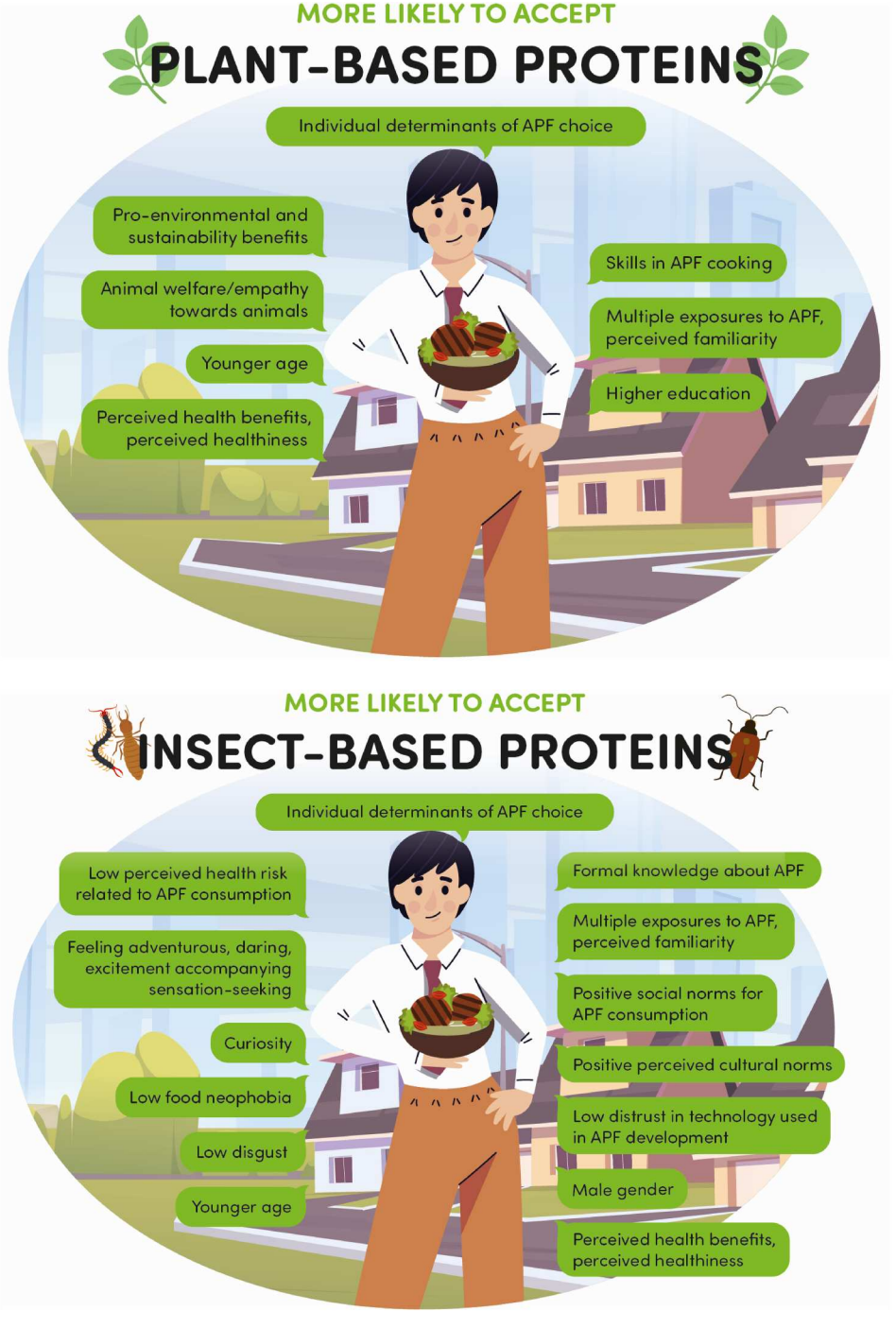

Figure 2. Summary of the individual-level characteristics associated with plant-based alternative protein food choices (the upper panel) and insect-based alternative protein food choices (the bottom panel): characteristics consistently supported in the meta-review.

Note: In case of all individual-level characteristics, consistent support was obtained in studies using either intention (to eat, try or buy) as the main outcome or the actual consumption of alternative proteins. If studies applying intention as the outcome are excluded, and solely studies applying the actual intake of alternative proteins as the outcome are considered, consistent support was provided only for: (i) cooking skills, perceived health benefits, younger age, and plant-based alternative proteins intake; (ii) food neophobia, pro-environmental/sustainability beliefs and insect-based alternative proteins intake.

excitement, emotion of curiosity, liking new food (neophilia), low neophilia, low disgust, and high self-efficacy beliefs. Male gender and younger age are also associated with *insect-based APF* choices (Table 1). For characteristics that received *consistent support*, see Figure 2, the bottom panel.

As in case of plant-based APF, the majority of research on insect-based APF focused on intention or 'acceptance' (see Table 1, rows reporting intention/acceptance). Across individual characteristics, only pro-environmental beliefs and neophobia were consistently supported in terms of links with an indicator of intake/purchase of insect-based APF (see Table 1), while preliminary support was obtained for formal knowledge, perceived cultural norms, low technology distrust, curiosity, and male gender.

Discussion

This study provides a theory-based synthesis of evidence concerning the individual-level characteristics that are consistently associated with indicators of intention, acceptance, and intake of alternative protein food. Alternative protein choices are examples of environmental health behaviours, which may require more attention and research, considering major global threats such as climate change (Inauen et al., 2021). The results highlight both similarities and differences in association patterns based on the source of APF, specifically comparing plant-based and insect-based APF choices.

Considering the three domains of the COM-B model (McDonagh et al., 2018; Michie et al., 2011), the *Capability* domain has received the least attention in the identified reviews. Multiple exposures to APF products and related feelings of familiarity emerged as the common individual-level correlate of plant-based and insect-based APF choices. Thus, increasing exposure to APF in the food environment could be an initial strategy to increase awareness and consumption of APF (Stiles et al., 2022). Cooking skills, the second consistently supported characteristics from the *Capability* domain, although the support was obtained for plant-based APF only. Future interventions promoting APF intake may include cooking workshops at schools or other public institutions to enhance cooking skills. Besides, they can provide the opportunity for exposure to APF, and thus increase the familiarity with these products. Such workshops may also leverage the 'IKEA effect', where active participation in the preparation process increases liking of the prepared food, which then increases the intake (Radtke et al., 2019). Improving cooking skills may also serve as a 'mastery experience' (e.g., 'I have done it successfully!'). This may, in turn, enhance consumers' self-efficacy referring to the ability to adopt a regular APF intake (Luszczynska & Schwarzer, 2020).

Across individuals' perceptions and beliefs about the social and physical environment, which constitute the *Opportunity* domain of the COM-B model (Cane et al., 2012; McDonagh et al., 2018; Michie et al., 2011), consistent evidence emerged for positive social norms, cultural norms, and distrust in technology used in insect-based APF development. Previous research has shown that when individuals were asked how they would eat insect-based APF products, their response was 'with either an expert' or 'with someone who knows how to cook them' (Bisconsin-Júnior et al., 2022). Identifying such experts who are relevant role models for the consumers may enhance consumers' confidence in insect-based APF as socially approved products and thus increase adoption of respective products.

We found that the approval of specific cultural norms, referring to the culinary traditions relying on animal-based products as typical components of protein-rich foods, was a barrier hindering insect-based APF choices. Previous research indicated that such cultural norms may be particularly strong in certain countries where animal-based products are continuously endorsed, for example by promoting animal-based products by awarding Protected Designation of Origin certificates (Mancini & Antonioli, 2022). These countries are also characterised by lower sales of some types of alternative proteins, such as insect-based APF (Mancini & Antonioli, 2022; Zaleskiewicz et al., 2024). Furthermore, previous reviews have shown that the levels of acceptance, intention or intake of insect-based APF vary across European countries and regions (cf. Zaleskiewicz et al., 2024). It is possible that the links between COM-B-based determinants and APF choices' indicators may vary across countries or cultures, depending on local policies, APF availability, culinary traditions, and other aspects of the

food system. A synthesis of cross-country differences was not possible due to the limited information provided in the included reviews.

Regarding insect-based APF, another significant psychosocial characteristic from the *Opportunity* domain is a lack of trust in the technology used to develop alternative proteins. Distrust may be associated with limited knowledge about insect-based APF (a *Capability* factor hindering APF intake) and negative emotion-related factors (such as neophobia, a *Motivation* factor). Previous research has suggested that high trust in the actions of food system stakeholders, including food producers, scientists, and consumer organisations, may be considered one of the key potential determinants of choices of various novel types of food (Siegrist & Hartmann, 2020). Our study points out that the trust factor may be specifically relevant for insect-based APF.

Regarding the individual-level psychosocial factors from the *Opportunity* domain as correlates of plant-based APF choices, we obtained preliminary (for plant-based APF) or consistent support (for insect-based APF) for positive social norms. The fact that social norms obtained 'only' preliminary support for plant-based APF may be explained by earlier research indicating that social norms may operate differently within certain subgroups. For example, among meat-eating men, the presence of other men (e.g., in restaurants) may be a barrier to choosing plant-based APF products due to the influence of masculinity norms (Bogueva et al., 2022). In contrast, women who frequently dine out in restaurants with friends are more likely to have positive social norms towards plant-based APF, which in turn is associated with higher plant-based APF choices (Weinrich & Elshiewy, 2023).

The *Motivation* domain of the COM-B model yielded the largest number of consistently supported factors, with most of these factors forming a distinctive set of psychosocial correlates either of plant-based APF or insect-based APF. Perceived health benefits constitute the only characteristic from this domain, that was consistently supported for both plant-based and insect-based APF. Previous research has argued that addressing health benefits in promoting the consumption of insect-based APF may have a limited effect due to the temporally distant character of health-related goals (Berger et al., 2018). Additionally, for insect-based APF, health risks and negative emotion-related factors, such as food neophobia or distrust, emerged as consistently supported correlates. Previous research has shown that beliefs about health-related risks may have an emotional component of fear or anxiety (Ruiter et al., 2001). Fear and anxiety are central components of general, food-specific, or insect-specific neophobia. As a result, health risk perceptions and neophobia may be interconnected, creating a vicious cycle that reduces the likelihood of adopting novel or insect-based APF foods. Beliefs about higher health risks may also be related to lower individual familiarity with novel APF products (Tuorila & Hartmann, 2020).

Our findings within the *Motivational* domain of the COM-B model highlight the crucial role of automatic regulatory processes in the adoption of insect-based APF into consumers' diets. Besides negative emotions, our findings underscore the pivotal role of positive emotions such as curiosity or feeling adventurous, daring, seeking excitement, and sensations in the adoption of dietary shifts, including insect-based APF. These findings may have practical implications. Interventions prompting curiosity and excitement should be implemented, accounting for a presence of experts whose knowledge and skills would guarantee safety and low health risks. Food events/festivals may constitute an intervention setting where curiosity may prompt individuals to try insect-based APF. Recent research has indicated that food festivals are the preferred setting for trying APF (Motoki et al., 2022).

In contrast to insect-based APF, a different set of *Motivation*-related factors emerged as consistently supported correlates of plant-based APF. These factors include pro-environmental and sustainability beliefs, and empathy towards animals. Interventions promoting plant-based APF should target sustainability beliefs or animal welfare issues, whereas interventions promoting insect-based APF should address different motivation-related determinants, such as curiosity, or familiarise consumers with insect-based food to reduce their neophobia.

Finally, our meta-review points towards the specificity of the sociodemographic factors associated with plant-based and insect-based APF choices. For insect-based APF, men are more likely to

opt for such products, whereas the education level is unlikely to hinder or promote insect-based APF choices. These findings are of particular relevance, as men and lower education groups are in need of nutrition interventions but are often harder to reach (Darmon & Drewnowski, 2008).

One important finding is the relative lack of research on individual-level psychosocial characteristics of actual trying or actual intake of APF. The majority of reviews focus on research addressing intentions and acceptability; self-reported intake is measured less frequently, and experimental research measuring the actual intake of APF is rare. Further evidence confirming the links between the psychosocial characteristics discussed in our review, and acts of purchase, trying, or regular intake of APF is needed.

Implications and limitations

The findings of this meta-review have some implications for practice. Awareness-raising campaigns, educational interventions, and other actions promoting the widespread acceptance of APF products require addressing various characteristics of consumers and accounting for the source of APF. Such tailoring may result in a better alignment between the characteristics of target populations and the type of the promoted APF product, and consequently mainstreaming APF choices. For example, a marketing strategy involving sustainability-oriented female consumer models and curiosity-oriented male consumer models might promote plant- and insect-based APF choices.

Beyond its strengths, the present study has several limitations. The majority of original studies analysed in the included reviews provide evidence for correlations between individual-level 'determinants' and the indicators of APF choices. Additionally, included reviews did not allow to differentiate between findings based on correlational studies and those based on experimental studies Thus, causal conclusions should not be made. On the other hand, the majority of included reviews reported original studies of which at least 10% were of experimental design, for example linking emotions and intake of insect-based alternative proteins (Ardoin & Prinyawiwatkul, 2021; Dagevos, 2021) or documenting causal associations between animal welfare beliefs and intake of plant-based alternative proteins (Graça et al., 2019). Future reviews should carefully distinguish between evidence gathered in observational versus experimental studies. The majority of the research reported in included reviews focused on intention to eat/try/buy or 'acceptance' of APF, but not on intake/purchase. Consequently, for intake/purchase of plant-based APF, the consistent support was obtained for only four individual determinants, and in the case of insect-based APF only two determinants were consistently supported. In case of remaining determinants, consistent support was based mostly on data addressing intention or acceptance of APF. As the majority (82%) of included reviews did not provide information on effect sizes or the strength of associations between a determinant and an APF choice indicator, the effect sizes for respective associations could not be estimated. The limited number of reviews addressing APF other than plant-based or insect-based imposes limitations to drawing conclusions regarding the specificity of correlates that may be significant, e.g., in the case of fungi- mushroom-, or microbial-based APF. The results of the quality evaluation indicated that only half of the reviews presented a low risk of bias. These findings should inspire consideration of the insufficient quality of many reviews and potentially flawed results. Furthermore, included reviews were heterogeneous in terms of target groups and settings, therefore any conclusions should be treated as preliminary. The conclusions of any meta-review may be biased if there is an overlap in the original studies analysed in the included reviews (Hennessy et al., 2019). The heterogeneity of the aims of reviews included in this meta-review reduces the likelihood of such overlap, yet some overlap is undoubtedly expected. The effects of the overlap were not tested systematically. In line with previous reviews (Horodyska et al., 2015), we used a threshold of 66% to indicate consistent support and 50% to indicate preliminary support for an analysed determinant. The distinction between these two thresholds is arbitrary and the pattern of the associations should be confirmed further in a meta-analysis of original research presenting quantitative results. As a

limited number of included reviews reported quantitative results for any of the determinants, conducting a meta-analysis was not feasible.

Concluding, this study offers a theory-based synthesis of evidence on individual-level psychosocial determinants of APF choices. Our findings may inform policymakers, food producers, researchers and other actors within the food supply chain, of the need for accounting for individual's capabilities, motivations, sociodemographic characteristics, and perceived opportunities when making plans for the development of programmes promoting APF intake. Finally, it underscores substantial differences in determinants associated with plant-based APF choices compared to insect-based APF choices.

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References

References marked with an asterisk indicate studies included in the meta-review. The complete list of references included in the meta-review is included in the Supplemental Material.

*Ardoin, R., & Prinyawiwatkul, W. (2021). Consumer perceptions of insect consumption: A review of western research since 2015. *International Journal of Food Science & Technology*, *56*(10), 4942–4958. https://doi.org/10.1111/ijfs.15167

*Baiano, A. (2022). 3D printed foods: A comprehensive review on technologies, nutritional value, safety, consumer attitude, regulatory framework, and economic and sustainability issues. *Food Reviews International*, *38*(5), 986–1016. https://doi.org/10.1080/87559129.2020.1762091

Bandura, A. (1997). *Self-efficacy: The exercise of control*. Freedom.

*Batat, W., & Peter, P. (2020). The healthy and sustainable bugs appetite: Factors affecting entomophagy acceptance and adoption in Western food cultures. *Journal of Consumer Marketing*, *37*(3), 291–303. https://doi.org/10.1108/JCM-10-2018-2906

Berger, S., Bärtsch, C., Schmidt, C., Christandl, F., & Wyss, A. M. (2018). When utilitarian claims backfire: Advertising content and the uptake of insects as food. *Frontiers in Nutrition*, *5*, 88. https://doi.org/10.3389/fnut.2018.00088

Bisconsin-Júnior, A., Rodrigues, H., Behrens, J. H., da Silva, M. A. A. P., & Mariutti, L. R. B. (2022). "Food made with edible insects": Exploring the social representation of entomophagy where it is unfamiliar. *Appetite*, *173*, 106001. https://doi.org/10.1016/j.appet.2022.106001

Bogueva, D., Marinova, D., & Bryant, C. (2022). Meat me halfway: Sydney meat-loving men's restaurant experience with alternative plant-based proteins. *Sustainability*, *14*(3), 1290. https://doi.org/10.3390/su14031290

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.

Campbell, M., Katikireddi, S. V., Sowden, A., & Thomson, H. (2019). Lack of transparency in reporting narrative synthesis of quantitative data: A methodological assessment of systematic reviews. *Journal of Clinical Epidemiology*, *105*, 1–9. https://doi.org/10.1016/j.jclinepi.2018.08.019

Cane, J., O'Connor, D., & Michie, S. (2012). Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*, *7*(1), 37. https://doi.org/10.1186/1748-5908-7-37

Chevance, G., Fresán, U., Hekler, E., Edmondson, D., Lloyd, S. J., Ballester, J., Litt, J., Cvijanovic, I., Araújo-Soares, V., & Bernard, P. (2023). Thinking health-related behaviors in a climate change context: A narrative review. *Annals of Behavioral Medicine*, *57*(3), 193–204. https://doi.org/10.1093/abm/kaac039

*Dagevos, H. (2021). A literature review of consumer research on edible insects: Recent evidence and new vistas from 2019 studies. *Journal of Insects as Food and Feed*, *7*(3), 249–259. https://doi.org/10.3920/JIFF2020.0052

Darmon, N., & Drewnowski, A. (2008). Does social class predict diet quality? *The American Journal of Clinical Nutrition*, *87*(5), 1107–1117. https://doi.org/10.1093/ajcn/87.5.1107

*De Cianni, R., Pippinato, L., & Mancuso, T. (2023). A systematic review on drivers influencing consumption of edible mushrooms and innovative mushroom-containing products. *Appetite*, *182*, 106454. https://doi.org/10.1016/j.appet.2023.106454

*Deroy, O., Reade, B., & Spence, C. (2015). The insectivore's dilemma, and how to take the West out of it. *Food Quality and Preference*, *44*, 44–55. https://doi.org/10.1016/j.foodqual.2015.02.007

EAT. (2022). *EAT-Lancet Commission summary report*. https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/

*Eckl, M. R., Biesbroek, S., van't Veer, P., & Geleijnse, J. M. (2021). Replacement of meat with non-meat protein sources: A review of the drivers and inhibitors in developed countries. *Nutrients*, *13*(10), 3602. https://doi.org/10.3390/nu13103602

*Florença, S. G., Guiné, R. P. F., Gonçalves, F. J. A., Barroca, M. J., Ferreira, M., Costa, C. A., Correia, P. M. R., Cardoso, A. P., Campos, S., Anjos, O., & Cunha, L. M. (2022). The motivations for consumption of edible insects: A systematic review. *Foods (Basel, Switzerland)*, *11*(22), 3643. https://doi.org/10.3390/foods11223643

*Giordano, S., Clodoveo, M. L., Gennaro, B. D., & Corbo, F. (2018). Factors determining neophobia and neophilia with regard to new technologies applied to the food sector: A systematic review. *International Journal of Gastronomy and Food Science*, *11*, 1–19. https://doi.org/10.1016/j.ijgfs.2017.10.001

*Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology*, *91*, 380–390. https://doi.org/10.1016/j.tifs.2019.07.046

Grossmann, L., & Weiss, J. (2021). Alternative protein sources as technofunctional food ingredients. *Annual Review of Food Science and Technology*, *12*(1), 93–117. https://doi.org/10.1146/annurev-food-062520-093642

Hagger, M. S., Cameron, L. D., Hamilton, K., Hankonen, N., & Lintunen, T. (2020). Changing behavior: A theory- and evidence-based approach. In M. S. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (1st ed., pp. 1–14). Cambridge University Press. https://doi.org/10.1017/9781108677318.001

*Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology*, *61*, 11–25. https://doi.org/10.1016/j.tifs.2016.12.006

*He, J., Evans, N. M., Liu, H., & Shao, S. (2020). A review of research on plant-based meat alternatives: Driving forces, history, manufacturing, and consumer attitudes. *Comprehensive Reviews in Food Science and Food Safety*, *19*(5), 2639–2656. https://doi.org/10.1111/1541-4337.12610

Hennessy, E. A., Johnson, B. T., & Keenan, C. (2019). Best practice guidelines and essential methodological steps to conduct rigorous and systematic meta-reviews. *Applied Psychology: Health and Well-Being*, *11*(3), 353–381. https://doi.org/10.1111/aphw.12169

Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2022). *Cochrane handbook for systematic reviews of interventions* (Version 6.3). Cochrane. www.training.cochrane.org/handbook

Horodyska, K., Luszczynska, A., van den Berg, M., Hendriksen, M., Roos, G., De Bourdeaudhuij, I., & Brug, J. (2015). Good practice characteristics of diet and physical activity interventions and policies: An umbrella review. *BMC Public Health*, *15*(1), 19. https://doi.org/10.1186/s12889-015-1354-9

Huang, J., Liao, L. M., Weinstein, S. J., Sinha, R., Graubard, B. I., & Albanes, D. (2020). Association between plant and animal protein intake and overall and cause-specific mortality. *JAMA Internal Medicine*, *180*(9), 1173. https://doi.org/10.1001/jamainternmed.2020.2790

Inauen, J., Contzen, N., Frick, V., Kadel, P., Keller, J., Kollmann, J., Mata, J., & van Valkengoed, A. M. (2021). Environmental issues are health issues. *European Psychologist*, *26*(3), 219–229. https://doi.org/10.1027/1016-9040/a000438

Kapoor, K. K., Dwivedi, Y. K., & Williams, M. D. (2014). Rogers' innovation adoption attributes: A systematic review and synthesis of existing research. *Information Systems Management*, *31*(1), 74–91. https://doi.org/10.1080/10580530.2014.854103

*Kauppi, S.-M., Pettersen, I. N., & Boks, C. (2019). Consumer acceptance of edible insects and design interventions as adoption strategy. *International Journal of Food Design*, *4*(1), 39–62. https://doi.org/10.1386/ijfd.4.1.39_1

*Kröger, T., Dupont, J., Büsing, L., & Fiebelkorn, F. (2022). Acceptance of insect-based food products in Western societies: A systematic review. *Frontiers in Nutrition*, *8*, 759885. https://doi.org/10.3389/fnut.2021.759885

Luszczynska, A., & Schwarzer, R. (2020). Changing behavior using social cognitive theory. In M. Hagger, L. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (pp. 32–45). Cambridge University Press. https://doi.org/10.1017/9781108677318.003

Mancini, M. C., & Antonioli, F. (2022). Italian consumers standing at the crossroads of alternative protein sources: Cultivated meat, insect-based and novel plant-based foods. *Meat Science*, *193*, 108942. https://doi.org/10.1016/j.meatsci.2022.108942

*Mancini, S., Moruzzo, R., Riccioli, F., & Paci, G. (2019). European consumers' readiness to adopt insects as food. A review. *Food Research International*, *122*, 661–678. https://doi.org/10.1016/j.foodres.2019.01.041

McDonagh, L. K., Saunders, J. M., Cassell, J., Curtis, T., Bastaki, H., Hartney, T., & Rait, G. (2018). Application of the COM-B model to barriers and facilitators to chlamydia testing in general practice for young people and primary care practitioners: A systematic review. *Implementation Science*, *13*(1), 130. https://doi.org/10.1186/s13012-018-0821-y

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), 42. https://doi.org/10.1186/1748-5908-6-42

*Mina, G., Peira, G., & Bonadonna, A. (2023). The potential future of insects in the European food system: A systematic review based on the consumer point of view. *Foods (Basel, Switzerland)*, *12*(3), 646. https://doi.org/10.3390/foods12030646

Motoki, K., Park, J., Spence, C., & Velasco, C. (2022). Contextual acceptance of novel and unfamiliar foods: Insects, cultured meat, plant-based meat alternatives, and 3D printed foods. *Food Quality and Preference*, *96*, 104368. https://doi.org/10.1016/j.foodqual.2021.104368

*Nguyen, J., Ferraro, C., Sands, S., & Luxton, S. (2022). Alternative protein consumption: A systematic review and future research directions. *International Journal of Consumer Studies*, *46*(5), 1691–1717. https://doi.org/10.1111/ijcs.12797

*Onwezen, M. C., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, *159*, 105058. https://doi.org/10.1016/j.appet.2020.105058

Onwezen, M. C., & Dagevos, H. (2024). A meta-review of consumer behaviour studies on meat reduction and alternative protein acceptance. *Food Quality and Preference*, *114*, 105067 . https://doi.org/10.1016/j.foodqual.2023.105067.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Papies, E. K., Nielsen, K. S., & Soares, V. A. (2024). Health psychology and climate change: Time to address humanity's most existential crisis. *Health Psychology Review*, 1–31. https://doi.org/10.1080/17437199.2024.2309242

Pfadenhauer, L. M., Gerhardus, A., Mozygemba, K., Lysdahl, K. B., Booth, A., Hofmann, B., Wahlster, P., Polus, S., Burns, J., Brereton, L., & Rehfuess, E. (2017). Making sense of complexity in context and implementation: The context and implementation of complex interventions (CICI) framework. *Implementation Science*, *12*(1), 21. https://doi.org/10.1186/s13012-017-0552-5

Radtke, T., Liszewska, N., Horodyska, K., Boberska, M., Schenkel, K., & Luszczynska, A. (2019). Cooking together: The IKEA effect on family vegetable intake. *British Journal of Health Psychology*, *24*(4), 896–912. https://doi.org/10.1111/bjhp.12385

Rodriguez, N. R. (2015). Introduction to Protein Summit 2.0: Continued exploration of the impact of high-quality protein on optimal health. *The American Journal of Clinical Nutrition*, *101*(6), 1317S–1319S. https://doi.org/10.3945/ajcn.114.083980

Ruiter, R. A. C., Abraham, C., & Kok, G. (2001). Scary warnings and rational precautions: A review of the psychology of fear appeals. *Psychology & Health*, *16*(6), 613–630. https://doi.org/10.1080/08870440108405863

*Siddiqui, S. A., Alvi, T., Sameen, A., Khan, S., Blinov, A. V., Nagdalian, A. A., Mehdizadeh, M., Adli, D. N., & Onwezen, M. (2022). Consumer acceptance of alternative proteins: A systematic review of current alternative protein sources and interventions adapted to increase their acceptability. *Sustainability*, *14*(22), 15370. https://doi.org/10.3390/su142215370

*Siddiqui, S. A., Bahmid, N. A., Mahmud, C. M. M., Boukid, F., Lamri, M., & Gagaoua, M. (2023). Consumer acceptability of plant-, seaweed-, and insect-based foods as alternatives to meat: A critical compilation of a decade of research. *Critical Reviews in Food Science and Nutrition*, *63*(23), 6630. https://doi.org/10.1080/10408398.2022.2036096

*Siddiqui, S. A., Zannou, O., Karim, I., Kasmiati, Awad, N. M. H., Gołaszewski, J., Heinz, V., & Smetana, S. (2022). Avoiding food neophobia and increasing consumer acceptance of new food trends—A decade of research. *Sustainability*, *14*(16), 10391. https://doi.org/10.3390/su141610391

Siegrist, M., & Hartmann, C. (2020). Consumer acceptance of novel food technologies. *Nature Food*, *1*(6), 343–350. https://doi.org/10.1038/s43016-020-0094-x

Stiles, G., Collins, J., & Beck, K. L. (2022). Effectiveness of strategies to decrease animal-sourced protein and/or increase plant-sourced protein in foodservice settings: A systematic literature review. *Journal of the Academy of Nutrition and Dietetics*, *122*(5), 1013–1048. https://doi.org/10.1016/j.jand.2021.12.010

*Szenderák, J., Fróna, D., & Rákos, M. (2022). Consumer acceptance of plant-based meat substitutes: A narrative review. *Foods (Basel, Switzerland)*, *11*(9), 1274. https://doi.org/10.3390/foods11091274

*Toti, E., Massaro, L., Kais, A., Aiello, P., Palmery, M., & Peluso, I. (2020). Entomophagy: A narrative review on nutritional value, safety, cultural acceptance and a focus on the role of food neophobia in Italy. *European Journal of Investigation in Health, Psychology and Education*, *10*(2), 628–643. https://doi.org/10.3390/ejihpe10020046

Tuorila, H., & Hartmann, C. (2020). Consumer responses to novel and unfamiliar foods. *Current Opinion in Food Science*, *33*, 1–8. https://doi.org/10.1016/j.cofs.2019.09.004

*Wang, M., Zhou, J., Tavares, J., Pinto, C. A., Saraiva, J. A., Prieto, M. A., Cao, H., Xiao, J., Simal-Gandara, J., & Barba, F. J. (2023). Applications of algae to obtain healthier meat products: A critical review on nutrients, acceptability and quality. *Critical Reviews in Food Science and Nutrition*, *63*(26), 8357–8374. https://doi.org/10.1080/10408398.2022.2054939

*Wassmann, B., Siegrist, M., & Hartmann, C. (2021). Correlates of the willingness to consume insects: A meta-analysis. *Journal of Insects as Food and Feed*, *7*(5), 909–922. https://doi.org/10.3920/JIFF2020.0130

*Weinrich, R. (2019). Opportunities for the adoption of health-based sustainable dietary patterns: A review on consumer research of meat substitutes. *Sustainability*, *11*(15), 4028. https://doi.org/10.3390/su11154028

Weinrich, R., & Elshiewy, O. (2023). A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption. *Algal Research*, *70*, 102999. https://doi.org/10.1016/j.algal.2023.102999

*Wendin, K. M., & Nyberg, M. E. (2021). Factors influencing consumer perception and acceptability of insect-based foods. *Current Opinion in Food Science*, *40*, 67–71. https://doi.org/10.1016/j.cofs.2021.01.007

*Wendt, M.-C., & Weinrich, R. (2023). A systematic review of consumer studies applying the food technology neophobia scale: Lessons and applications. *Food Quality and Preference*, *106*, 104811. https://doi.org/10.1016/j.foodqual.2023.104811

West, R., & Michie, S. (2020). A brief introduction to the COM-B model of behaviour and the PRIME theory of motivation. *Qeios*. https://doi.org/10.32388/WW04E6

Whiting, P., Savović, J., Higgins, J. P. T., Caldwell, D. M., Reeves, B. C., Shea, B., Davies, P., Kleijnen, J., & Churchill, R. (2016). ROBIS: A new tool to assess risk of bias in systematic reviews was developed. *Journal of Clinical Epidemiology*, *69*, 225–234. https://doi.org/10.1016/j.jclinepi.2015.06.005

Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2024). Geographical context of European consumers' choices of alternative protein food: A systematic review. *Food Quality and Preference*, *117*, 105174. https://doi.org/10.1016/j.foodqual.2024.105174

Publikacja dotycząca Badania 2

International Journal of Behavioral Nutrition and Physical Activity

REVIEW

Open Access

Characteristics of built food environments associated with alternative protein food choices: a systematic review

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Abstract

Background This systematic review contributes to the understanding of the characteristics of built food environments that may be associated with choices of alternative protein foods (APF). Using the built food environment typology proposed by Downs et al., we investigated various environmental structures (e.g., supermarkets, other retailers, farmers' markets, restaurants, schools, and online vendors) and the characteristics that may facilitate or hinder consumers' choices. For example, facilitators and barriers may refer to the physical characteristics of environmental structures, food presentation practices, the organizational strategies or policies operating in the setting, or the actions that retailers or consumers engage in while selling, serving, choosing, trying, or purchasing APF in these environmental structures.

Methods A systematic review (PROSPERO database preregistration; no. CRD42023388700) was conducted by searching 13 databases for peer-reviewed journals focusing on the fields of economics and business, agriculture, medical sciences, and social sciences. Data searches, coding, and quality evaluations were conducted by at least 2 researchers. A total of 31 papers (36 original studies) were included. The risk of bias was evaluated with the Joanna Briggs Institute quality evaluation tool, with 24 publications presenting low risk of bias.

Results The findings indicate that perceived and actual availability facilitate consumers' APF choices across a built food environment. Several barriers/facilitators were associated with APF choices in specific types of built food environments: the way food is presented in produce sections (supermarkets), consumer habits in terms of green and specialty shopping (grocery stores), and mismatches among retailer actions in regard to making APF available in one type of food environment structure (e-commerce) and consumers' preferences for APF being available in other food environment structures (supermarkets, grocery stores). The effect of a barrier/facilitator may depend on the APF type; for example, social norms regarding masculinity were a barrier affecting plant-based APF choices in restaurants, but these norms were not a barrier affecting the choice of insect-based APF in restaurants.

Conclusions Addressing barriers/facilitators identified in this review will help in developing environment-matching interventions that aim to make alternative proteins mainstream.

Trial registration PROSPERO database registration: #CRD42023388700.

Keywords Alternative protein food, Built environment, Systematic review, Nutrition behavior

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Background

As highlighted by the EAT-Lancet Commission Report [1], the role of food in shaping human health and environmental sustainability is pivotal. The dietary shift that is key to securing healthier societies and more sustainable food production can be achieved by reducing the consumption of animal-based proteins (such as meat) and incorporating alternative protein sources (e.g., plant-based) into the daily diet [1]. For example, the EAT-Lancet Commission Report [1] suggested that transitioning from a diet where meat constitutes the main protein source to a diet with plant-based proteins would substantially reduce any-cause mortality risks, as well as the risk of stroke, type 2 diabetes, and cardiovascular diseases. Considering greenhouse emissions, land use, energy use, and acidification potential, soybeans, legumes, grains, and vegetables rich in proteins have the lowest environmental effects per serving, whereas meat from ruminant livestock has the greatest environmental effect [1]. Alternative protein foods (APF) encompass a wide range of protein concentrates derived from various sources, such as insects, krill, microbial biomass, mushrooms, fungi, and plants such as peas or rapeseed [2]. The term "alternative protein" often excludes cultured meat due to the ongoing debate about the environmental benefits of its production [2].

The concept of the "food environment" is usually applied to investigate linkages among built environment, social, and political contexts and dietary choices and their consequences for human health and the natural environment [3–6]. The physical built environment has a prominent role in the overall food environment [5, 6], and its characteristics constitute a setting where the social and political contexts operate together [7]. The various taxonomies explaining the physical food environment exhibit some similarities. For example, McKinnon et al. [6] categorized physical food environments into the following types: food stores, restaurants, schools, and worksite environments. A taxonomy proposed by Downs et al. [5] considers formal structures, such as supermarkets, hypermarkets, other retailers, farmers' markets, restaurants, institutional and public procurement settings, mobile vendors, and online vendors, as well as informal environmental structures such as wet markets.

Between 2013 and 2022, major retailers (e.g., Walmart, Carrefour, and Tesco) started selling their own plant-based alternative protein food ranges, whereas major fast food companies (e.g., Yum!, the owner of KFC and Pizza Hut) have established commercial relationships with plant-based food producers and launched plant-based protein products [3]. In 2022, Burger King opened its first plant-only outlet in London, England [3]. Thus, APF is becoming more readily available for consumers in various built food environmental structures.

In addition to identifying where specific dietary choices occur (e.g., [5]), taxonomies of the built food environment should be complemented by the evidence-based characteristics of the respective structures that may facilitate or hinder dietary shifts toward specific choices (e.g., an increase in APF intake). The latter approach is in line with the context and implementation of the complex intervention approach [7], which highlights the role of the setting (a structure in a physical environment) and its contextual characteristics in codetermining the efficacy of any actions promoting new nutrition behaviors. The built food environment taxonomy proposed by Downs et al. [5] assumes that the characteristics of the food environment may include general features of built environment structures (e.g., availability, affordability, and sustainability of food products). Other approaches indicate that the characteristics of the "setting" (or the structure of the built food environment) may be divided into macro- (e.g., national policies addressing respective settings), meso- (e.g., ale strategies adopted by a retail chain), and microlevels (individual) [7]. Characteristics at the individual level may refer to the attributes of various food system actors (e.g., producers, retailers, and consumers).

Existing systematic reviews have explored the associations between behaviors such as increased intake of plant-based proteins or meat reduction and food promotion strategies (e.g., the recipe design, product labeling, or sensory characteristics of APF). For example, a review of 18 intervention studies investigated the microenvironmental characteristics associated with reducing meat consumption [8]. Strategies such as reducing meat portion sizes, altering the sensory characteristics of meat and meat alternatives, and providing meat-free options were associated with a reduction in meat intake. Notably, making meat alternatives available has been found to have a sustained effect [8]. Similarly, Stiles et al. [9] reviewed the effectiveness of strategies aimed at decreasing animal protein food and increasing plant protein food in food service settings, including menu redesign (increasing availability of nonmeat proteins on the menu), recipe redesign, service redesign (to improve sustainability), menu labeling (e.g., "a climate choice"), and prompts at the point of sale (e.g., "dish of the day"). The menu offer redesign strategy demonstrated the most substantial and significant effects [9].

Findings from previous reviews [8, 9] indicated that increased availability of APF facilitated changes in

protein intake (meat reduction and increased plant protein intake). However, these reviews do not provide insights into whether these effects apply across different built environments (e.g., school canteens, restaurants, or supermarkets) or whether certain strategies are more impactful in specific settings (e.g., restaurants vs. supermarkets). Furthermore, these reviews do not delve into the barriers that may hinder APF uptake, and it remains unclear whether these findings can be generalized to other APF products, such as insect-based APF.

The intake and acceptability of insect-based APF in developed countries differ from what has been observed for African, Latin American, and Southeast Asian countries [10]. Consumers in the latter countries collect insects from uncultivated wild areas and sell them via informal markets [5]. These practices contrast with the strictly regulated formal market of insect-based APF in Western countries [11]. Due to these differences in the physical food environments where APF choices occur, our review focuses on built food environments in Western countries and developed Asian countries with strictly regulated formal APF markets (i.e., Japan).

The literature lacks a synthesis of evidence of characteristics that may be linked to an increase in the uptake of APF in specific settings. It remains unclear whether these characteristics are common or specific for some physical environmental structures and whether they are generalizable across different types of alternative proteins (e.g., plant-based vs. insect-based APF). A synthesis of evidence aids in the development of interventions promoting APF by identifying evidence-based characteristics that may facilitate or hinder APF consumption.

Using the systematic review method, the aim of this study was to identify the characteristics of the structures of the built food environment that may act as either barriers or facilitators for choosing APF products. In particular, we investigated (a) informal market food environments (wet markets, street vendors, kiosks, and mobile vendors) and (b) formal market food environments (supermarkets, hypermarkets, retailers, farmers' markets, restaurants, institutional public procurement settings, mobile vendors, and online vendors) (cf. [5]). Furthermore, we sought to explore any built food environment characteristics that have been tested for their associations with consumers' APF choices.

Methods

Materials and general procedures

This study was conducted following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [12]. The findings presented are part of a broader systematic review, which was registered with the PROSPERO database under the registration number #CRD42023388700. The overarching goal of this systematic review is to identify the physical environmental characteristics related to consumers' APF choices.

Search strategy

We conducted a systematic search of 11 databases containing peer-reviewed journals from the fields of economics and business, agriculture, medical sciences, and social sciences (Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, and Academic Research Source eJournals), which were accessed through the EBSCO platform. Separate searches of 2 additional databases, Web of Science and SCOPUS, were conducted following the primary search. Our search included documents and articles published up to March 2023.

The search strategy adopted three groups of keywords: (1) *alternative protein food* (e.g., "seaweed*" OR "alga*" OR "insect*" OR "lupin*" OR lentil* OR "mealworm"), (2) *physical built environment* (e.g., "shop*" OR "retail*" OR "cater*" OR "restaurant*" OR "supermarket") and (3) *consumer or behavior-related* (e.g., "intake" OR "food" OR "consume*" OR "eat" OR "sale") keywords. For the full list of keywords, see Additional File 1. These keywords were selected using existing reviews on APF [13–15] and the food environment typology by Downs et al. [5]. Researchers from the fields of consumer sciences, food sciences, and nutrition from the LIKE-A-PRO consortium were consulted regarding the appropriateness of the keywords [16].

The feasibility of the search string was pretested across the databases before the search was initiated. The aim of this approach was to capture a wide range of relevant articles across the databases. This approach increased the number of identified entries and, thus, minimized the likelihood of excluding relevant documents during the initial screening stages.

To ensure the robustness of the search, we performed manual searches of references within the full texts of original studies assessed for inclusion, as well as complementary nonsystematic searches of Google Scholar using the same keywords as used in the databases. Finally, we searched the CORDIS and Open Research Europe (ORE) databases for open peer-reviewed articles. The keywords were modified to fit the character limits (up to 50 characters in length) imposed by CORDIS and ORE.

Inclusion and exclusion criteria

The following inclusion criteria were applied: (1) peer-reviewed English-language original quantitative or

qualitative studies; (2) studies addressing alternative protein-based foods, including proteins that are land or sea plant-based, fungi-based, bacteria-based, or based on any other alternative protein sources, such as krill, as well as combinations of meat- and plant-based proteins; and (3) studies investigating built and/or physical environmental structures, based on the built food environment typology by Downs et al. [5], where European consumers made choices regarding APF. Original studies were included if (4) they discussed any type of link between the characteristics of the food environment and any (a) indicators of consumers' choices, such as perceived display/ways of exhibiting food in the built environment, intention to buy, intention to eat, actual intake, and actual sales, or (b) indicators of food availability in the respective food environment.

The exclusion criteria were as follows: (1) studies that did not report any original data, such as reviews or position papers; (2) dissertations, protocols, conference materials, or book chapters; (3) studies focusing solely on reducing meat intake without investigating how proteins will be supplemented in the diet by APF products; (4) studies focusing on increasing the intake of fruits or vegetables without specific data on plant-based protein sources; (5) studies solely addressing the physical environment in Asia, Africa, or South America, entailing locally collected wild-living insects and their local consumption or local retail; (6) studies involving novel foods without mentioning that the food is made of/with alternative protein sources, e.g., novel drinks based on sea buckthorn; (7) studies addressing consumers' choices regarding laboratory-based, in vitro-grown meat, with no alternative proteins added; (8) studies focusing on geographical factors, such as between-country or between-region differences; and (9) studies investigating APF as supplements or animal feed.

Data collection and extraction

Figure 1 illustrates the data selection process. The databases were independently searched by three researchers (HZ, EK, MS), and the searches were unsystematically checked by a fourth researcher (AL). The initial search yielded $k=7{,}935$ records obtained from searches of 11 databases using the EBSCO search engine, $k=838$ from the Web of Science, and $k=6{,}680$ from SCOPUS. All abstracts were screened by two researchers (randomly assigned from a group of five researchers, HZ, EK, ZS, MS, and AB) to identify potentially relevant studies. Any conflicts regarding the inclusion of a document were resolved through discussions with a fourth researcher (AL). Next, three researchers (AL and two randomly assigned researchers from a group of five researchers—HZ, EK, ZS, MS, and AB—independently read the full-text versions of the articles and determined their match with the inclusion criteria. Additional searches for original peer-reviewed studies were conducted through screening the references of articles evaluated for inclusion independently by PC and TP and searching Google Scholar, CORDIS, and ORE databases (conducted by AL or HZ).

Thirty-one publications reporting 36 independent studies were included (Fig. 1). Two articles [17, 18*] reported findings from the same study; only the latest publication [18*] was included. We included two original studies reported in a publication by Vandenbroele et al. [19*], three original studies reported by Motoki et al. [20*], and three original studies reported by Baker et al. [21*].

The following data were extracted to address the study's objectives: study population characteristics, country of data collection, design of the original study and type of methods used to collect data, the period when the data were collected, the type of alternative proteins investigated, the type of built environment and its characteristics, indicators of the consumers' choices, and key results (see Supplementary Table 1, Additional File 1). Data extraction was conducted by two researchers (HZ and AL). Any disagreements during these stages were resolved by a consensus method (searching for possible rating errors, followed by discussion and arbitration by a third researcher, AB) [22].

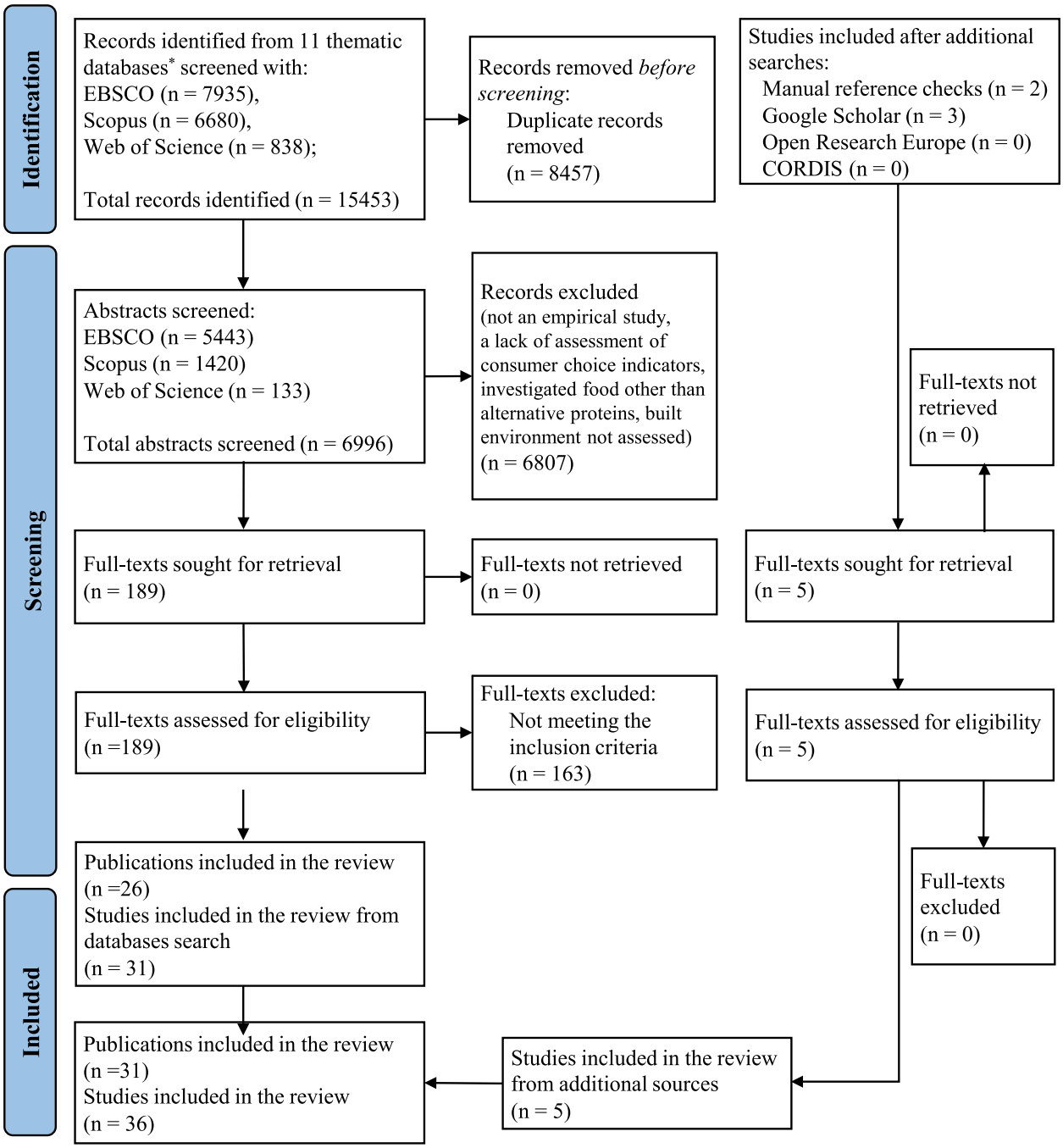
Data coding, analysis, and synthesis

The data retrieved from each original study were coded according to four categories: (1) a type of alternative protein food products; (2) a type of built food environmental structure; (3) a characteristic of the built food environment that was related to consumers' choices of alternative proteins; and (4) a type of the consumers' choice indicator. Additional File 1 presents the definitions, theoretical background, and categories applied during the coding procedures.

The included material was heterogeneous for each type of built environmental structure (e.g., supermarkets) in terms of consumers' choice indicators, types of alternative proteins, and built environment characteristics. Therefore, a meta-analysis was not feasible. We employed narrative synthesis methods instead [23, 24] (for details, see Additional File 1).

Risk of bias and quality assessment

The methodological quality and risk of bias in the included studies were assessed using the Joanna Briggs Institute Critical Appraisal Tools [25] for both cross-sectional and qualitative studies. These tools are appropriate for evaluating



*Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals

Fig. 1 PRISMA flow diagram of the article search and selection process for the systematic review

qualitative and quantitative cross-sectional studies (no observational longitudinal studies were included, $k=6$ manuscripts reported experimental studies). Each study was evaluated based on eight criteria and overall quality (good, fair, or poor). For details, see Additional File 1.

The methodological quality (risk of bias) of the included publications and respective studies was assessed by two pairs of independent reviewers (PC and TP or AB and MS). Studies were scored according to the critical appraisal questions. Disagreements were resolved by

discussion or by consulting a third researcher (AL). The overall risk of bias for the included studies was determined using the following cutoffs: low risk of bias, if at least 70% of the assessed criteria were met; moderate risk, if 50–69% of the criteria were met; and high risk, if less than 50% of the criteria were met.

Results

Description of included studies

A total of $k=36$ original studies were included. Additional File 1 presents the general descriptive information about the included studies and the results of coding referring to consumer choice indicators (e.g., acceptability, intention to eat, intention to buy, etc.). The enrolled populations were heterogeneous, with a total of $N=113{,}984$, sample sizes ranging between 15 and < 100,000 (M = 3,453.09; SD = 17,344.40), and ages ranging from 7 to 90 years. Almost half of the studies were cross-sectional ($k=15$, 41.6%), $k=11$ (30.5%) were experimental, $k=9$ (25%) were qualitative, and $k=2$ (5.5%) were mixed method studies.

Types of APF addressed in the original studies

Across the original studies, $k=17$ studies discussed plant-based alternative protein products, $k=15$ studies addressed insect-based alternative protein products, $k=1$ accounted for hybrid meat products (with meat and plant-based meat replacement combined), $k=4$ analyzed foods from a combination of either plant-based proteins or insect-based sources, and $k=3$ focused on a broader category of novel food, including either plant-based or insect-based APF or APF from various sources.

Built environmental structures studied in the included research

None of the studies addressed informal market structures (wet markets, street vendors, kiosks, or mobile vendors), whereas $k=31$ (all studies) addressed the formal market food environment. In particular, $k=6$ studies addressed supermarkets, $k=10$ discussed other food retailer structures (e.g., grocery stores), $k=2$ addressed farmers' markets, $k=17$ addressed restaurants, $k=2$ addressed institutional and public procurement (schools) settings, $k=4$ addressed online vendors, $k=1$ addressed vending machines, and $k=4$ addressed food festivals.

The risk of bias

The findings indicated that 24 of the included publications presented a low risk of bias, three studies had a moderate risk, and four studies had a high risk of bias (for details, see Additional File 2). An interrater reliability analysis between the independent reviewers' scores was performed using Cohen's kappa (values larger than 0.60 indicate strong agreement). The analysis showed strong agreement between the two raters, with $\kappa=0.69$ (95 CI: [0.42, 0.96]). No study was excluded on the basis of the quality assessment.

Findings for the formal market food environment

The extracted data were organized using the following grouping categories: (a) type of physical built environmental structure, using Downs et al.'s [5] taxonomy, and (b) type of organizational characteristics of the setting, i.e., meso-level (e.g., availability, product location, and promotion strategies used in the setting), as well as microlevel (e.g., stakeholders' perceptions of availability, social norms, shopping habits, preferences for location, and occasion to eat APF) [7]. The findings for different types of APF (plant-based, insect-based, and other APF sources) are discussed separately to determine potential differences.

Supermarkets

The characteristics of supermarkets linked with consumers' APF choices were reported in six studies [26,* 27,* 28,* 29,* 30,* 31*]. Three studies discussed plant-based alternative proteins, and three discussed insect-based proteins. All studies focused on the APF presentation in supermarkets, the period during which a product was available for sale, and the availability of the products.

Availability (plant-based APF) The number of APF products available in supermarkets has been on the rise. For example, Australian data indicate a doubling of APF (130% increase) between 2014 and 2021, with a 150% increase in plant-based meat replacements. However, the availability of tofu products has decreased over time [26*]. Most APF products have been available in supermarkets for an average of two years [26,* 27*]. Sausage is the most popular plant-based meat replacement [27*].

Product location, APF promotion, and ease of finding APF (plant-based APF) Plant-based meat alternatives are allocated a less shelf space than other protein products. Plant-based APF products are placed in less prominent sections of supermarkets and are perceived as "hidden" by consumers. They are also less likely to have sale, quality, or promotional signage compared to traditional meat products [28*]. Plant-based meat alternatives are often placed in produce (fruits/vegetables) sections or among high-end products [28*].

Plant-based meat alternatives are perceived as difficult to locate in stores, especially compared to meat products,

which is also attributed to inconsistencies in their placement within and across retail chains [28*].

Retailers' beliefs and practices (plant-based APF) Supermarket retailers await clear demand signals before introducing new APF products [28*]. Retailers believe that including APF in dairy and meat sections will reduce supermarket profits, and placing APF-based meat substitutes away from meat sections may address the concerns of vegetarians and vegans [28*].

Shopping habits and preferred location for intake (plant-based APF) Consumers who typically purchase protein products in upscale supermarket chains are willing to pay more for plant-based APF products [29*]. In contrast, those who usually shop in discount supermarkets were less willing to pay for APF products, possibly due to lower quality perceptions [29*].

Retailers focus on e-commerce and perceived availability in supermarkets (insect-based APF) For consumers, the focus of retailers on selling via e-commerce instead of in supermarkets may be perceived as a barrier [30*]. To enhance consumer trust and confidence, the widespread distribution of insect-based APF products in supermarkets and other grocery stores is recommended [30*]. Finally, consumers report that the lack of availability of insect-based APF in supermarkets is a barrier to the intention to eat [31*].

Grocery stores/other types of shops selling food

The characteristics of grocery stores associated with consumers' choices of alternative protein food were reported in 11 studies, reported in nine publications [18,* 19,* 21,* 27,* 32,* 33,* 34,* 35,* 36*]. Six studies discussed plant-based alternative proteins, while five discussed insect-based proteins. The research focused on the APF presentation at retail points, the perceived availability of products, the preference for the type of point of sale/retail, and consumer shopping practices, including "green" shopping, specialty food shopping, and shopping off campus (students).

Product location and promotion (plant-based APF) The placement of APF on shelves with vegetarian food or in produce departments results in lower sales of APF, while higher sales occur when the APF is placed in the meat section [19*]. In addition, an increase in APF sales was also achieved when sandwiches made with plant-based APF were placed in the same refrigerator as sandwiches with meat (compared to a separate refrigerator) or in a refrigerator visible from the shop entrance (versus with its back to the entrance) [19*].

Perceived availability (plant-based APF) The perceived availability of food in locations where food is usually purchased is related to satisfaction with plant-based proteins [32*]. Research revealed that 25% of respondents indicated "not available where I usually buy food" as a key barrier to trying new plant-based APF [33*]. Furthermore, consumers who intended to purchase such foods claimed that the availability in their usual food shopping places was low. Availability was a significant factor for those respondents who were likely to purchase new protein alternatives, but it was weakly associated with consumer choice indicators among undecided consumers [33*].

Shopping habits (plant-based APF) The level of approval of plant-based APF was greater among customers who regularly shop in specialty food stores [18*]. Students who shopped for food in grocery stores located outside of university campuses were more likely to purchase plant-based APF than those who shopped on campuses [35*].

Product promotion (insect-based APF) Research has indicated no major differences in the intention to purchase or expected fondness for/attractiveness among products with visible insects on the package vs. pictures of an insect-based powder and a Latin name [21*]. Notably, the levels of intention to buy insect-based APF were relatively low [21,* 34,* 36*].

Preferred location for availability and shopping habits (insect-based APF) Consumers indicated their preference for the availability of insect-based APF across different food outlets, such as grocery stores, convenience stores, and petrol stations, and disagreed that such products should be available via e-commerce only or in specialty shops [27,* 36*]. Frequent "green shopping" in grocery stores was positively associated with a greater willingness to buy, fondness for, and willingness to pay for APF [34*].

Farmers' markets

Only two studies have investigated the characteristics of farmers' markets linked to consumers' APF choices [26,* 27*].

Preferred location for APF purchases Porretta et al. [27*] reported that older consumers were willing to buy insect-based APF if they were available from local producers selling their products in small markets. In contrast, Aerni

et al. [26*] reported that points of sale at railway stations in large cities (e.g., Zurich) had greater sales of plant-based alternative food than did small farmers' markets in the same cities.

Restaurants

Seventeen studies (reported in 14 publications) addressed restaurant characteristics in relation to consumers' choice of APF [18,* 20,* 21,* 37,* 38,* 39,* 40,* 41,* 42,* 43,* 44,* 45,* 46,* 47*]. Six focused on plant-based APF, five focused on insect-based APF, and six discussed APF from various sources. The investigation addressed preferences for restaurants, such as APF environments, a prognosis of availability by experts, consumer social norm conformity, restaurant image creation and promotion, and meal presentation.

Experts' perceptions of the popularity of plant-based and insect-based APF Research investigating haute cuisine restaurant trends suggested that expert panels (selected on the basis of their entry on the official Michelin Guide website) predict that alternative proteins (insect- and plant-based) will become a strong trend in major European restaurants [47*]. These experts anticipate that plant- and insect-based proteins will be served to a greater extent than in vitro/cultivated meat. Additionally, the trend toward using locally sourced ingredients is expected to continue, with ingredients from distant regions playing a less important role [47*].

Experts' actions to create a positive social image of plant-based APF Creating a positive social image for restaurants is a strategy for increasing consumer interest. For example, renowned chefs have recognized the potential of using microalgae-based APF as an ingredient in their cuisines since there is a growing audience of consumers interested in food novelty who identify themselves with chefs' discourses about sustainability, ethnicity, and authenticity [46*]. Such celebrated restaurants may also help popularize the use of plant-based APF in casual or mid-range restaurants, as well as home-based dining [46*].

Perceived availability of plant-based APF Perceived availability in the restaurant was identified as a determinant of consumers' decisions to purchase plant-based APF in these restaurants. For example, consumers' perceptions that plant-based APF is easy to find on restaurant menus were associated with a greater willingness to pay for this type of food [45*].

Eating-out habits and preferred location, occasion, and company for consumption (plant-based APF) A greater frequency of eating in restaurants was related to a greater willingness to pay for plant-based meat alternatives [37*]. Among women, a higher frequency of dining out/going to restaurants with friends and family was related to perceiving microalgae-based food as healthy, sustainable, and nutritious, whereas among men, it was related to unfavorable perceptions (e.g., limited healthiness or nutritional values of algae-based foods) [18*]. The findings regarding gender differences align with previous research indicating that higher masculinity is associated with lower acceptance of social eating situations (e.g., restaurants) involving the consumption of nonmeat products among men [40*]. Weinrich and Elshiewy [18*] also noted that the relationship between APF perceptions and the frequency of dining out/going to restaurants with friends and family may also depend on the country where the study was conducted.

Research highlights the relevance of social norms and the social context in the consumption of plant-based APF in vegetarian/vegan restaurants [40*]. Young meat-eating men were more likely to eat plant-based APF burgers in vegetarian restaurants when encountering specific social cues, such as the presence of other men queuing for a veggie burger or dining with a female romantic partner [40*]. Conversely, visiting such restaurants and portraying oneself as dining in a vegetarian restaurant on social media was seen as a threat to masculinity [40*]. In line with this, omnivores and flexitarians indicated low acceptance rates for eating plant-based APF while dining in restaurants or during business lunches with coworkers [44*].

Consumers report that eating plant-based APF in more casual, private situations may be perceived as more appropriate than consuming this type of food during more celebratory occasions [44*]. These eating occasions may take place at home or in pubs, bars, or restaurants. For omnivores and flexitarians, eating alone, with friends, or with family members on a weekday is perceived as the best (and equally appropriate) environment to eat plant-based meat alternatives [44*]. However, for omnivores and flexitarians, eating plant-based meat alternatives for a family Sunday meal or at a barbecue party received similar, low appropriateness ratings [44*]. These results echo similar findings obtained by [40*], who highlighted the influence of social norms on the purchase of plant-based meat alternatives in restaurants.

Eating-out habits and preferred location, occasion, and company for consumption (various types of APF) Restaurants were indicated as the second most preferred place for consumers to try various types of novel food, including insect-based and plant-based APF (food festivals were the most preferred, and homes, cafés, pubs, and bars were less preferred locations) [20*].

Availability of locations serving insect-based APF Insect-serving restaurants were perceived as relatively rare, with only 31% of consumers agreeing that some European gourmet restaurants incorporate edible insects into their food preparation [42*].

Experts creating a positive social image of restaurants (insect-based APF) The use of APF can serve as a strategic promotional tool for restaurants. This strategy may include pushing boundaries with unusual ingredients, encouraging customers to try small portions of novel foods, and offering refunds if the meal is unsatisfactory [41*]. Applying such strategies conveys a greater sense of freedom of choice to customers [41*]. A positive image of edible insect restaurants was related to a stronger intention to eat insects [43*]. Furthermore, being an environmental advocate (the ability to convince others to act for environmental conservation) was related to a better image of insect-serving restaurants [43*].

Studies have shown that the presence of visible insects in restaurant-served meals leads to a lower intention to purchase, lower expected liking, and lower attractiveness of the food compared to food with invisible insects and vague descriptions of insect-based ingredients [21*]. Restaurants serving insects often employ strategies such as name ambiguity for meals containing insects and deliberate beautification during their presentation (e.g., garnishing to obscure ingredients and reduce neophobic tendencies) [41*]. The absence of visible insects in restaurant-served meals was related to low perceived risks [21*] and low anxiety while eating the respective types of foods, which resulted in stronger intentions to (re)visit restaurants serving insect-based APF [38*].

Preferred location and company for consumption (insect-based APF) Restaurants are perceived as the preferred places to eat insect-based APF products. When asked about how they would eat food made with edible insects, the majority of consumers stated, "with an expert", followed by "in a restaurant", and "with someone who knows how to prepare it" [39*].

Schools

Two studies [48,* 49*] focused on the availability of plant-based APF and the impact of school workshops among children aged 7–14 years. Other institutions or public procurement environments were not investigated.

Availability of plant-based APF The studies revealed that public schools did not offer APF for lunch, whereas private schools offered them less than once per week [48*].

Delivery of education interventions regarding insect-based APF An approximately 20% increase in readiness to choose insect-based APF for lunch was observed among children after brief (45 min) workshops addressing the reasons for and context of eating insects, followed by insect-based APF tasting, being delivered at schools [49*].

Online vendors

Four studies discussed aspects associated with consumers' choices of APF [27,* 36,* 50,* 51*], with all of them reporting on insect-based APF products.

Availability of insect-based APF Insect-based APF sales predominantly occur through online retail channels, with European producers using e-commerce as a distribution channel five times more frequently than physical sale points [51*]. However, this strategy may have consumer trust and credibility limitations. To enhance consumer trust and credibility, these products may need to be sold in supermarkets and local groceries instead of focusing on e-commerce [50*].

Preferred location for the purchase of insect-based APF When consumers were asked about their preference for the availability of insect-based APF across different food sale points, they generally disagreed with the idea that this type of food should be exclusively available through e-commerce [27,* 36*].

Food festivals

Two studies [20,* 45*] highlighted the significance of food events and food festivals as highly approved environments for plant- and insect-based APF.

Preferred location or occasion for purchasing/trying plant-based and insect-based APF Regarding willingness to try plant-based meat alternatives, consumers indicated the highest willingness to try them at food festivals, followed by restaurants (lower at home, cafés, bars,

and pubs) [20*]. Consumers who reported an opportunity to consume seaweed or algae-based food during a gastronomic event or a trip are more likely to consume plant (algae)-based APF than those who did not participate in such events [45*]. Potential consumers who were asked about their preferred location to try insect-based APF reported that they were most willing to try them during food festivals, whereas significantly lower levels were reported for trying them at home or in restaurants/cafés/bars/pubs [20*].

Food vending machines

Research focusing on a specific type of food (algae-based breadsticks) suggests that customers consider this type of food a snack rather than a meal substitute and should be sold from vending machines [52*].

Informal market environment: wet markets, mobile vendors, street vendors, kiosks, vending machines, and farmers' markets There is no evidence directly linking wet markets, street vendors, kiosks, mobile vendors, and consumers' behaviors and intentions to buy/pay for *plant-based or insect-based APF*. It seems plausible that the European food market is mostly formalized due to national and European Union-level regulations referring to food safety, labeling, and quality, particularly those referring to novel foods (cf. the European Commission Implementing Regulation, 2018/456 of 19 March 2018 [53]).

Summary of findings

Table 1 summarizes the findings, focusing on (a) the structures of the built food environment where consumers make APF choices and (b) barriers to and facilitators for choosing plant-based and insect-based APF, operating in the respective structures. Barriers and facilitators refer to: the physical characteristics of environmental structures; food presentation practices; organizational strategies or policies operating in the setting; and the actions and beliefs of retailers or consumers while selling, serving, choosing, trying, or purchasing APF in these environmental structures. The synthesis of the evidence indicated potential differences between the characteristics of the structures of the built environment that may be relevant for plant-based APF (Fig. 2) and those that may be relevant for insect-based APF (Fig. 3).

Discussion

Complementing the proposal of Downs et al. [5] that lists built environment structures relevant for all food choices, the findings of this systematic review provide an overarching synthesis of the characteristics that can either promote or hinder consumers' choices of APF products in restaurants, supermarkets, grocery stores, schools, farmers' markets, or at food festivals (see Table 1). Consistent with existing typologies [5, 6, 54] and systematic reviews [8, 9], our study highlights that availability is the core characteristic of the built environment that facilitates consumers' APF choices. Our review provides insights into how availability is shaped and how it influences the choices of different types of APF across different settings within the built food environment. Limited availability appears to constitute a common barrier observed across supermarkets, grocery stores, restaurants, and schools.

Our review indicates a mismatch between the APF supply and the APF demand that may be responsible for stagnated APF sales and low consumption. Retailers believe that increasing APF in supermarkets will harm profits [30*], and their subsequent decisions to sell APF via e-commerce [51*] result in low APF availability in groceries/supermarkets. Consumers, in turn, report low trust in products that are not available in grocery stores or supermarkets but are only available via e-commerce [50,* 55]. Consumers' trust is a key determinant of buying and eating novel foods [56]. The limited availability of APF in locations where consumers usually shop for food results in low APF acceptance and low intention to buy or try APF [30,* 33,* 45*]. Consumers are less likely to choose an APF if the APF is perceived as difficult to find in supermarkets/grocery stores/on restaurant menus [30,* 33,* 45*]. The lack of actual availability of plant-based APF at schools [48*] may also result from the low trust of consumers in novel foods such as APF.

The current systematic review highlights that barriers and facilitators are specific for both the type of built environment and the type of APF (plant-based vs. insect-based). Regarding the type of structure in the built environment, our review indicates several specific social facilitators and barriers that operate in restaurants. In terms of facilitators, restaurants are preferred locations to try novel foods for the first time [39*], possibly because consumers perceive restaurants as places where experts prepare and serve food they can feel safe consuming [56]. The narrative created by chefs and the social image of restaurants promoting novel and sustainable foods [46*] may facilitate the use of APF in restaurants. Moreover, consumers' beliefs about the importance of the sustainability of APF are among the key individual-level predictors of consumers' choices of APF (cf., e.g., [57]). In contrast, social norms of masculine behavior among young meat-eating men may act as barriers, particularly in official or business settings or when dining with meat-eating male friends [40*].

Food festivals or gastronomic events emerge as specific types of food environmental structures where

Table 1 Types of built food environments and factors associated with consumers' APF choices

Type of built food environment	Type of alternative protein	The barriers and facilitators operating in the built food environment associated with consumers' choices of the respective APF
Supermarkets	**Plant-based APF**	**Barriers:** 1. APF perceived by consumers as difficult to find (presented in less prominent sections, inconsistencies in exposition between different supermarkets, or shorter shelf length) 2. Barriers to availability may include retailers' beliefs (a) better to wait for high demand signals before increasing availability (b) including APF in meat or dairy sections will reduce supermarket profits (c) presenting APF far away from meat sections will satisfy vegetarians 3. Consumers willing to pay more for APF in international chains than in domestic discount stores (perceived lower quality in discount stores as a barrier)
	Insect-based APF	**Barriers:** 1. Retailers using e-commerce (instead of increasing availability in supermarkets) may be a barrier to increased intake 2. Perceived lack of availability in supermarkets as a barrier to consumers' intention to eat **Facilitators:** 1. Consumers' trust/confidence in APF may be higher if APF are widely available in supermarkets (instead of sales mostly via e-commerce)
Groceries/other food retailers	**Plant- based APF**	**Barriers** 1. Selling APF from vegetarian or produce shelves/sections associated with lower actual sales; selling from meat sections – higher sales 2. Key barrier indicated by the consumers who intended to try/eat APF: "APF not available where I usually shop for food" (Note: consumers who are undecided to eat APF rarely indicate this barrier) 3. Availability of APF limited to specialty shops and e-commerce **Facilitators** 1. Selling APF products presented side by side with meat products (in the same refrigerators) results in higher sales of APF; the refrigerators visible from the shop entrance: higher sales of APF 2. Frequent 'green shopping' related to higher willingness to pay 3. Frequent specialty food store shopping related to higher approval 4. Availability of APF across different food retail outlets (not only in specialty shops or via e-commerce) in line with consumers' preferences 5. Purchase of APF more likely among students shopping for food outside of campus compared to those shopping for food mostly on campus
	Insect-based APF	**Neutral characteristic** 1. Similar (low) intention to buy, perceived attractiveness regardless the types of packaging (with insect visible vs. insect powder + a Latin name)
Farmer's markets	**Plant-based APF**	**Barrier** 1. Adult consumers are less likely to buy at small farmers' markets than at popular larger grocery stores (e.g., on their way home from work, at/near the public transportation stop)
	Insect-based APF	**Facilitator** 1. Older consumers willing to buy APF if they are available from local producers at local famers' markets

Table 1 (continued)

Type of built food environment	Type of alternative protein	The barriers and facilitators operating in the built food environment associated with consumers' choices of the respective APF
Restaurants	**Plant-based APF**	**Barriers** 1. Young omnivorous men: being seen as an APF consumer in a vegetarian restaurant as a threat for masculinity; lining up with other men or visiting with a female romantic partner may reduce this barrier 2. Beliefs about low social approval for eating APF is a barrier for acceptance of eating APF in restaurants or eating at business lunches 3. Among men, high frequency of dining out at restaurants with friends (findings for Dutch and German men, but not French) may be a barrier **Facilitators** 1. Predictions of experts in haute cuisine: APF will be a strong trend in EU restaurants (together with local food) 2. Creating a social image of a restaurant as promoting novel food; chef's discourse on sustainability and authenticity 3. Eating APF considered more appropriate in casual situations, (compared to more formal, celebratory occasions) 4. Consumers' ability to easily find the APF in menus related to higher willingness to pay 5. Restaurants are the most preferred or 2nd most preferred location where consumers are willing to try (versus cafés, pubs, bars, homes) 6. Higher frequency of eating out in restaurants related to higher willingness to pay
	Insect-based APF	**Barriers** 1. The majority (68%) of consumers believed insects are not served in gourmet restaurants **Facilitators** 1. Restaurants indicated as the most preferred environment to try insect-based APF. Preferably, "with an expert" and "someone who knows how to prepare it" 2. The image of a restaurant: being an environmental advocate 3. Insects invisible in the meal (in contrast to visible insects), name ambiguity, deliberate beautification and garnishing related to lower anxiety when trying new APF, higher attractiveness, and higher likelihood of buy and to eat APF
Schools	**Plant based APF**	**Barriers** 1. Public schools not offering any APF for lunches
Online vendors	**Insect-based APF**	**Barriers** 1. E-commerce 5 times more likely to be used as a distribution channel by the producers (versus physical locations for sales, e.g. groceries) 2. Consumers preferences for APF to be distributed in places where they usually buy their food (supermarkets, etc.) not mostly via e-commerce
Food festivals	**Plant-based APF**	**Facilitators** 1. Food events or food festivals perceived as the most adequate environment to try new APF (homes, cafés, pubs: less preferred) 2. Taking part in a gastronomic event or a trip
	Insect based APF	**Facilitators** 1. Food event or food festival perceived as the most adequate environment to try insect-based APF
Vending machines	**Plant-based APF**	**Facilitators** 1. APF sold as a snack from a vending machine

Note. *APF* alternative protein food

consumers may be willing to try APF [20,* 45*]. Visiting food events or festivals may satisfy consumer needs of being adventurous, their curiosity or sensation seeking, which, in turn, are related to stronger intentions to try, greater attractiveness, and willingness to try APF [57, 58]. While restaurants and food festivals/gastronomic events may be the locations where consumers first *try* an APF, the adoption of regular intake of the APF could depend on other structures, such as supermarkets and grocery stores—places where consumers typically buy their food—and the associated barriers and facilitators within these structures [33*].

The findings highlight that certain barriers and facilitators may be relevant in specific types of built food environments where consumers try new foods but do not apply in environments where daily food shopping takes place. For instance, the lack of visible insects and the use of ambiguous names of insect-based APF in restaurants facilitated consumers' choices, likely by reducing anxiety and increasing the likelihood of trying this type of APF

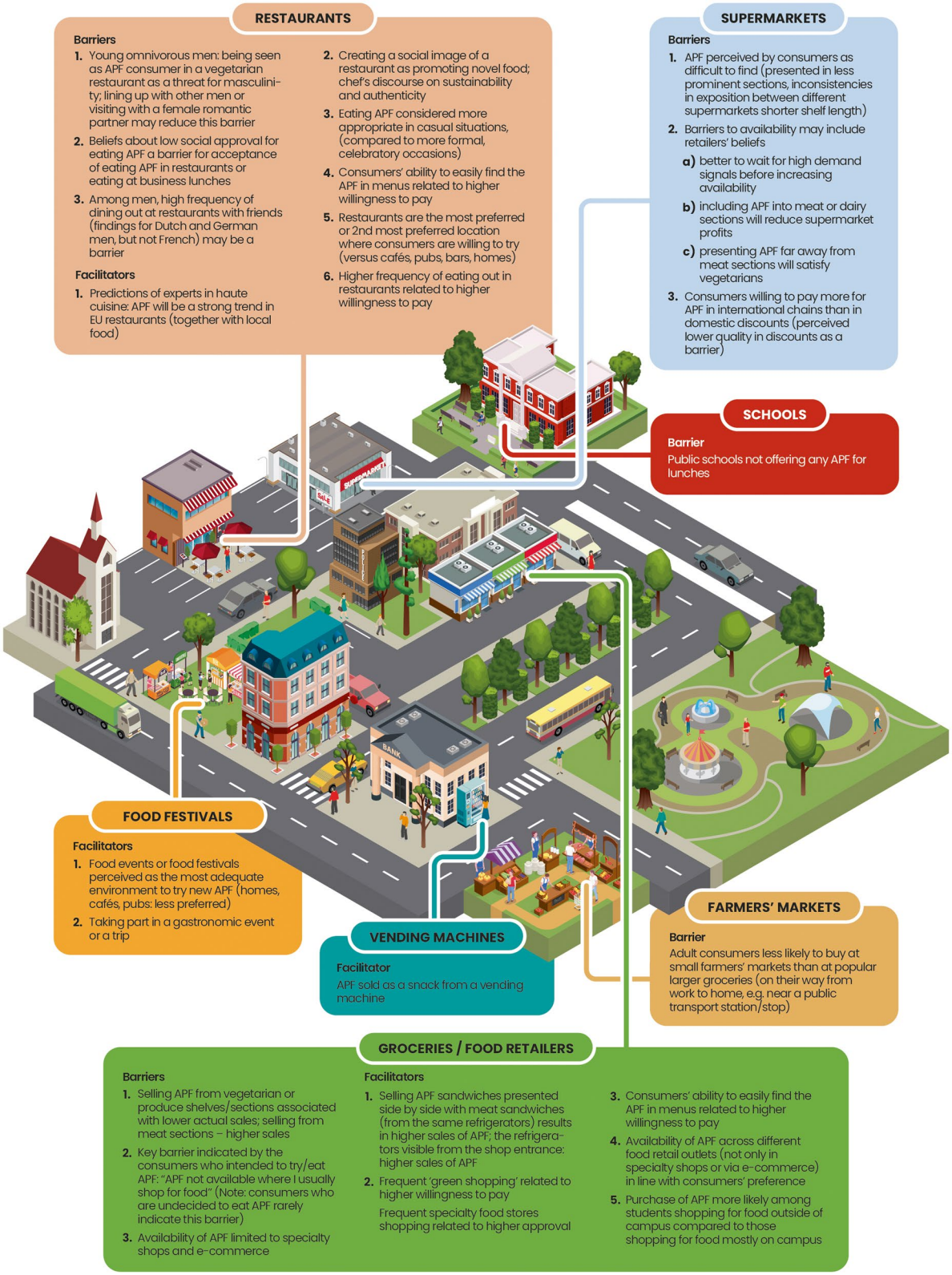


Fig. 2 Built environment barriers to/facilitators of plant-based alternative protein foods (APF) consumer choices

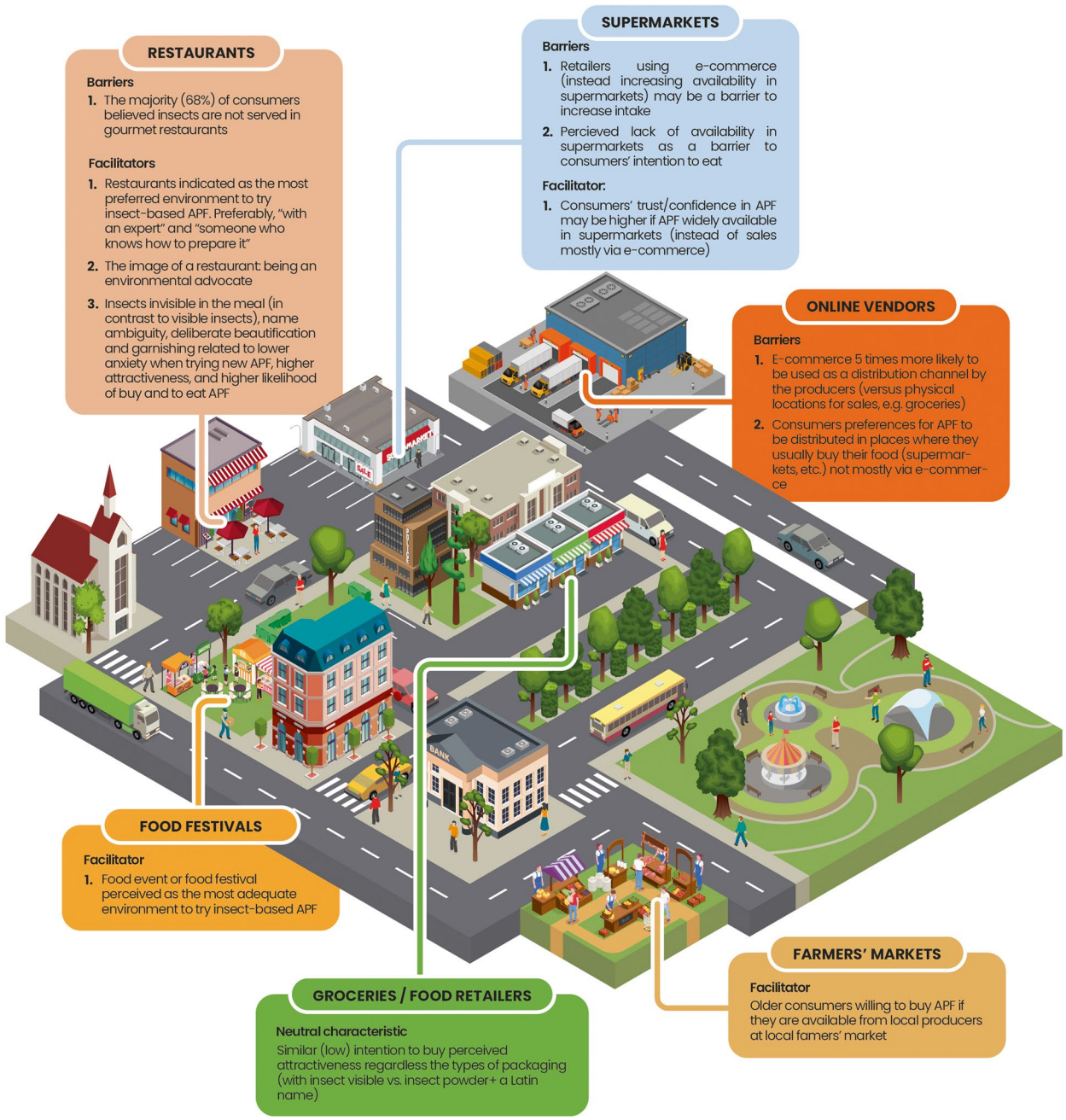


Fig. 3 Build environment barriers to/facilitators of insect-based alternative protein foods (APF) consumer choices

in restaurants [41*]. In contrast, the perceived attractiveness of insect-based APF was low regardless of insect visibility and package labeling of food sold in retail stores.

Our review also provides evidence for differences in facilitators of consumers' choices to consume plant-based APF and insect-based APF. These differences are particularly evident when considering restaurants as built food environments. Social norms related to masculinity act as barriers to young men visiting vegetarian restaurants or buying and eating plant-based APF in restaurants or at business lunches [40,* 44*]. Previous systematic reviews focusing on individual determinants of insect-based APF have indicated that young men and high sensation seekers are more likely to try eating insects [57,

59]. Therefore, it is possible that social norms regarding masculinity could actually facilitate the consumption of insect-based APF in restaurants among young men.

The results provide no insights into the underlying mechanisms that explain the associations between barriers/facilitators and consumers' APF choices in specific environmental structures. Unfortunately, such mechanisms were rarely investigated in the original studies. Thus, any discussion of the underlying processes remains hypothetical. It may be assumed that the potential mechanisms may include consumers' motivations, emotions, and beliefs related to the APF; social and cultural norms about eating novel food; and habits related to buying and preparing any type of food. These mechanisms may be significant (or may be less relevant), depending on the type of physical environmental setting where the choice of APF occurs. For example, the effects of social norms may be stronger in a setting where consuming food is a social activity (e.g., in restaurants) than in a setting where an APF is purchased via a website of an online vendor. Consumers' curiosity and sensation seeking may be significant drivers for trying new APF in novel environments such as food festivals. In contrast, curiosity may be less important when a consumer's behavior is aimed at restocking breakfast supplies in a local grocery store. When shopping "on autopilot" (e.g., during routine weekend shopping at a local supermarket), automatic, nonreflective responses to cues may be the key mechanisms determining consumers' choices. In this context, cues such as the retailer's strategy of placing a product in a specific section may be among the strongest drivers of consumers' choices. Future research should explore the common and specific mechanisms determining consumers' choices across the structures of the built environment.

This study has potential implications for promoting APF choices. Our review lists characteristics of the built food environment to be considered in interventions targeting the initiation and adoption of APF intake. APF promotion strategies may be adjusted to specific types of barriers/facilitators operating in specific structures of the built environment. Furthermore, the results referring to the availability of APF may suggest changes in strategic considerations at the retailer level (for example, a shift from an emphasis on sales via e-commerce to supermarket sales). The results may also inform public health policies and address the physical food environment, helping to prioritize specific changes in the respective setting (e.g., positioning APF in meat and produce sections in supermarkets).

Our study inevitably has certain limitations related to the number, quality, and heterogeneity of the studies included. First, the number of studies we identified was limited, and replications across contexts (e.g., in different countries) are missing. Furthermore, most of the empirical evidence is based on correlation studies; therefore, causal conclusions cannot be drawn. The included research used a broad range of indicators of consumer choices, ranging from intention (to buy or to try/eat) to actual intake. Intention may have a limited effect on the adoption of a new consumer behavior and its maintenance over time [60] because intention is only moderately associated with respective food intake [61]. The quality of 22.3% of the included studies was moderate or low, which limits the reliability of the conclusions. To address publication bias, we conducted additional searches for grey literature (published in outlets other than impacted journals) via searches of the Google Scholar, CORDIS, and ORE databases. Approaches that allow us to quantify the heterogeneity of the results could not be used, as the data were analyzed using a narrative synthesis instead of a meta-analysis.

Future original studies may also need to control for potential confounders (e.g., economic factors such as disposable income in families and food policies operating in the respective countries) and address some methodological shortcomings. For example, specific barriers and facilitators were usually studied in one setting and one location only; hence, the generalizability of the results to other settings (e.g., other supermarket chains) and different locations (e.g., urban versus rural areas) is limited. The characteristics of consumers, such as lower income, may constitute a universal barrier to APF choices [62]. Higher prices of many APF (compared to animal-based protein products) may affect APF affordability among people with lower incomes, regardless of the setting where the purchase takes place. The original research was heterogeneous in terms of the socioeconomic status of the participants, and the effect of socioeconomic variables was usually not considered. Future research should account for the confounding role of economic factors.

Furthermore, the applied methods of the systematic review also have limitations. The use of narrative synthesis and to the inability to conduct a meta-analysis hindered the evaluation of the actual significance and strength of the relations between the characteristics operating in the respective types of built food environments and the indicators of consumers' choices. Due to very limited empirical evidence for APF other than plant-based and insect-based APF, the proposed extension of the typology for the built environment does not provide insights into the characteristics of the food environment that may promote or hinder mainstreaming krill-based, fungus-based, and bacteria-based alternative proteins or proteins from other sources.

Conclusions

This review provides novel insights into the barriers and facilitators operating in different types of built food environments that may affect the uptake of novel foods developed with alternative proteins. Barriers and facilitators may refer to the physical characteristics of the structure, food presentation practices, organizational strategies or policies operating in the setting, the actions and beliefs of retailers or consumers while selling or purchasing the APF in the setting, etc. Our results indicate that perceived and actual availability are common facilitators operating across the various types of built environments. The results also indicated several determinants associated with consumers' choices in specific types of built food environments: the ways food is presented in produce sections (supermarkets), consumers' green and specialty shopping routines (groceries), a mismatch between retailers' actions of making APF available in one type of environment (e-commerce), and consumers' preferences for other types of APF environments (supermarkets, groceries). We also indicate that one type of barrier/facilitator operating within a specific type of built food environment may have different associations with consumers' choices depending on the type of APF (e.g., social norms regarding masculinity as a barrier for plant-based, but not insect-based, APF in restaurants).

Abbreviation

APF Alternative protein foods

Supplementary Information

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Additional file 1: Description of data: The full list of keywords applied in the review; details of data analysis and synthesis; definitions, theoretical background, and categories applied during the coding procedures; description of the included studies; populations' characteristics in the included studies; Supplementary Table 1 - descriptive information about the original research included into the review

Additional file 2: Description of data: Details of the quality and risk of bias assessment of the included in the systematic review studies

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Authors' contributions

HZ, AL, EK, MS, ZS, AB, FG, PC, BTN, TP, AS, AX, AK: design of the theoretical construction of the review as well as the searching strategy process; HZ, EK, MS, AL, ZS, AB, PC, TP: screening of potentially relevant documents; HZ, AL: data extraction; EK, MS, ZS, AB: data extraction verification; AB, MS, AL, PC, TP: quality and risk of bias assessment; AL, HZ: data analysis; HZ, AL: writing the manuscript draft; EK, MS, ZS, AB, FG, PC, BTN, TP, AS, AX, AK: critical revision of the intellectual content of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

All data analyzed during this study are either secondary (retrieved from original studies included in the review) or included in this published article (and its supplementary information files).

Declarations

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Not applicable.

Consent for publication

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Competing interests

The authors declare that they have no competing interests.

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References

References marked with an asterisk indicate studies included in the systematic review.

1. EAT. EAT-Lancet Commission Summary Report. Available from: https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/. Accessed 31 Jul 2023.
2. Grossmann L, Weiss J. Alternative Protein Sources as Technofunctional Food Ingredients. Annu Rev Food Sci Technol. 2021;12(1):93–117.
3. Mylan J, Andrews J, Maye D. The big business of sustainable food production and consumption: Exploring the transition to alternative proteins. PNAS. 2023;20(47):e2207782120.
4. Glanz K, Sallis JF, Saelens BE, Frank LD. Healthy nutrition environments: concepts and measures. Am J Health Promot AJHP. 2005;19(5):330-3 ii.
5. Downs SM, Ahmed S, Fanzo J, Herforth A. Food Environment Typology: Advancing an Expanded Definition, Framework, and Methodological Approach for Improved Characterization of Wild, Cultivated, and Built Food Environments toward Sustainable Diets. Foods Basel Switz. 2020;9(4):532.
6. McKinnon RA, Reedy J, Morrissette MA, Lytle LA, Yaroch AL. Measures of the Food Environment: A Compilation of the Literature, 1990–2007. Am J Prev Med. 2009;36(4):S124–33.

7. Pfadenhauer LM, Gerhardus A, Mozygemba K, Lysdahl KB, Booth A, Hofmann B, et al. Making sense of complexity in context and implementation: the Context and Implementation of Complex Interventions (CICI) framework. Implement Sci. 2017;12(1):21.
8. Bianchi F, Garnett E, Dorsel C, Aveyard P, Jebb SA. Restructuring physical micro-environments to reduce the demand for meat: a systematic review and qualitative comparative analysis. Lancet Planet Health. 2018;2(9):e384–97.
9. Stiles G, Collins J, Beck KL. Effectiveness of Strategies to Decrease Animal-Sourced Protein and/or Increase Plant-Sourced Protein in Foodservice Settings: A Systematic Literature Review. J Acad Nutr Diet. 2022;122(5):1013–48.
10. Kim TK, Yong HI, Kim YB, Kim HW, Choi YS. Edible Insects as a Protein Source: A Review of Public Perception, Processing Technology, and Research Trends. Food Sci Anim Resour. 2019;39(4):521–40.
11. Delgado L, Garino C, Moreno FJ, Zagon J, Broll H. Sustainable Food Systems: EU Regulatory Framework and Contribution of Insects to the Farm-To-Fork Strategy. Food Rev Int. 2023;39(9):6955–76.
12. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:71.
13. Biasini B, Rosi A, Giopp F, Turgut R, Scazzina F, Menozzi D. Understanding, promoting and predicting sustainable diets: A systematic review. Trends Food Sci Technol. 2021;111:191–207.
14. Mancini S, Moruzzo R, Riccioli F, Paci G. European consumers' readiness to adopt insects as food. A review Food Res Int. 2019;122:661–78.
15. Nguyen J, Ferraro C, Sands S, Luxton S. Alternative protein consumption: A systematic review and future research directions. Int J Consum Stud. 2022;46(5):1691–717.
16. CORDIS | European Commission. From niche to mainstream - alternative proteins for everybody and everywhere | LIKE-A-PRO Project (2022). Available from: https://cordis.europa.eu/project/id/101083961. Accessed 31 Jul 2023.
17. Weinrich R, Elshiewy O. Preference and willingness to pay for meat substitutes based on micro-algae. Appetite. 2019;142:104353.
18. * Weinrich R, Elshiewy O. A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption. Algal Res. 2023;70:102999.
19. * Vandenbroele J, Slabbinck H, Van Kerckhove A, Vermeir I. Mock meat in the butchery: Nudging consumers toward meat substitutes. Organ Behav Hum Decis Process. 2021;163:105–16.
20. * Motoki K, Park J, Spence C, Velasco C. Contextual acceptance of novel and unfamiliar foods: Insects, cultured meat, plant-based meat alternatives, and 3D printed foods. Food Qual Prefer. 2022;96:104368.
21. * Baker MA, Shin JT, Kim YW. An Exploration and Investigation of Edible Insect Consumption: The Impacts of Image and Description on Risk Perceptions and Purchase Intent. Psychol Mark. 2016;33(2):94–112.
22. Higgins J, Thomas J, Chandler J, Cumpston M, Li T, Page M, et al. Cochrane Handbook for Systematic Reviews of Interventions version 6.4 (updated August 2023). [cited 2023 Nov 21]. Cochrane Handbook for Systematic Reviews of Interventions. Available from: https://training.cochrane.org/handbook.
23. Campbell M, Katikireddi SV, Sowden A, Thomson H. Lack of transparency in reporting narrative synthesis of quantitative data: a methodological assessment of systematic reviews. J Clin Epidemiol. 2019;105:1–9.
24. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC Methods Programme. Lancaster University; 2006. Available from: https://www.lancaster.ac.uk/media/lancaster-university/content-assets/documents/fhm/dhr/chir/NSsynthesisguidanceVersion1-April2006.pdf. Accessed 31 July 2023.
25. JBI. JBI Critical Appraisal Tools. 2020. Available from: https://jbi.global/critical-appraisal-tools. Accessed 31 Jul 2023.
26. * Aerni P, Scholderer J, Ermen D. How would Swiss consumers decide if they had freedom of choice? Evidence from a field study with organic, conventional and GM corn bread. Food Policy. 2011;36(6):830–8.
27. * Porretta S, Gere A, Radványi D, Moskowitz H. Mind Genomics (Conjoint Analysis): The new concept research in the analysis of consumer behaviour and choice. Trends Food Sci Technol. 2019;84:29–33.
28. * Brooker PG, Hendrie GA, Anastasiou K, Colgrave ML. The range and nutrient profile of alternative protein products sold in Australian supermarkets between 2014 and 2021. Int J Food Sci Nutr. 2022;73(8):1067–79.
29. * Grasso S, Jaworska S. Part Meat and Part Plant: Are Hybrid Meat Products Fad or Future? Foods. 2020;9(12):1888.
30. * Gravely E, Fraser E. Transitions on the shopping floor: Investigating the role of Canadian supermarkets in alternative protein consumption. Appetite. 2018;130:146–56.
31. * Menozzi D, Sogari G, Veneziani M, Simoni E, Mora C. Eating novel foods: An application of the Theory of Planned Behaviour to predict the consumption of an insect-based product. Food Qual Prefer. 2017;59:27–34.
32. * Aaslyng MD, Højer R. Introducing Tempeh as a New Plant-Based Protein Food Item on the Danish Market. Foods. 2021;10(11):2865.
33. * Clark LF, Bogdan AM. The Role of Plant-Based Foods in Canadian Diets: A Survey Examining Food Choices, Motivations and Dietary Identity. J Food Prod Mark. 2019;25(4):355–77.
34. * Collins CM, Vaskou P, Kountouris Y. Insect Food Products in the Western World: Assessing the Potential of a New 'Green' Market. Ann Entomol Soc Am. 2019;112(6):518–28.
35. * Drake MA, Gerard PD. Consumer Attitudes and Acceptability of Soy-fortified Yogurts. J Food Sci. 2003;68(3):1118–22.
36. * Herbert M, Beacom E. Exploring Consumer Acceptance of Insect-based Snack Products in Ireland. J Food Prod Mark. 2021;27(6):267–90.
37. * Ortega DL, Sun J, Lin W. Identity labels as an instrument to reduce meat demand and encourage consumption of plant based and cultured meat alternatives in China. Food Policy. 2022;111: 102307.
38. * Ali L, Ali F. Perceived risks related to unconventional restaurants: A perspective from edible insects and live seafood restaurants. Food Control. 2022;131:108471.
39. * Bisconsin-Júnior A, Rodrigues H, Behrens JH, da Silva MAAP, Mariutti LRB. "Food made with edible insects": Exploring the social representation of entomophagy where it is unfamiliar. Appetite. 2022;173:106001.
40. * Bogueva D, Marinova D, Bryant C. Meat Me Halfway: Sydney Meat-Loving Men's Restaurant Experience with Alternative Plant-Based Proteins. Sustainability. 2022;14(3):1290.
41. * Cai CH, Ding A, Legendre TS. Exploring persuasive sales techniques to improve customer acceptance of sustainable but unfamiliar menu in restaurants. Int J Contemp Hosp Manag. 2021;33(10):3093–114.
42. * Florença SG, Correia PMR, Costa CA, Guiné RPF. Edible Insects: Preliminary Study about Perceptions, Attitudes, and Knowledge on a Sample of Portuguese Citizens. Foods. 2021;10(4):709.
43. * Hwang J, Choe JY (Jacey), Kim JJ. Strategy for enhancing the image of edible insect restaurants: Focus on internal environmental locus of control. J Hosp Tour Manag. 2020;45:48–57.
44. * Michel F, Hartmann C, Siegrist M. Consumers' associations, perceptions and acceptance of meat and plant-based meat alternatives. Food Qual Prefer. 2021;87:104063.
45. * Palmieri N, Forleo MB. An Explorative Study of Key Factors Driving Italian Consumers' Willingness to Eat Edible Seaweed. J Int Food Agribus Mark. 2022;34(4):433–55.
46. * Pérez-Lloréns JL. Microalgae: From staple foodstuff to avant-garde cuisine. Int J Gastron Food Sci. 2020;21:100221.
47. * Schwark N, Tiberius V, Fabro M. How Will We Dine? Prospective Shifts in International Haute Cuisine and Innovation beyond Kitchen and Plate. Foods. 2020;9(10):1369.
48. * Borkowski S, Rubenstein W, Galvez M, Deierlein AL. Prevalence of meats offered during meals at New York city schools. Health Behav Policy Rev. 2020;7(2):146–53.
49. * Jones V. 'Just don't tell them what's in it': Ethics, edible insects and sustainable food choice in schools. Br Educ Res J. 2020;46(4):894–908.
50. * Reverberi M. The new packaged food products containing insects as an ingredient. J Insects Food Feed. 2021;7(5):901–8.
51. * Pippinato L, Gasco L, Vita GD, Mancuso T. Current scenario in the European edible-insect industry: a preliminary study. J Insects Food Feed. 2020;6(4):371–81.
52. * García-Segovia P, García Alcaraz V, Tárrega A, Martínez-Monzó J. Consumer perception and acceptability of microalgae based breadstick. Food Sci Technol Int Cienc Tecnol Los Aliment Int. 2020;26(6):493–502.

53. Commission Implementing Regulation (EU) 2018/456 of 19 March 2018 on the procedural steps of the consultation process for determination of novel food status in accordance with Regulation (EU) 2015/2283 of the European Parliament and of the Council on novel foods (2018). Available from: http://data.europa.eu/eli/reg_impl/2018/456/oj/eng. Accessed 31 Jul 2023.
54. Lytle LA, Sokol RL. Measures of the food environment: A systematic review of the field, 2007–2015. Health Place. 2017;44:18–34.
55. Yang Y. Reframing the Dilemma of Consumer Trust in Food E-commerce Live Streaming: Problems, Reasons and Strategies. Adv Econ Manag Res. 2023;6(1):669–669.
56. Meijer GW, Lähteenmäki L, Stadler RH, Weiss J. Issues surrounding consumer trust and acceptance of existing and emerging food processing technologies. Crit Rev Food Sci Nutr. 2021;61(1):97–115.
57. Onwezen MC, Bouwman EP, Reinders MJ, Dagevos H. A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. Appetite. 2021;159:105058.
58. Wendin KM, Nyberg ME. Factors influencing consumer perception and acceptability of insect-based foods. Curr Opin Food Sci. 2021;40:67–71.
59. Kauppi SM, Pettersen IN, Boks C. Consumer acceptance of edible insects and design interventions as adoption strategy. Int J Food Des. 2019;4(1):39–62.
60. Hagger MS, Luszczynska A. Implementation intention and action planning interventions in health contexts: state of the research and proposals for the way forward. Appl Psychol Health Well-Being. 2014;6(1):1–47.
61. Mullan B, Allom V, Brogan A, Kothe E, Todd J. Self-regulation and the intention behaviour gap. Exploring dietary behaviours in university students. Appetite. 2014;73:7–14.
62. Florença SG, Guiné RPF, Gonçalves FJA, Barroca MJ, Ferreira M, Costa CA, et al. The motivations for consumption of edible insects: A systematic review. Foods. 2022;11(22):3643. https://doi.org/10.3390/foods11223643.

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Geographical context of European consumers' choices of alternative protein food: A systematic review

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ABSTRACT

This review synthesizes empirical evidence for the associations between alternative protein food (APF) choices and geographical context factors, including differences and similarities between consumers from various European countries, rural versus urban environments, and the "local" attribute of APF. The preregistered systematic review (PROSPERO repository, no. CRD42023388700) was conducted in 13 databases with 25 original studies being included. The risk of bias was evaluated using Joanna Briggs Institute quality evaluation tools.

The findings indicate that across consumers from European countries, levels of intention to eat, try, and buy APF are low-to-moderate. Patterns of APF consumers' choices differed between Northern Europe (Denmark, Finland), Southern Europe (Italy, Spain), and Eastern Europe (Poland, Czech Republic). For example, Danish consumers have positive attitudes but relatively low intention to eat plant-based APF. In turn, Polish consumers have lower levels of knowledge and low readiness to shift dietary patterns toward APF intake compared to Western European consumers (e.g., Germany). Italian consumers have a lower acceptance of insect-based APF than consumers from Western or Northern European countries (e.g., Belgium, Denmark). Our findings do not support rural–urban differences. Finally, perceiving an APF product as local may increase the likelihood of APF choice by European consumers. Our review provides preliminary insights into differences among consumers inhabiting European countries, suggesting the use of different messages to promote APF intake across Europe. Systematic research comparing countries across Europe is needed to verify the consistency of geographical differences.

1. Introduction

Alternative protein food (APF) encompasses protein concentrates obtained from various sources, including insects, krill, microbial biomass, mushrooms, fungi, or plants such as peas or rapeseed (cf. Grossmann & Weiss, 2021). While multiple definitions of alternative proteins exist, some stress that APF should refer to proteins produced from sources with lower environmental impact than conventional protein sources (e.g., beef, pork, poultry, and animal dairy). This definition excludes cultured meat due to ongoing debates about the environmental benefits of its production (Grossmann & Weiss, 2021).

Geographically defined political and administrative units, such as countries, regions, and cities, are the basic units organizing research on food systems, food environments, food production, and food consumption (Arcaya et al., 2015; Boto, 2013; Vandecandelaere et al., 2009). These units represent populations residing in the same geographic areas, exposed to similar risk factors and protective factors, including food policies and distances to various built food environment structures, such

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as local grocery stores/supermarkets where people usually shop for food (Arcaya et al., 2015). The geographically defined European units (countries, cities, etc.) exhibit diverse cultural, political, and economic characteristics, shaping consumer behaviors (Bambra et al., 2019). The importance of geographical units is highlighted in frameworks discussing key contextual factors that may determine the effectiveness of public policies or interventions (Pfadenhauer et al., 2017), including those addressing sustainable nutrition choices. Existing evidence suggests that country, region, or city (or a lower administrative unit) are meaningful categories (Bambra et al., 2019), crucial for research focusing on the development of sustainable food systems (Pucci et al., 2021).

Original research examining consumers' choice indicators of APF have investigated *differences between European countries* (e.g., Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Gómez-Luciano et al., 2019; Grasso et al., 2022; Henn et al., 2022; Naranjo-Guevara et al., 2021; Piha et al., 2018; Ribeiro et al., 2022; Tzompa-Sosa et al., 2023; Weinrich & Elshiewy, 2023). However, existing systematic reviews have largely overlooked differences between administrative units (e.g., countries, regions, and rural vs. urban environments). For example, Mancini et al. (2019) analyzed the determinants of consumers' choices within Europe as a single administrative unit. Siddiqui et al. (2022) presented plant-based and insect-based APF choices in specific countries but did not summarize research testing between-country differences. Major differences in production, intake, and acceptability of APF (e.g., insect-based) are observed between Europe and continents such as Asia, Africa, and South America (Kim et al., 2019) and as Europe is the leading market in production and sales of APF (Andreani et al., 2023; Pippinato et al., 2020), this review focuses on one continent (Europe) only. In sum, although original research on this topic is mounting, an overarching synthesis of between-country differences in APF choices across Europe is missing.

Beyond cross-country differences, research suggests *regional differences within European countries* (e.g., within the United Kingdom), as well as *rural–urban differences* (Bambra et al., 2019; Giannakis & Bruggeman, 2020) in consumer choices of APF. The differences may relate to economic development in the region or the socio-economic position of the consumers (Bambra et al., 2019; Giannakis & Bruggeman, 2020). Moreover, the food environment may differ greatly across these geographical units. For example, research conducted in the Netherlands indicated that between 2004 and 2018 there was an increase in the number of supermarkets and food convenience stores in urbanized neighborhoods, while a decrease was observed in less urbanized areas (Pinho et al., 2020). While some original studies addressing consumers' choices of APF have considered regional and urbanization-related differences (Brandner et al., 2022; Bryant & Sanctorum, 2021; Florença et al., 2021; Henn et al., 2022; Szendrő et al., 2020), a synthesis of such evidence has not been presented so far.

Finally, the frameworks of local food systems (Deller et al., 2017) highlight the importance of *food locality* as a determinant of food choices. Local food systems can be referred to as networks involving producers, intermediate food system actors, and consumers who, by prioritizing "local products," collectively contribute to the economic development of local communities and promote a better environment through shorter producer-to-consumer supply chains (Deller et al., 2017). The definition of "local food" is relative and may encompass a range of geographic areas, from a neighborhood to an entire country (Deller et al., 2017; Giovannucci et al., 2010). Conversely, other approaches propose more restrictive definitions of local food systems, defining them as systems in which foods are produced, processed, and retailed within approximately a 100 km radius (Kneafsey et al., 2013). Reviews of local food (other than alternative proteins) indicate that consumers are willing to pay more for local foods than non-local ones and that local producers benefit from greater recognition, which, in turn, affects the economic well-being of the local community (Enthoven & van den Broeck, 2021). Research on APF has analyzed associations between the locality of the production and APF choices by the consumers and products (Aaslyng & Højer, 2021; Brayden et al., 2018; Henn et al., 2022; Hoerterer et al., 2022; Porretta et al., 2019). However, there is currently no comprehensive synthesis of the findings obtained from the original research.

In sum, the overarching synthesis of geographical determinants of differences in European consumers' choices indicators of APF is missing. Using the methods of a systematic review, this study aims to synthesize empirical evidence for the geographical context factors as the source of differences in consumers' dietary choices of various APF products. We explore: (i) differences and similarities between consumers, depending on the European countries in which they reside; (ii) differences between consumers residing in rural and urban areas in European countries, and (iv) the associations between the "local" positioning of APF products in European countries and consumers' choices indicators.

2. Methods

2.1. Materials and general procedures

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The present study reports findings from a search conducted in a larger systematic review (registered with the PROSPERO database; no. CRD42023388700) aimed at eliciting physical environment characteristics that are related to consumers' choices of APF.

2.2. Search strategy

A systematic search encompassing 11 databases of peer-reviewed journals (Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals) was performed using the EBSCO platform. The selected databases either have a multidisciplinary focus or cover fields related to economics and business, agriculture, medical sciences, and social sciences. Searches in Web of Science and SCOPUS were also conducted. Documents and articles published between the inception of the databases and March 2023 were included.

The search was conducted using a combination of three groups of keywords referring to: (1) APF (e.g., "seaweed*" OR "alga*" OR "insect*" OR "lupin*" OR "mealworm protein" OR "krill protein" OR "microbial protein" OR "cultivated mushroom protein" OR "fermented fungal protein" OR "pea protein"); (2) physical environment, including geographical context variables allowing for conducting cross-country or cross-cultural comparisons, urban, rural environment, and investigation of locality, as well as physical environment variables (e.g., "cross-cultur*" OR "cross-countr*" OR "between-countr*" OR "between-cultur*" OR "across-countr*" OR "urban" OR "local sale" OR "rural" OR "suburban" OR "geograph*" OR "neighborhood*"); and (3) consumer or behavior-related (e.g., "intake" OR "food" OR "consume*" OR "eat" OR "sale" OR "purchase" OR "buy*" OR "sell*"). The full list of keywords is reported in Supplementary Material. The keywords were selected based on existing reviews on APF (Biasini et al., 2021; Mancini et al., 2019; Nguyen et al., 2022), the food environment typology by Downs et al. (2020), geographical context variables investigated in geography of health inequalities, such as country, region, and urban versus rural area (cf. Arcaya et al., 2015), and frameworks for research on interventions accounting for geographical context (Pfadenhauer et al., 2017). For this review, we employed a broad and inclusive search string (e.g., applying multiple terms that could represent the investigated factors, using only basic operators [AND, OR], and applying no specific limits) that could be used across the databases. The decision to use this broad search string aimed to maximize the number of identified articles. The feasibility of this search strategy was pretested across the selected databases before initiating the search.

To secure the robustness of the search, the systematic search was complemented by: (1) manual searches of the references of retrieved full-text original studies that were assessed for inclusion; (2) complementary searches in Google Scholar; and (3) CORDIS and Open Research Europe (ORE) Databases. The search was performed using "alternative protein" keywords (the keywords were modified as CORDIS and Open Research Europe impose limits for the length of search strings, allowing for up to 50 characters).

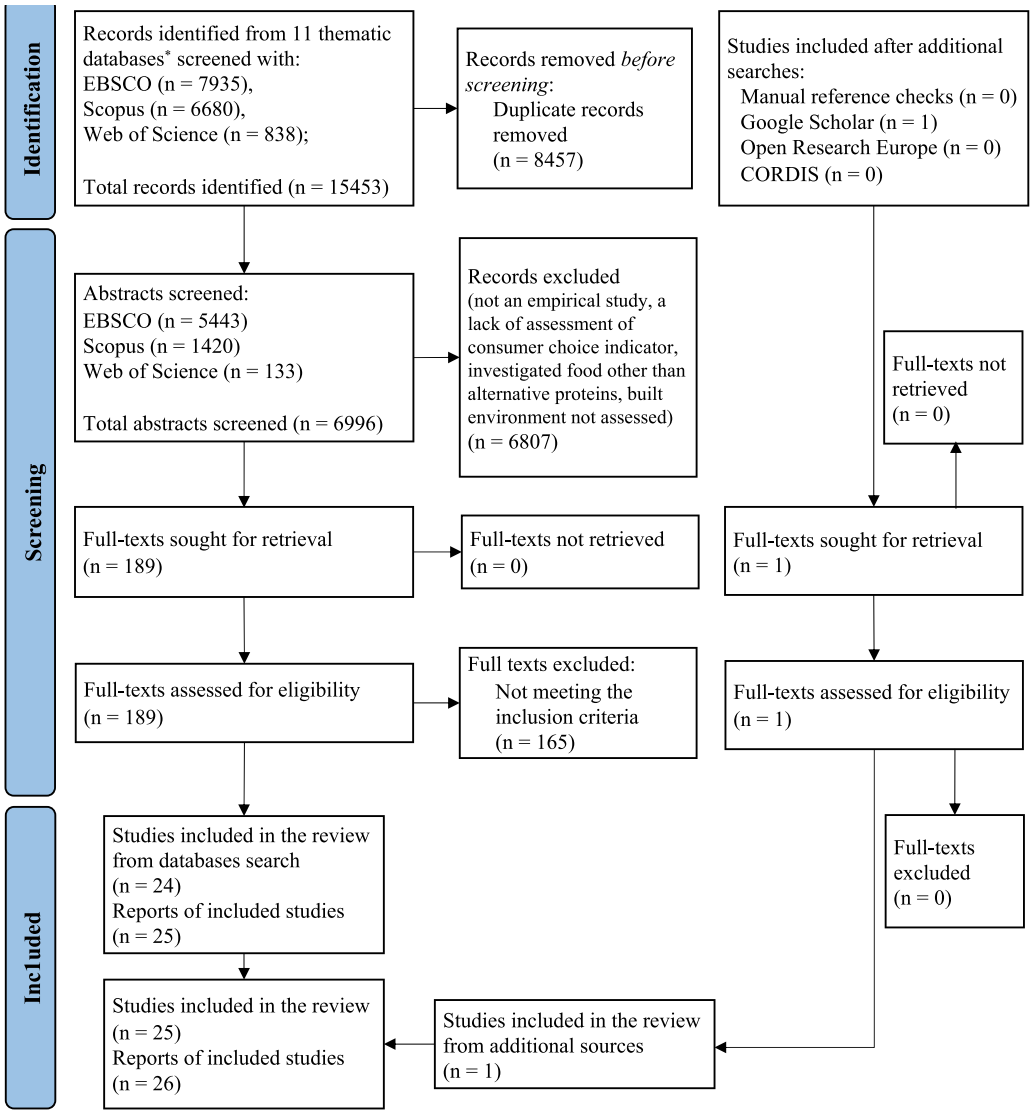
2.3. Inclusion and exclusion criteria

The following inclusion criteria were applied: (1) peer-reviewed English-language original quantitative or qualitative studies; (2) studies addressing alternative protein-based food, including plant-based proteins, insect-based proteins, or any other sources, such as krill, bacteria, or fungi, etc.; (3) studies investigating differences in APF choices in at least two European countries, or investigating differences in/effects of urban, suburban, and rural areas, or analyzing the effects of the locality of production of APF on a consumers' choices indicator; and (4) studies measuring a consumers' choices indicators, such as perceptions of availability, intention to buy, intention to eat, actual intake, or actual sales.

The exclusion criteria were: (1) documents that do not report any original data, including reviews or position papers; (2) dissertations, protocols, conference materials, and book chapters; (3) studies focusing solely on a reduction of meat intake without investigating how proteins could be supplemented in a diet by APF products; (4) studies focusing on increasing fruit and/or vegetable intake without specific data on plant-based protein sources; (5) studies accounting for countries located in Asia, Africa, or South America, entailing locally collected wild-living insects and their local consumption or local retail; (6) studies comparing consumers' choices in only one European country with a country in Asia or Africa, or South America (no cross-European comparisons); (7) studies involving "novel food" without an indication that the food is made from/with alternative protein sources; (8) studies addressing consumers' choices of laboratory-based in-vitro grown meat (no other APF investigated); and (9) studies investigating APF products as supplements or as animal feed.

2.4. Data collection, extraction, and coding

Fig. 1 presents the details of the data selection process. All identified



*Academic Search Ultimate, PsycInfo, PsycArticles Business Source Ultimate, Agricola, GreenFILE, Health Source: Nursing Academic Edition, SocINDEX, MEDLINE, MasterFILE Premier, Academic Research Source eJournals

Fig. 1. The data selection process.

abstracts were screened by two researchers (randomly assigned from a group of five researchers: HZ, EK, ZS, MS, and AB) to elicit potentially relevant studies. Any conflicts related to the potential inclusion of a document were resolved through discussions with a third researcher (AL). Next, three researchers (AL and two researchers randomly assigned from a group of five: HZ, EK, ZS, MS, AB) independently read the full-text versions of the articles and determined their alignment with the inclusion criteria. Additional searches for any other papers reporting original peer-reviewed studies beyond those identified in the database search involved the following strategies: screening references of the articles evaluated for inclusion (conducted by two reviewers independently (PC and TP), searches in Google Scholar (conducted independently by HZ and AL) and searches in CORDIS database and Open Research Europe database (conducted by AL). Overall, the search process and evaluation of all studies resulted in the inclusion of 26 articles reporting 25 independent studies (two articles were reporting the same study) (see Fig. 1).

To address the study objectives, the following data were extracted (see Table 1): characteristics of the studied population; the country where data was collected; the location within the country (urban vs. rural; an indicator of locality); the design of the original study; the type of APF investigated; the indicators of consumer choice; the key results.

Data extraction and coding were conducted by two researchers (HZ and AL). Any disagreements during these stages were resolved through a consensus method, which involved searching for possible rating errors, followed by discussion and arbitration by a third researcher, AB (Higgins et al., 2022).

Data retrieved from each original study were coded into three categories: (1) the type of APF products; (2) geographical context variables (countries, regions within countries, living in urban vs. rural environment, locality); and (3) the type of consumers' choices indicators. The APF products were coded into the following categories based on their protein sources (Bedsaul-Fryer et al., 2024; Grossmann & Weiss, 2021): (1) food developed with land plant-based proteins, such as beans; (2) seaweed-based proteins; (3) microalgae-based proteins; (4) food including or made of insect-based protein; (5) food including or made of other types of alternative protein sources, such as krill, fungi; (6) hybrid products, developed with a combination of plant-based proteins and meat products (pork, beef, poultry), with a proportion of 75–25 %, 50–50 % or 25–75 % of respective sources. The APF consumers' choices indicators may included: (1) attitudes toward and perceptions of the physical and social environment, which either facilitate or hinder APF consumption; attractiveness, approval, acceptance, or appropriateness of AFP products; (2) intentions to act (e.g., intention to buy, intention to eat APF); and (3) actual behavioral performance (e.g., buying APF, intake of APF). These indicators align with theories of health behavior change (e.g., Ajzen & Schmidt, 2020; Luszczynska & Schwarzer, 2020). For further details referring to the coding of geographical context variables and APF consumer's choices indicators, see Supplementary Material.

2.5. Risk of bias and quality assessment

Pairs of two researchers (PC and TP or AB and MS) independently rated the potential risk of bias related to the quality of each included study using the Joanna Briggs Institute Critical Appraisal Tool (Moola et al., 2020). This tool was selected because it is suitable for evaluating both qualitative studies and quantitative cross-sectional research (no longitudinal studies were included, whereas only one experimental study was included). Each study was evaluated along eight criteria, followed by an overall quality evaluation (good, fair, or poor). The scores are reported in Table 1 and Supplementary Material (Table S1). Studies were scored based on the responses to the critical appraisal questions (Yes = 2 – the criterion met completely, No = 0 – the criterion was not met, Unclear = 1 – some information provided, no complete clarity/information was inadequate to make a judgment). Any discrepancies in ratings were resolved through discussion or by involving the third researcher (AL). The overall risk of bias for individual studies was determined using the following cutoffs: low risk of bias – at least 70 % of answers were "yes," moderate – 50 to 69 % of answers were "yes," and high risk if the scores were below 50 %.

2.6. Data analysis

The included material in this review exhibited heterogeneity in terms of the countries compared, consumers' choices indicators, and types of APF (see Table 1). Additionally, there was a limited number of comparative studies between any pair of countries (e.g., Spain vs. Germany). Given this, a meta-analysis was not deemed appropriate. We employed a narrative synthesis method based on the Economic and Social Research Council guidance (Campbell et al., 2019; Popay et al., 2006). The exploration of similarities and differences among consumers residing in different European countries was conducted in two steps. First, we explored patterns emerging for APF, depending on the protein source (plant-based, insect-based, algae-based, etc.,). Second, data were analyzed for four European regions, as defined by the European Union (2024), which are North, East, South, and West. In each region, two countries were selected. The applied selection criterion referred to the largest number of studies comparing consumers from a respective country with consumers from any other European country. For further details, see Supplementary Material.

3. Results

3.1. Descriptive information

A total of $k = 25$ original studies were included. Table 1 presents the details of the populations analyzed, the country of data collection, the overall design, the type of alternative protein food (APF) products, and a summary of the main results.

Original studies were conducted in 18 European countries, with data from Germany ($n = 8$ studies, 32 %), Denmark ($n = 7$, 28 %), and the UK ($n = 5$, 20 %) being analyzed most frequently. Three studies compared 5 countries, $k = 3$ included samples from 4 countries, $k = 3$ accounted for 3 countries, and $k = 5$ compared 2 countries. Eleven studies addressed rural–urban differences or locality of the product (for details, see Supplementary Material). Six studies were published between 2013 and 2018, the remaining 19 studies were published between 2019 and 2023. The enrolled populations were heterogeneous, with sample sizes ranging between $N = 109$ and $N = 4{,}322$ ($M = 1{,}110.24$, $SD = 1{,}098.46$) and age ranging from 15 to 89 years old (see Supplementary Material for further information about the population characteristics). Most studies applied an observational cross-sectional design ($k = 23$, 92 %), while one study (4 %) was experimental and one study (4 %) was qualitative.

No study was excluded based on the quality assessment. Overall, 23 of the studies had a low risk of bias, 1 had a moderate risk of bias, and 1 had a high risk of bias (see Table 1 and Supplementary Table S1). The values of the inter-rater reliability coefficient (the weighted Cohen's κ) showed that there was a high agreement between the two raters with $\kappa = 0.91$ (95 CI: [0.74, 1.00]).

3.2. Cross-country similarities and differences

3.2.1. Cross-country similarities and differences in European consumers' choices

Fourteen studies (Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Barska, 2014; Gómez-Luciano et al., 2019; Grasso et al., 2022; Henn et al., 2022; Naranjo-Guevara et al., 2021; Piha et al., 2018; Ribeiro et al., 2022; Tzompa-Sosa et al., 2023; Weinrich & Elshiewy, 2019, 2023 [two papers presenting findings from one study]; Verneau et al., 2020; Verneau et al., 2016; Zabrocki, 2017) compared indicators of consumers' choices of APF in at least two European countries. The findings

Table 1
Descriptive information about the original research included in the systematic review.

Author, year	Population (*N*, age, gender	Type of the study (design), the JBI quality evaluation score	Type of consumer choice indicators	Type of alternative proteins	Country/region/ urbanization/ locality	Main findings of the original studies
Comparisons Between European Countries						
Banovic and Sveinsdóttir (2021)	$N = 1{,}397$; women only; $M_{age} = 43$	Quantitative (questionnaire) JBI = low	Intention to buy, the attractiveness of APF	Plant-based APF	Denmark, Romania, Germany, Finland, Iceland ($k = 5$ countries)	Positive attitude, attractiveness of meat analogues: similar level across 5 countries. Intention to buy was the lowest in Denmark (higher meat intake) compared to Romania, Germany, Finland, and Iceland.
Banovic et al. (2022)	$N = 2{,}766$; 51 % women; $M_{age} = 42$	Quantitative (online questionnaire) JBI = low	Intention to buy	Hybrid products, including plant-based proteins and meat	Denmark, Spain, the UK ($k = 3$ countries)	Hybrid products (50 % meat + 50 % plant combination): UK, Denmark, Spain. Intention to buy hybrid products was low-to-moderate across countries (around 3.5–4.5 on a 7-point scale). Intention to buy was the lowest when hybrid products contained rapeseed ($M = 3.68$) and soy ($M = 3.95$) protein. This was particularly true for Spanish participants who showed lowest levels of appropriateness for rapeseed protein ($M = 3.17$), mainly due to their lower levels of familiarity with this plant-based ingredient; Danish participants had lower preference for soy protein ($M = 3.60$). Intention to buy hybrid products was highest when containing pea ($M = 4.20$), followed by bean ($M = 4.15$), and oat ($M = 4.09$) protein. Pea protein was preferred by Spanish participants ($M = 4.33$), while bean protein was preferred among UK participants ($M = 4.45$) as an appropriate ingredient for APF. For Danish participants, pea and bean proteins were found as appropriate parts of APF (pea: $M = 4.04$; bean: $M = 4.07$).
Barska (2014)	$N = 791$; 60 % women; consumers aged 18–29	Quantitative (survey) JBI = high	Self-reported buying, intention to buy	Various innovative foods (plant- and insect-based)	Poland, Czech Republic, Slovakia, Germany ($k = 4$ countries)	Innovators and early followers (buying soon after various innovative foods are out vs. after some consideration): a difference between Germany (73 %) compared to Poland, the Czech Republic, and Slovakia (24–36 %); reluctance to buy new product: 0 % in Germany, 13–17 % Poland, Czech, Slovakia.
Gómez-Luciano et al. (2019)	$N = 983$; UK sample = 48.3 % men, 51.7 % women; Spain sample = 50.5 % men, 47 % women; age range: 25 and 54	Quantitative (digital and paper questionnaire) JBI = low	Intention to buy	Various innovative foods (plant- and insect-based)	UK, Spain ($k = 2$ countries) (also included: Brazil, Dominican Republic) ($k = 2$ countries)	Percentage of willingness to buy plant-based alternative proteins high among countries (50–60 % in UK and Spain), much lower willingness to buy insect-based alternative proteins (18–22 % in UK and Spain, respectively).
Grasso et al. (2022)	$N = 2{,}405$; 25.63 % were 18–32 years old, 24.74 % were 33–46 years old, 31.68 % were 47–61 years old and 17.95 % were 62–75 years old.; UK – 51.0 % women; Spain – 49.8 % women; Denmark – 50 % women	Quantitative (online survey) JBI = low	Intention to eat; Intention to buy	Hybrid products, including plant-based proteins and meat	UK, Spain, Denmark ($k = 3$ countries)	Hybrid meat: In the UK and Denmark there was no significant difference between the meat-to-plant ratios, 75:25 and 50:50, indicating that both ratios were deemed equally preferable. Spanish consumers ranked the 50:50 ratio as the most preferable, followed by 75:25. Across 3 countries, at least 50 % of consumers were

(*continued on next page*)

Table 1 (*continued*)

Author, year	Population (*N*, age, gender	Type of the study (design), the JBI quality evaluation score	Type of consumer choice indicators	Type of alternative proteins	Country/region/ urbanization/ locality	Main findings of the original studies
						willing to try hybrid meats but less willing to buy them. Spanish consumers seemed to be the most favorable, with 71 % willing to try and 63 % willing to buy. In the UK, the willingness to buy was 53 %, in Denmark- 46 % was willing to buy hybrid meat.
Henn et al. (2022)	$N = 4,322$	Quantitative (web-based survey) JBI = low	Intention to eat	Plant-based APF	Denmark, Germany, Spain, UK, Poland ($k = 5$ countries)	Poland had higher intention to replace animal products (meat, cheese, and eggs) with pulses-based (pulses) products, compared to Denmark, Germany, Spain and UK. Respondents from Poland did not only show higher odds of being part of the "replacer" segment, but significantly more respondents indicated replacing pork and poultry, fish, cheese, and eggs with pulses. Polish consumers did not replace beef to an extent comparably to pork and poultry. In contrast, many Danish consumers used pulses to first and foremost replace beef. Danish consumers may be in advanced stages of meat reduction, i.e., consume less beef than poultry. The Danish consumers may be more informed about the environmental impact of beef production, leading to more conscious choices on reducing beef compared to other meat types.
Naranjo-Guevara et al. (2021)	$N = 222$; 30 % women; university students; $M_{age} = 21$	Quantitative (survey) JBI = low	Consumers attitudes and beliefs (acceptance)	Insect-based APF	The Netherlands, Germany ($k = 2$ countries)	No differences between Dutch and German students in acceptance of insects as food.
Piha et al. (2018)	$N = 887$; Northern Europe – 60 % women; $M_{age} = 37$ years old; Central Europe – 61 % women; $M_{age} = 39$	Quantitative (questionnaire) JBI = low	Intention to buy	Insect-based APF	Sweden, Finland, Germany, Czech Republic ($k = 4$ countries)	Consumers in Sweden and Finland (data from two countries combined) had more positive beliefs about insect-based food and higher willingness to buy them than consumers in Germany and Czech Republic (data combined). Objective knowledge about insect-based products did not differ across the clusters whereas product related experiences were higher in Sweden-Finland cluster than in Germany-Czech Republic cluster.
Ribeiro et al. (2022)	$N = 666$; Norway – 67 % women, Portugal – 59 % women; M_{age} Norway = 41 years old; M_{age} Portugal = 40 years old; Age range: 18 and > 55	Quantitative (online-based questionnaire) JBI = low	Consumers attitudes and beliefs (acceptance)	Insect-based APF	Norway, Portugal ($k = 2$ countries)	Acceptance of insects as food was low-to-medium but higher in Norway than in Portugal. The predictors of acceptance vs rejection of insects as food are determined by lower disgust, higher education, higher familiarity among Norwegians and by lower disgust, younger age, male gender among Portuguese. Norway had higher and earlier promotion of insect-based food than southern European countries.
Tzompa-Sosa et al. (2023)	$N = 1046$ Belgium – 271 women and 247 men; Italy – 278 women	Quantitative (online survey)	Intention to eat	Insect-based APF	Belgium, Italy, ($k = 2$ countries); (also	Italy (compared to Belgium) had the highest number of people who indicate they are not willing

(*continued on next page*)

Table 1 (*continued*)

Author, year	Population (*N*, age, gender	Type of the study (design), the JBI quality evaluation score	Type of consumer choice indicators	Type of alternative proteins	Country/region/ urbanization/ locality	Main findings of the original studies
	and 250 men Age range: 18 to > 65 years old	JBI = low			included: the USA, China, Mexico)	to include whole insects into their food (80 % vs. 72 % and 74 % respectively). The lowest approval to include whole insects in Italy may be based on the shortest time this type of food is present in the market (compared to Belgium). For powdered insect-based food the refusal of including was respectively 61 % (Italy), 48 % (Belgium). Europeans are more likely to refuse the inclusion of whole insects than non-Europeans.
Weinrich and Elshiewy (2019)	$N = 938$; 51 % women; M_{age} between 31 and 34	Quantitative (questionnaire) JBI = low	Intention to pay	Microalgae-based APF	Germany, the Netherlands, France ($k = 3$ countries)	There was no significant difference in the average willingness to pay for more micro-algae-based proteins in meat substitutes across Germany, the Netherlands, and France. Some determinants of willingness to pay may differ across the countries, e.g., the most positive attitude toward a meat-free diet was found in the Netherlands, while the opposite was true for France.
Weinrich and Elshiewy (2023)	$N = 938$; 51 % women; M_{age} between 31 and 34	Quantitative (questionnaire) JBI = low	Consumers attitudes and beliefs (perceived healthiness)	Microalgae-based APF	Germany, the Netherlands, France ($k = 3$ countries)	Perceiving microalgae-based food as healthy, sustainable, and nutritious was unrelated to habits of shopping in specialty food stores among consumers from France, Germany, and the Netherlands (men and women subsamples).
Verneau et al. (2016)	$N = 282$; university students; Denmark − 65 women, $M_{age} = 23$; Italy − 74 women; $M_{age} = 23$	Quantitative (experiment) JBI = low	Intention to eat	Insect-based APF	Denmark, Italy ($k = 2$ countries)	The main effect of nation on intention was significant, $p < 0.001$, the mean score of intention was higher for the Danish ($M = 4.37$) compared to the Italians ($M = 3.55$). The effect of nation on intention was also significant $p < 0.01$, the mean score was higher for the Danish participants ($M = 4.43$) compared to the Italian participants ($M = 3.84$).
Verneau et al. (2020)	$N = 280$; 138 women; $M_{age} = 23$	Quantitative (computer-based questionnaire) JBI = low	Intention to eat	Insect-based APF	Denmark, Italy ($k = 2$ countries)	Intentions to eat insects are stronger in Denmark than in Italy.
Zabrocki (2017)	$N = 428$; population aged 55+	Quantitative (survey questionnaire) JBI = moderate	Intention to buy; consumers attitudes and beliefs (knowledge about APF)	Various innovative food (plant- and insect-based)	Germany, Poland ($k = 2$ countries)	Among individuals aged over 55 years old, German respondents declared greater knowledge of innovative products and were more inclined to make faster purchasing decisions for such products compared to respondents from Poland.
Regional Differences						
Brandner et al. (2022)	$N = 1,177$; 65 % women; the majority were Millenials	Quantitative (cross-sectional survey) JBI = low	Actual sales of products	Plant-based APF	England versus Scotland ($k = 1$ country)	Higher purchase in England than in Scotland (differences may be driven by ethnicity).
Bryant and Sanctorum (2021)	$N = 1,001$ in 2019 & $N = 1,000$ in 2020; 50 % women; $M_{age} = 48$	Quantitative (cross-sectional survey) JBI = low	Consumers attitudes and beliefs (acceptability)	Plant-based APF	Flanders versus Walloon, versus Brussels (Belgium) ($k = 1$ country)	Significant but small differences in plant-based meat substitutes acceptance (higher in Flanders

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Table 1 (*continued*)

Author, year	Population (*N*, age, gender	Type of the study (design), the JBI quality evaluation score	Type of consumer choice indicators	Type of alternative proteins	Country/region/ urbanization/ locality	Main findings of the original studies
						[49.1 %] compared to Walloon [45.6] or Brussels [44.3]).
Lucas et al. (2019)	$N = 495$; Sample 1: 53 % women; Sample 2: 54 % women; Sample 3: 51 % women; Age: > 15	Qualitative (in-person interviews) JBI = low	Self-reported intake	Seaweed-based APF	France (different regions) ($k = 1$ country)	Paris and western France had higher intake (Western France is where more seaweed-based food is produced hence likely to be more available).
Menozzi et al. (2017)	$N = 109$; 61 % women; $M_{age} = 23$	Quantitative (questionnaire, tasting session) JBI = low	Intention to eat	Insect-based APF	Italy (different regions) ($k = 1$ country)	Intention to eat insect-based foods was weakest in Southern Italy and strongest in the Central and Northern regions. No associations between intention and actual behavior were found.
Rural Versus Urban Environment						
Brandner et al. (2022)	$N = 1,177$; 65 % women; most of the participants were Millenials	Quantitative (cross-sectional survey) JBI = low	Actual sales of products	Plant-based APF	The UK (areas of low and high socioeconomic position index) ($k = 1$ country)	No overall differences in areas of high vs. low deprivation index (although there are differences in eating legumes, e.g., frozen or dried beans, with low deprivation buying more/ indicating a good source of protein).
Bryant and Sanctorum (2021)	$N = 1,001$ in year 2019 & $N = 1,000$ in year 2020; 50 % women; $M_{age} = 48$	Quantitative (cross-sectional survey) JBI = low	Consumers attitudes, beliefs (satisfaction)	Plant-based APF	Flanders versus Walloon versus Brussels (Belgium) ($k = 1$ country)	Urban vs. rural areas did not differentiate satisfaction with products.
Florença et al. (2021)	$N = 213$; 79 % women; Age range between 18 and > 66	Quantitative (online questionnaire) JBI = low	Consumers attitudes and beliefs (acceptability)	Insect-based APF	Portugal (different regions, rural and urban) ($k = 1$ country)	Living in urban, rural or suburban environment has no effect on beliefs about edible insects or acceptability of insect-based food products.
Henn et al. (2022)	$N = 4,322$	Quantitative (web-based survey) JBI = low	Intention to eat	Plant-based APF	Denmark, Germany, Spain, the UK, Poland (rural and urban) ($k = 5$ countries)	Plant-based (pulses) replacements of animal products (meat, cheese, and eggs): no differences between urban and rural residence for analysis conducted from data of consumers from Denmark, Germany, Poland, Spain and the UK.
Hoek et al. (2013)	$N = 3,613$; vegetarians: $n = 32$ (73 % women); consumers of meat substitutes: $n = 17$ (59 % women); meat consumers: $n = 3,564$ (54 % women); age range: 18–75	Quantitative (survey) JBI = low	Self-reported intake by the consumers	Plant-based APF	The Netherlands (different regions, rural and urban) ($k = 1$ country)	Being a plant-based meat substitute consumer was related to a higher level of urbanization.
Nevalainen et al. (2023)	$N = 1,000$; 50.5 % women; age range: 18–79	Quantitative (online questionnaire) JBI = low	Self-reported intake by the consumers	Various innovative foods (plant- and insect-based)	Finland (different regions, rural and urban) ($k = 1$ country)	The respondents in the "less red meat, more plant proteins" cluster were more likely to live in a larger city compared to the whole sample. Respondents of the "less red meat, more poultry" cluster: living in middle-sized or small cities or municipalities. "No/very little meat, more plant proteins" cluster: lived mostly in the capital area of Helsinki.
Szendrő et al. (2020)	$N = 414$; 65.5 % women	Quantitative (questionnaire) JBI = low	Consumers attitudes and beliefs (acceptability)	Insect-based APF	Hungary (different regions, rural and urban) ($k = 1$ country)	No associations between the type of residence (urban vs. rural) and acceptance or rejection of insect-based foods.
Vartiainen et al. (2020)	$N = 564$; 66.8 % women; age range: 16–89	Quantitative (questionnaire) JBI = low	Intention to eat	Insect-based APF	The Netherlands (different regions, rural and urban) ($k = 1$ country)	The strength of intention to consume insect-based foods in the future: people living in rural areas had less intention than people living in city areas. Nevertheless, most of those living in rural areas were among either potential or likely (76 %) consumers of insect-based food.

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Table 1 (*continued*)

Author, year	Population (*N*, age, gender	Type of the study (design), the JBI quality evaluation score	Type of consumer choice indicators	Type of alternative proteins	Country/region/ urbanization/ locality	Main findings of the original studies
						In urban areas either potential or likely consumers constituted 85 % of the population.
Locality of Products						
Aaslyng and Højer (2021)	$N = 395$; 78 % women; age range: 18–29	Quantitative (online survey) JBI = low	Self-reported intake by the consumers	Plant-based APF	Denmark ($k = 1$ country)	Higher intake of plant-based proteins if they were "locally" produced.
Henn et al. (2022)	$N = 4,322$	Quantitative (web-based survey) JBI = low	Intention to eat, self-reported intake	Various innovative foods (plant- and insect-based)	Denmark, Germany, Spain, the UK, Poland ($k = 5$ countries)	Plant-based (pulses) replacements of animal products (meat, cheese, and eggs): no effect of locality (related to consumers residence) for the analyses conducted from data of consumers from Denmark, Germany, Poland, Spain, and the UK.
Hoerterer et al. (2022)	$N = 362$; 53 % women; mostly $\leq$ 25 years old	Quantitative (questionnaire) JBI = low	Intention to pay	Seaweed-based APF	Germany ($k = 1$ country)	Attitudes towards seaweed-based APF: German consumers indicated the importance of its local production and considered locality as one of the key characteristics of the sustainability of aquaculture.
Lucas et al. (2019)	$N = 495$; Sample 1: 53 % women; Sample 2: 54 % women; Sample 3: 51 % women; age > 15	Qualitative (in-person interviews) JBI = low	Self-reported intake by the consumers	Seaweed based APF	France ($k = 1$ country)	Seaweed-based food: production in France (versus imported) did not have an effect on self-reported intake. However, people living in areas of France where the production of seaweed-based APF is the highest in the country was associated with a higher intake of seaweed-based APF (Rennes compared with Montpellier, Lille, Lyon, Strasbourg, Bordeaux); the exception refers to Paris, where similar level of intake (as in Rennes) was observed (explained with a higher minority of Asian-origin, favoring seaweed-based food).
Weinrich and Elshiewy (2019)	$N = 938$; 51 % women; M_{age} between 31 and 34	Quantitative (questionnaire) JBI = low	Intention to pay	Algae-based APF	Germany, the Netherlands, France ($k = 3$ countries)	79 % of consumers have a positive preference to select local algae-based APF as meat substitutes. The locality of the production of algae-based APF was a significant predictor of the preference to substitute meat with APF.

Note. Study design = Type of the study; JBI = Joanna Briggs Institute overall study quality index; Study quality values are reported as three levels of risk of bias: low risk, moderate risk, or high risk; APF = alternative protein food; "plant-based APF" - products from plants such as pulses, rapeseed, seaweed-based APF and algae-based APF were excluded from this category.

suggest some similarities in patterns of associations, depending on the type of alternative proteins.

First, research suggested moderate levels of willingness/intention to buy or try plant-based APF or hybrid products (combining meat and plant-based APF). Willingness to buy plant-based alternative proteins was reported by only 50–60 % of consumers in the UK and Spain (Gómez-Luciano et al., 2019). Across the studies conducted in the UK, Denmark, and Spain, at least 50 % of consumers were willing to try hybrid products, including meat-based and plant-based proteins (Grasso et al., 2022). Additionally, across these three countries, fewer consumers were willing to buy hybrid products than to try these products (e.g., 71 % of Spanish consumers were willing to try, but only 63 % were willing to buy; Grasso et al., 2022). Willingness to buy hybrid products (50 % meat + 50 % plant combination) was moderate among consumers from the UK, Denmark, and Spain (between 3.5 and 4.0 on a 7-point response scale; Banovic & Sveinsdóttir, 2021). Intention to buy was the lowest for hybrid products containing rapeseed protein ($M = 3.68$) and soy protein ($M = 3.95$; Banovic & Sveinsdóttir, 2021).

Second, the intention to buy insect-based APF is rarely reported by consumers. For example, only 18–22 % of consumers in the UK and Spain report a willingness to buy insect-based APF (Gómez-Luciano et al., 2019).

Third, there are some similarities in the levels of knowledge and acceptance of insect-based APF. In particular, regarding objective knowledge about insect-based products, no differences were found between consumers recruited in Sweden, Finland, Germany, and the Czech Republic (Piha et al., 2018). No difference in the acceptance of insects as human food was observed between Dutch and German students: overall,

51 % of the participating young people either rejected the idea of including insects in their diet or had no opinion about it (Naranjo-Guevara et al., 2021).

Fourth, differences in consumers' choices indicators for insect-based APF may emerge if consumers from Northern European countries are compared with consumers from some Eastern, Western, or Southern European countries. For example, consumers from Sweden and Finland (data combined) seem to have generally more positive attitudes toward insect-based food and a higher willingness to buy such food compared to consumers from Germany and the Czech Republic (data combined) (Piha et al., 2018). Also, Ribeiro et al. (2022) showed significantly higher acceptance of including insect-based APF into the daily diet among respondents from Norway than from Portugal.

Fifth, some similarities in consumers' choices indicators referring to microalgae-based APF were found across countries in Western Europe. For example, no significant differences in average willingness to pay, knowledge, and beliefs referring to microalgae-based APF were found across respondents from Germany, the Netherlands, and France (Weinrich & Elshiewy, 2019; Weinrich & Elshiewy, 2023).

Besides similarities among consumers from European countries, 4 of the 14 studies (28.6 %%) suggested differences between consumers, depending on the countries of residence (Banovic et al., 2022; Piha et al., 2018; Ribeiro et al., 2022; Weinrich & Elshiewy, 2019, 2023 [two papers reporting the same study]).

3.3. Case studies: Consumers' choices across four European regions

Patterns of APF consumers' choices from two countries in each of the four European regions (the European Union, 2024) were analyzed. In the case of Northern Europe, the two countries most frequently included in the comparisons with other countries were Denmark (between-country comparisons conducted in 6 studies) and Finland (between-country comparisons reported in 2 studies). In the case of Eastern Europe, data from consumers recruited in Poland and the Czech Republic (comparisons reported in 3 and 3 studies, respectively) were most frequently studied. For Southern Europe, the respective countries were Spain and Italy (comparisons reported in 4 and 3 studies, respectively), and for Western Europe, these were Germany and the UK (comparisons reported in 7 and 4 studies, respectively).

3.3.1. Results for consumers from Northern Europe: Denmark and Finland

Six studies compared consumers' choices of APFs in Denmark with other European countries (Banovic et al., 2022; Banovic & Sveinsdóttir, 2021; Grasso et al., 2022; Henn et al., 2022; Verneau et al., 2020; Verneau et al., 2016).

Danish consumers harbor positive attitudes towards and have positive beliefs about hybrid products (combining plant-based proteins and meat) and plant-based APF. For example, for Danish consumers, hybrid products but also plant-based APF were rated higher than meat products in terms of the attributes of being healthy, ethical, environmentally friendly, and nutritious (Grasso et al., 2022). Similar patterns were observed for consumers from the UK and Spain, who also rated hybrid products and plant-based meat-free alternatives as more healthy, ethical, and environmentally friendly than meat products (Grasso et al., 2022). Unfortunately, cross-country comparisons were not conducted (Grasso et al., 2022).

A strong positive association between drivers of consumers' choices, referring to protection of the environment, better health, and sustainability, and reports of replacement of pork and poultry with pulse-based APF was found for consumers from Denmark, whereas this association was weaker for Polish consumers (Henn et al., 2022). Another study indicated that Danish consumers have a relatively high awareness of the healthiness of pulses-based protein products, similar to beliefs of Spanish consumers (Banovic et al., 2022). Importantly, these studies (Banovic et al., 2022; Grasso et al., 2022; Henn et al., 2022) predominantly focus on attitudes, beliefs, and knowledge and therefore provide evidence for the motivational drivers of intake of plant-based APF and hybrid products.

Positive attitudes and beliefs do not always translate to strong intentions. Three out of five studies (60 %) addressing APF-related intentions indicate that Danish consumers seem to harbor relatively low intention to buy plant-based APF or hybrid products, compared to consumers from other countries. For example, research addressing the intention to buy plant- and meat-hybrid products indicates lower intention in Denmark than in the UK (Banovic et al., 2022). Among Danish consumers, only 46 % were willing to buy hybrid meat (a product combining plants and meat), compared to 63 % of consumers in Spain and 53 % in the UK) (Grasso et al., 2022). Another study suggested that women from Denmark reported weak-to-moderate intention to buy plant-based APF and to replace meat APF ($M = 3.33$), whereas respective intentions were moderate and stronger among women from Romania, Germany, Finland, and Iceland (mean values between 3.41 and 4.89, reported on a 7-point scale; Banovic & Sveinsdóttir, 2021).

Two out of five studies addressing willingness to try/eat APF indicated that Danish consumers report intentions of similar strength to those of consumers in other European countries. When German, Spanish, the UK-based, Polish, and Danish consumers were compared, intention to use pulses to replace 8 out of 10 protein products was most frequently reported by Polish consumers, whereas less frequent intention was reported by consumers from other countries, including Denmark (Henn et al., 2022). However, in the case of beef, Danish consumers reported intentions to use pulses as a replacement more often than consumers from other countries (Henn et al., 2022). Another study indicated that, regarding hybrid products, Danish and Spanish consumers had similar overall average levels of intention to buy (Banovic et al., 2022).

Besides specific patterns for hybrid products and plant-based APF, Danish consumers differ from consumers from Southern European countries, such as Italy, in terms of intention to eat insect-based APF. For example, being Danish (compared to being Italian) was one of the significant predictors of intention to eat insect-based APF (Verneau et al., 2020). Another study indicated that intention to eat insect-based APF was higher among consumers from Denmark than among respondents from Italy, with differences of medium size observed before ($d = 0.46$) and after ($d = 0.31$) a psychosocial intervention addressing benefits of eating insects (Verneau et al., 2016). Importantly, participants from both countries benefitted from the intervention: among Danish consumers, intention increased from $M = 4.37$ to $M = 4.43$, whereas among Italian consumers, intention increased from $M = 3.55$ to $M = 3.84$ (answers provided on a 7-point scale; Verneau et al., 2016).

Concluding, Danish consumers may be considered to be in the *stage of contemplating a change* regarding plant-based APF and hybrid products. In contrast to consistent findings for relatively positive attitudes and beliefs (similar to those observed in consumers from other investigated countries), the findings of 3 out of 5 studies referring to intention to eat plant-based APF or hybrid products indicate lower levels of intention to consume in respondents from Denmark than among respondents from other countries. These patterns of associations may indicate a stage when the consumers are aware of many pros of adopting a new behavior and have positive attitudes about adopting APF but still hesitate and consequently fail to form strong and consistent intentions. Furthermore, research addressing the intention to eat insects suggests a stronger intention among Danish consumers compared to Italian consumers. For a summary of findings addressing Danish consumers, see Fig. 2.

In the case of Finland, only two studies provided data on cross-country comparisons. Levels of positive attitude, attractiveness, and intention to buy plant-based APF were similar to levels observed among respondents from Iceland, Romania, Germany, and Denmark (Banovic & Sveinsdottir, 2021). There was one exception in these comparisons: Finnish consumers reported a higher intention to buy plant-based APF than Danish consumers (Banovis & Sveinsdottir, 2021). Regarding

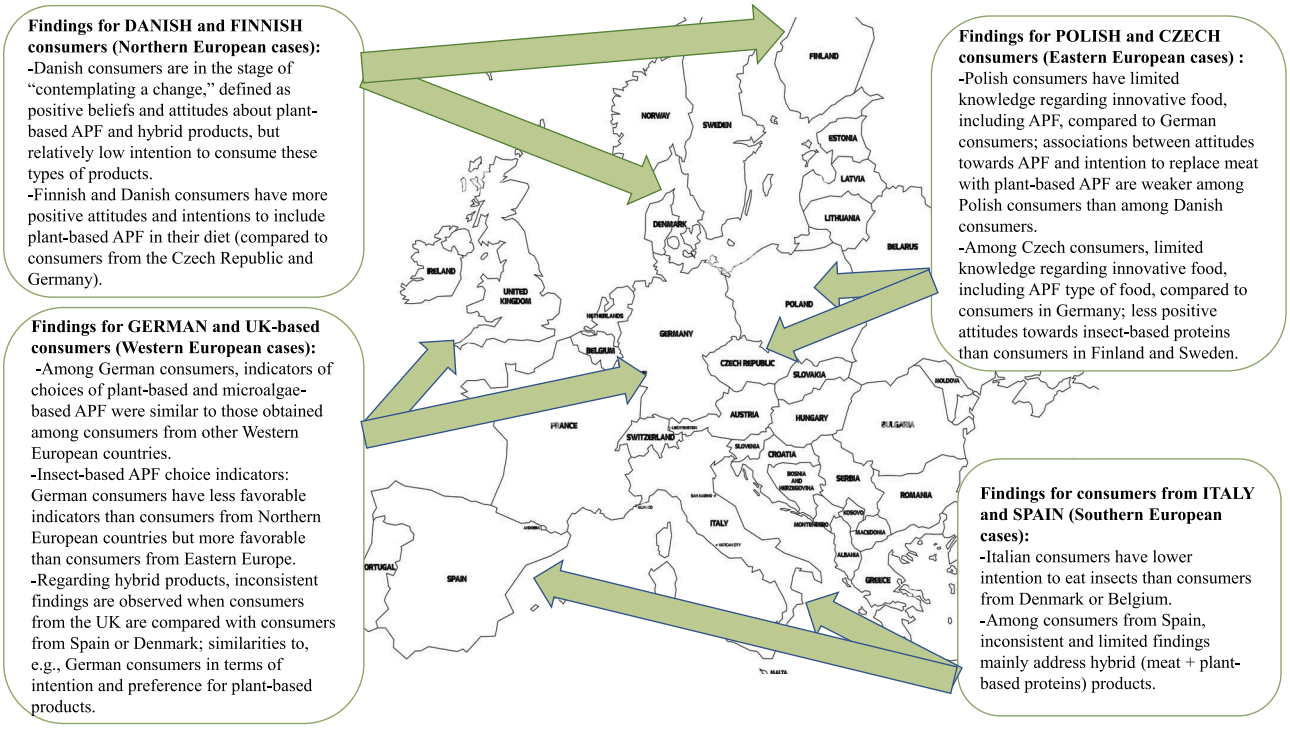

Fig. 2. Alternative Protein Food (APF) choices among consumers recruited in Northern, Eastern, Western, and Southern European Countries.

insect-based APF, consumers from Finland (combined with Swedish consumers) reported more positive attitudes, higher willingness to buy, and rated their product-related experiences higher than consumers from Germany and the Czech Republic combined (Piha et al., 2018). Concluding, the evidence comparing consumers from Finland with consumers from other counties is very limited, with two studies only, each addressing different type of APF.

3.3.2. Results for consumers from Eastern Europe: Poland and the Czech Republic

Three studies analyzed indicators of APF choices among Polish consumers (Barska, 2014; Henn et al., 2022; Zabrocki, 2017). These studies showed less positive attitudes toward plant-based APF of Polish consumers compared to German consumers and weaker associations between attitudes and self-reported APF choices, when compared with consumers from Denmark. Specifically, a study comparing German and Polish consumers (aged 55 years or older) indicated that Polish respondents had significantly lower levels of knowledge regarding innovative food products (including those containing plant-based APF), were more hesitant in their decisions, and less frequently decided to purchase such products (Zabrocki, 2017). A cross-country comparison of young consumers only indicated that among people from Germany, "food innovators" (i.e., buying soon after various innovative foods are out) and "early followers" (those who buy after some consideration) constitute 73 % of the population (Barska, 2014). This contrasts with findings observed for young people from Poland, the Czech Republic, and Slovakia, where "food innovators" and "early followers" constitute only 24–36 % of consumers (Barska, 2014). While strong reluctance to buy innovative APF (including those containing plant-based APF) was not found among young consumers from Germany, it was present among 13 %–17 % of consumers from Poland, the Czech Republic, and Slovakia (Barska, 2014). Furthermore, among Polish consumers, environmental and sustainability motives formed weaker associations with self-reported replacement of pork and poultry with pulse-based APF than among consumers from Denmark, which may be indicative of a less important role of sustainability awareness in protein choices of Polish consumers (Henn et al., 2022).

One study (Henn et al., 2022) indicated that Polish consumers may report higher intention to use pulses to replace several other protein products than consumers from different regions in Europe. Compared to consumers from Denmark, Germany, Spain, and the UK, Polish consumers more frequently reported intentions to use pulses to replace animal-based protein products (pork, poultry, fish, cheese, and eggs), but also to replace nuts, vegetables, and tofu with pulse-based APF (Henn et al., 2022). However, in case of one type of traditional protein source, beef, consumers from Poland had less frequently reported intentions to replace it with pulses, when compared to Danish consumers (Henn et al., 2022).

Concluding, 2 out of 3 studies (66 %) addressing consumers from Poland indicated that they are characterized by limited knowledge regarding innovative food products and relative reluctance to adopt novel foods and their attitudes towards alternative proteins are weakly associated with reports of intention to replace meat with plant-based APF. One out of three studies addressing consumers from Poland yielded an unclear pattern of findings for intentions to use pulses to replace other protein products. For a summary of findings, see Fig. 2.

Two studies compared consumers from the Czech Republic with those from other countries (Barska, 2014; Piha et al., 2018). The study by Barska (2014) indicates that in terms of reluctance to buy plant-based APF, consumers from the Czech Republic and Poland are similar, and more reluctant than consumers from Germany (Barska, 2014). Regarding insect-based APF, Czech consumers also have less positive beliefs, lower willingness to buy, and less positive product-related experiences than consumers from Sweden and Finland combined (Piha et al., 2018). Concluding, the studies comparing consumers from the Czech Republic and other countries yielded similarities to trends observed for Polish consumers.

3.3.3. Results for consumers from Southern Europe: Italy and Spain

No study compared Italian consumers' choices of plant-based APF to choices of consumers from other European countries. However, three studies addressed differences in Italian consumers' intentions to eat

insect-based APF from those of other European countries (Tzompa-Sosa et al., 2023; Verneau et al., 2020; Verneau et al., 2016). Intentions to eat insects were weaker among consumers recruited in Italy than among consumers from Denmark (Verneau et al., 2016; Verneau et al., 2020). The effects indicating between-country differences were of medium size ($d = 0.46$; Verneau et al., 2016). Compared to Belgian consumers, those recruited in Italy were more frequently indicating they would not eat whole insects (72 % in Belgium, 80 % in Italy; Tzompa-Sosa et al., 2023). The refusal to include powdered insect-based food in a meal was also more frequently found among consumers from Italy (61 %) as compared to participants from Belgium (48 %) (Tzompa-Sosa et al., 2023).

Overall, these studies suggest a potential difference in attitudes, intentions, or acceptance of insect-based APF among consumers from Italy compared to consumers in Denmark or Belgium. For a summary of findings, see Fig. 2.

Spanish consumers had similar overall average levels of intention to buy hybrid products (combining meat and plant-based proteins) as consumers from the UK and Denmark (Banovic et al., 2022). Another study comparing Spanish, Danish, and UK-based consumers also analyzed hybrid products but yielded different results: a higher percentage of Spanish consumers reported an intention to buy such products than those in Denmark or the UK (Grasso et al., 2022). Concluding, there are inconsistent findings obtained for consumers from Spain and hybrid product choices, compared to consumers from other European countries. Finally, an overall similar pattern of stronger preference for plant-based APF compared to a weaker preference for insect-based APF was found among both Spanish and UK-based consumers (Gómez-Luciano et al., 2019).

3.3.4. Results for consumers from Western Europe: Germany and the UK

Regarding plant-based APF, German consumers indicated similar levels of attitudes, perceived attractiveness, and intention to buy as consumers from Romania, Finland, Iceland, and Greece (except for one indicator, intention to buy, which was lower among Danish consumers; Banovic & Sveinsdóttir, 2021) and similar intention to replace animal protein products with pulses-based APF as consumers from Denmark, Spain, and the UK (Henn et al., 2022). German consumers reported similar average levels of willingness to pay for microalgae-based proteins as French and Dutch consumers (Weinrich & Elshiewy, 2019). Across consumers from Germany, France, and the Netherlands, similar average levels were found for willingness to pay and consumer preferences towards microalgae-based APF as for animal protein replacement products (Weinrich & Elshiewy, 2019).

German consumers reported lower reluctance and higher readiness to adopt insect-based proteins than consumers from 3 Eastern European countries (Barska, 2014); they also had greater knowledge of such products and a higher willingness to buy than Polish consumers (Zabrocki, 2017). German consumers have a similar acceptance of insects as food as Dutch consumers (Naranjo-Guevara et al., 2021). However, they have less positive beliefs and product experience and a lower willingness to buy insect-based APF than consumers from Northern European countries, that is Sweden and Finland (Piha et al., 2018).

In sum, the patterns observed for German consumers indicate that, regarding plant-based APF, insect-based proteins, and microalgae-based proteins, the levels of consumers' choices indicators are similar to those observed in other Western European countries. In turn, regarding the indicators of insect-based APF, German consumers report more positive indicators of consumers' choices than those from Eastern European countries (Poland, the Czech Republic, Slovakia), but less favorable than those from Northern Europe (Sweden, Denmark, Finland).

Regarding UK-based consumers and their preferences for hybrid products, one study indicated that UK-based consumers had a similar willingness to buy as Danish consumers but lower than Spanish consumers (Grasso et al., 2022). In contrast, another study indicated an opposite pattern, with UK-based consumers reporting similar levels of willingness to buy hybrid products to levels found for Spanish consumers, but higher among UK consumers than among Danish consumers (Banovic et al., 2022).

Two studies addressing plant-based APF show similarities among UK-based consumers and Spanish, German, and Danish consumers. UK-based consumers had similar intentions to replace animal products with plant-based APFs as Spanish, German, and Danish consumers (Henn et al., 2022). A similar pattern of stronger preference for plant-based APF compared to the preference for insect-based APF was found among both Spanish and UK-based consumers (Gómez-Luciano et al., 2019).

In conclusion, research comparing UK-based consumers' choice indicators to those from other countries yielded an inconsistent pattern of findings for hybrid products. However, there were some similarities in terms of intention and preference for plant-based products when consumers from the UK were compared with Spanish, German, and Danish consumers.

3.4. Differences across regions within European countries

Four studies indicated within-country regional differences (Brandner et al., 2022; Bryant & Sanctorum, 2021; Lucas et al., 2019; Menozzi et al., 2017). The differences may be mostly explained by factors such as availability, familiarity, and ethnicity.

Consumers from Paris and western France had a higher self-reported intake of plant-based APF (seaweed) compared to those from the rest of France (Lucas et al., 2019). Western France is where more seaweed-based food is produced, hence likely to be more available, and Paris is considered fast in incorporating a variety of international food trends (Lucas et al., 2019). In Italy, consumers' intention to eat insect-based APF was weakest in the south and strongest in the central region. However, no differences between consumers from Italian regions in the actual levels of insect-based food intake were found (Menozzi et al., 2017). It may be the case that, as in France (Lucas et al., 2019), the exposure of consumers to insect-based food is more frequent in large Italian cities (e.g., Rome and Milan), in central and northern regions than in southern Italy (Lucas et al., 2019).

Higher levels of self-reported purchases of plant-based APF were found among consumers in England compared to Scotland (Brandner et al., 2022). Differences may be driven by food choices among participants with Asian or Black/Caribbean backgrounds. Specifically, consumers with Asian or Black/Caribbean backgrounds reported more frequent purchases of plant-based meat alternatives than White participants (Brandner et al., 2022). People with Asian or Black/Caribbean backgrounds were also more likely to reside in England than in Scotland.

Significant but small differences in acceptance of plant-based APF were found between consumers from regions of Belgium (higher in Flanders [49 %] compared to Walloon [46 %] or Brussels [44 %]; Bryant & Sanctorum, 2021). These differences may be explained by the higher acceptance of a meat-free diet among consumers from the Netherlands, while a less positive attitude toward a meat-free diet is found in consumers from France (Weinrich & Elshiewy, 2019). Flanders is a Dutch-speaking region of Belgium, whereas Walloon is a French-speaking region, with cultural influences of respective countries persisting in these regions of Belgium (Weinrich & Elshiewy, 2019).

3.5. Rural versus urban environment

Across 8 studies addressing this topic, 5 studies (62.5 %) indicated no difference in consumers' choices of plant-based and insect-based APF between rural and urban environments (Brandner et al., 2022; Bryant & Sanctorum, 2021; Florença et al., 2021; Henn et al., 2022; Szendrő et al., 2020). Living in urban/rural/small-town locations did not affect the level of satisfaction with plant-based meat alternatives among consumers recruited in Belgium (Bryant & Sanctorum, 2021). The willingness to replace animal products (meat, cheese, and eggs) with plant-based products (pulses) was similar among consumers from urban and

rural residences in five European countries: Denmark, Germany, Poland, Spain, and the UK (Henn et al., 2022). In Portugal, living in urban, rural, or suburban environments did not affect attitudes toward/acceptability of edible insects (Florença et al., 2021). Similarly, there were no associations between the type of residence (urban vs. rural) and acceptance or rejection of insect-based foods among consumers from Hungary (Szendrő et al., 2020). The lack of differences between urban and rural environments is in line with an absence of evidence for differences between areas of high vs. low economic deprivation. Regarding the self-reported purchase of plant-based meat alternatives, no differences in areas of high vs. low deprivation index were found in a UK-based study (Brandner et al., 2022).

On the other hand, three studies (Hoek et al., 2013; Nevalainen et al., 2023; Vartiainen et al., 2020) indicated the effect of living in an urban area on (more favorable) consumer behavior and preferences for APF. Being a plant-based meat substitute consumer (self-reported) was related to a higher level of urbanization in the Netherlands (Hoek et al., 2013). This study, however, is one of the earliest studies on plant-based meat substitutes, and the effects could have changed in the period of more than 15 years that passed between the Hoek et al. (2013) study and more contemporary research on urban vs. rural environment (Brandner et al., 2022; Bryant & Sanctorum, 2021; Florença et al., 2021; Henn et al., 2022; Szendrő et al., 2020).

Living in urban (vs. rural) areas in Finland was a significant predictor of a stronger intention to become an insect-based APF consumer in the future (Vartiainen et al., 2020). Similar findings were reported in another study conducted in Finland, indicating that consumers who tend to agree with the statement "less red meat, more plant proteins" were more likely to live in a larger city compared to those living in rural areas (Nevalainen et al., 2023). However, Finnish consumers agreeing with "No/very little meat, more plant proteins" lived mostly in the capital area of Helsinki, not in other cities in Finland (Nevalainen et al., 2023). Concluding, the majority of the recent studies (5 out of 6 published in year the 2020 or later) suggest that rural–urban differences in indicators of APF choices may not be significant.

Besides rural–urban environment differences, the differences between the cities themselves may need to be considered. Consumers from capitals or cities, where there is a larger (compared to other cities) population of inhabitants coming from countries where an acceptance of a specific type of APF is high, may report higher acceptance of a respective type of APF than consumers from other major cities (Lucas et al., 2019). This may cause a higher than average consumption of seaweed-based APF in Paris (this effect was not observed in 5 other French cities); Paris has a relatively large population of Asian-origin inhabitants who accept seaweed-based food (Lucas et al., 2019). Another city with a higher-than-average consumption was located in the region with particularly high local production of seaweed-based APF (Rennes) (Lucas et al., 2019).

3.6. Local APF products

Five studies addressed the "locality" of the production or the origin of APF and their relationships with consumers' choices (Aaslyng & Højer, 2021; Henn et al., 2022; Hoerterer et al., 2022; Lucas et al., 2019; Weinrich & Elshiewy, 2023). Three out of five studies (60 %) suggest that locality may be a relevant predictor of consumers' choices of APF (Aaslyng & Højer, 2021; Hoerterer et al., 2022; Weinrich & Elshiewy, 2019). One study provides mixed findings supporting the effect of locality defined as regional production (but not national production), and one suggests no effects of the locality of the production.

In particular, consumers from Denmark were more likely to indicate a higher intake of APF products based on peas or beans-based protein if these products were "locally" produced (Aaslyng & Højer, 2021). When questioned about their attitudes towards seaweed-based APF, German consumers indicated the importance of its local production and considered locality as one of the key characteristics of the sustainability of aquaculture (Hoerterer et al., 2022). Unfortunately, the study does not clarify if "local" means regional, national, or European production. Consumers from France, Germany, and the Netherlands indicated a preference for purchasing food from local microalgae-based meat substitutes (79 % of consumers reported such preference; Weinrich & Elshiewy, 2019).

Lucas et al. (2019) indicated that people living in area of France, where the production of seaweed-based APF is the highest in the country was associated with a higher intake of seaweed-based APF (compared to intake in cities in 5 other regions in France, except for Paris). However, when the locality was defined as "produced in France" (versus imported from another country), there was no significant effect on self-reported intake (Lucas et al., 2019).

Only one study showed no effect of APF's local origin and consumer acceptance. Among consumers from Denmark, Germany, Poland, Spain, and the UK (Henn et al., 2022), there was no effect of locality of the product on consumers' willingness to purchase plant-based (pulses) replacements of animal products (meat, cheese, and eggs). However, this study only specified that locality referred to the consumers' places of residence; the actual breadth of the "local" origin was not defined (e.g., a region in the country, the whole country, the European Union market).

4. Discussion

This review synthesizes evidence on the associations between geographical context variables and the intentions, purchase, or intake of APF. Specifically, based on data obtained from studies conducted in 8 countries (Denmark, Finland, Poland, the Czech Republic, Italy, Spain, Germany, and the UK), we elucidate evidence-based differences and similarities between consumers from Northern, Eastern, Southern, and Western Europe, as well as the effects of urban and rural environments, and locality of APF production.

The findings reveal some similarities across the studies enrolling consumers from different European countries. Notably, there is a recurring pattern of relatively low levels of intention to eat, acceptance, and intention to buy, try, or adopt insect-based APF products. Additionally, there is a moderate intention to buy hybrid products (plant-based proteins combined with meat-based proteins) and plant-based APFs. Importantly, included studies testing cross-country differences accounted for only a small number of European countries (e.g., three to five countries). Thus, there is a need for pan-European research that could address holistically cross-country differences, that can also allow for more solid conclusions. Nonetheless, our work provides a first step to understanding the role of geographical context in consumers' choices of APF.

Given the low or moderate level of intentions to buy or eat APF, it is imperative to develop and implement targeted interventions and promotion campaigns that aim to bolster consumer motivation. In line with theories of behavior change, such as the theory of planned behavior (Ajzen & Schmidt, 2020) and social cognitive theory (Luszczynska & Schwarzer, 2020), in case of weak or moderate intention to adopt a new behavior, such as buying and/or eating APF, interventions should initially focus on increasing individual's motivation. The motivational factors could include perceived health benefits, beliefs about sustainability, environmental benefits, animal welfare-related motives, self-efficacy about the ability to prepare a meal with APF, etc. (Graça et al., 2019; Onwezen et al., 2021).

4.1. European consumers' choices of APF and the country of residence

The findings indicate potential differences between European consumers depending on the country of residence. The first difference refers to indicators of insect-based APF choices, which may be lower among consumers from Italy than among countries from Northern or Western Europe (e.g., Denmark, Belgium). The relatively low willingness of Italian consumers to include whole insects in a meal may be attributed to

the relatively short presence of this type of food in the Italian market as compared to markets like Belgium or Norway (Ribeiro et al., 2022; Tzompa-Sosa et al., 2023). Food culture and eating patterns in Northern Europe might have changed in recent decades, embracing innovative approaches, whereas Italian food culture is considered one of the strongest in Europe, nurtured and promoted within the Italian food system (Verneau et al., 2016), with over 200 food products awarded Protected Designation of Origin or Protected Geographic Indication certificates, and where meat plays an important role in this local cuisine (Mancini & Antonioli, 2022). Our findings align with a previous review of the Italian market of alternative proteins conducted by Mancini and Antonioli (2022), which suggests limited readiness among Italian consumers to embrace insect-based APF.

The findings obtained for Danish consumers suggest that people residing in this Northern European country may be characterized by positive attitudes, such as viewing plant-based APF as healthier and more sustainable than meat. On the other hand, the findings addressing intention to adopt plant-based APF or hybrid products suggest that it may be relatively low among Danish consumers (however, the evidence for intention is mixed). This should be considered in the context of a high but decreasing meat intake in Denmark and a low but increasing pulse intake in Denmark since year 2018 (FAO, 2023). Overall, these results may suggest that consumers in Denmark may be undergoing a transformation in their consumption habits of plant-based APF and meat. Using the terminology applied in the transtheoretical model of behavior change (DiClemente & Prochaska, 1998), Danish consumers' attitudes toward plant-based APF align with the stages of contemplation (considering behavioral changes) and initiation (moving toward initiation of behavioral change).

In contrast, findings for consumers from Poland and the Czech Republic (Eastern European countries) indicate consumers' lower knowledge regarding innovative food products (e.g., Poland vs. Denmark) and higher reluctance to adopt novel foods (e.g., Poland vs. Germany). These patterns should be considered in the context of persistently high (vs. low) intake of meat (vs. pulses) per capita in the years between 2018 and 2020 in countries such as Poland (FAO, 2023). Referring to the terminology applied in the transtheoretical model (DiClemente & Prochaska, 1998), consumers recruited in studies conducted in Poland are positioned in the stage of precontemplation. This suggests that they are not yet considering the pros and cons of moving toward more sustainable food choices and embracing APF, indicating a potential need for targeted interventions and awareness campaigns to promote such dietary changes.

Any conclusions drawn for the countries are tentative. They are based on a limited number of studies and a small number of between-country comparisons. Research involving representative samples showing trends across all countries in the respective regions of Northern, Eastern, Southern, and Western European regions is lacking.

4.2. Rural-urban differences and locality of APF production

Recent research indicated limited rural–urban differences in APF choices of consumers from European countries. However, studies suggest potential between-cities differences (cf. Lucas et al., 2019; Nevalainen et al., 2023). These differences may not be explained by the size of the city but rather by its multicultural and cosmopolitan character compared to other locations within the country. For example, cities like Paris (France), and Helsinki (Finland), which are more ethnically diverse, tend to exhibit higher levels of consumer acceptance of APF or intentions to consume APF compared to consumers from cities with less ethnically diverse consumers (cf. Lucas et al., 2019; Nevalainen et al., 2023). Consumers from such major cities (e.g., European capitals) are also more likely to have restaurants offering alternative cuisine or introducing novel food trends, including alternative proteins (Pérez-Lloréns, 2020; Schwark et al., 2020).

Our review aligns with previous reviews addressing the effect of locality on the production of various foods (Enthoven & van den Broeck, 2021). The findings indicate that consumers are more likely to choose APF products when they are perceived as "local". It is important to note that most of the studies in our review did not specify how "local" was defined and whether it accounted for sustainable and short food chains or simply meant a product originating in the same country. Nevertheless, labeling APF products as local and promoting locally produced APF could facilitate dietary shifts among European consumers.

The findings have some important implications for policies and strategies aiming to increase APF choices. Our review provides insights into geographical variations, suggesting the use of different strategies to promote APF intake across macro-regions of Europe. For example, enhancing beliefs about APF-related benefits may be more necessary and a priority for countries in Eastern Europe than in Scandinavia. Across European consumers, intention to eat, try, and buy APFs is moderate or low-to-moderate, which points toward the importance of further interventions prompting consumers' motivational factors and environmental opportunities (such as higher availability of APFs, cf. Bianchi et al., 2018; Stiles et al., 2022).

5. Limitations

The present study has several limitations. First, the number of available studies testing cross-country differences was small. Across included research, the heterogeneity of APF types (and their sensory characteristics) was high. Differences in APF were studied in different countries which limits the comparability of the findings. The conclusions referring to differences between European macro-regions should be treated with caution, as systematic cross-regional comparisons are lacking. Another limitation is the absence of longitudinal studies, which could provide more robust insights into the process of change over time. The included research used a wide range of indicators of APF choices, from intention (to buy or to try/eat) to actual intake. Actual intake of APF was investigated rarely, which is the key limitation for any conclusions. It has to be noted that intention is only moderately associated with respective food intake (Mullan et al., 2014). Furthermore, the applied methods of the systematic review have their limitations as well. The narrative synthesis and a lack of possibility to conduct a meta-analysis to evaluate the actual effect sizes limit any conclusions.

There are many potential sources of cross-country differences in the consumers' choices indicators of APF. The difference may be due to the individual characteristics of the consumers, such as motivations, capabilities, and socioeconomic position (cf. Pfadenhauer et al., 2017). Future research should consistently control for key sociodemographic and motivational variables that have an empirically established association with consumers' choices of APF. Another source of differences may refer to the type of alternative food, which may vary in terms of taste and availability. This review discusses findings for 3 different types of alternative proteins: from animal sources (insect-based), hybrid protein products (e.g., including a 50–50 % or 75–25 % proportion of plant to meat), and non-animal APF (algae-based and legumes-based), which may need to be investigated separately (Bedsaul-Fryer et al., 2024). Comparisons accounting for the role of the protein type were not possible in this review due to a limited number of studies addressing the geographical differences in consumers' choices indicators for each of the three types of APF. Another major source of cross-country differences in the consumers' choice indicators of APF may refer to differences in the epidemiological trends in the country, economic factors (at the macro-level), as well as legal and policy solutions present in the country (cf. Pfadenhauer et al., 2017). Future analyses may need to consider an interaction between geographical factors (e.g., rural–urban environment, the type of the city) and other macro-level determinants, such as the implementation of food policies or economic macro-level factors. Finally, cross-country differences may be rooted in cross-cultural differences in collectivism and conformity (Bond & Smith, 1996). The higher collectivism and related need for conformity and social approval

may, at least partially, explain the findings obtained by Henn et al. (2022), in which Polish consumers (recruited in a more collectivistic country of higher conformity) reported higher intentions to replace various types of food with alternative proteins, than consumers from more individualistic countries (Denmark, Germany, Spain, and the UK).

6. Conclusions

This review offers new insights into the patterns of consumers' choices of APF, obtained in studies conducted in Northern, Eastern, Southern, and Western European countries. In general, the intention to eat, try, and buy APF is considered moderate or low-to-moderate. Key differences are observed in the acceptability of insect-based APF, with consumers from countries such as Denmark showing higher acceptance compared to consumers from Italy (where strong cuisine traditions of local food and meat intake may counteract the adoption of insect-based APF). Second, we present consumers from Denmark as an example of consumers in a "contemplation" stage regarding positive attitudes but relatively low intention to take up plant-based APF. Third, we present Poland's consumers as an example of consumers "in stagnation," with relatively less positive attitudes and low readiness to shift dietary patterns toward higher APF intake. Finally, positioning APF products as local may be a possible strategy to increase the likelihood of choosing APF products by European consumers.

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CRediT authorship contribution statement

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Declaration of competing interest

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Data availability

This is a systematic review of published research; no original data were collected

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2024.105174.

References

References marked with an asterisk indicate studies included in the systematic review.

*Aaslyng, M. D., & Højer, R. (2021). Introducing tempeh as a new plant-based protein food item on the Danish market. *Foods, 10*(11), 2865. https://doi.org/10.3390/foods10112865

Ajzen, I., & Schmidt, P. (2020). Changing behavior using the theory of planned behavior. In M. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (pp. 17–31). Cambridge University Press. https://doi.org/10.1017/9781108677318.

Andreani, G., Sogari, G., Marti, A., Froldi, F., Dagevos, H., & Martini, D. (2023). Plant-based meat alternatives: Technological, nutritional, environmental, market, and social challenges and opportunities. *Nutrients, 15*(2), 2. https://doi.org/10.3390/nu15020452

Arcaya, M. C., Arcaya, A. L., & Subramanian, S. V. (2015). Inequalities in health: Definitions, concepts, and theories. *Global Health Action, 8*. https://doi.org/10.3402/gha.v8.27106

Bambra, C., Smith, K. E., & Pearce, J. (2019). Scaling up: The politics of health and place. *Social Science & Medicine, 232*, 36–42. https://doi.org/10.1016/j.socscimed.2019.04.036

*Banovic, M., Barone, A. M., Asioli, D., & Grasso, S. (2022). Enabling sustainable plant-forward transition: European consumer attitudes and intention to buy hybrid products. *Food Quality and Preference, 96*, Article 104440. https://doi.org/10.1016/j.foodqual.2021.104440

*Banovic, M., & Sveinsdóttir, K. (2021). Importance of being analogue: Female attitudes towards meat analogue containing rapeseed protein. *Food Control, 123*, Article 107833. https://doi.org/10.1016/j.foodcont.2020.107833

*Barska, A. (2014). Attitudes of young consumers towards innovations on the food market. *Management, 18*(1), 419–431. https://doi.org/10.2478/manment-2014-0031

Bedsaul-Fryer, J. R., Monroy-Gomez, J., Van Zutphen-Küffer, K. G., & Kraemer, K. (2024). An introduction to traditional and novel alternative proteins for low- and middle-income countries. *Current Developments in Nutrition, 8*, Article 102014. https://doi.org/10.1016/j.cdnut.2023.102014

Bianchi, F., Garnett, E., Dorsel, C., Aveyard, P., & Jebb, S. A. (2018). Restructuring physical micro-environments to reduce the demand for meat: A systematic review and qualitative comparative analysis. *The Lancet Planetary Health, 2*(9), e384–e397. https://doi.org/10.1016/S2542-5196(18)30188-8

Biasini, B., Rosi, A., Giopp, F., Turgut, R., Scazzina, F., & Menozzi, D. (2021). Understanding, promoting and predicting sustainable diets: A systematic review. *Trends in Food Science & Technology, 111*, 191–207. https://doi.org/10.1016/j.tifs.2021.02.062

Bond, R., & Smith, P. B. (1996). Culture and conformity: A meta-analysis of studies using Asch's (1952b, 1956) line judgment task. *Psychological Bulletin, 119*(1), 111–137. https://doi.org/10.1037/0033-2909.119.1.111

Boto, I. (2013). The geography of food: Reconnecting with origin in the food system. *The Technical Centre for Agricultural and Rural Cooperation (CTA)*. https://cgspace.cgiar.org/handle/10568/76751.

*Brandner, M. M. E., Fyfe, C. L., Horgan, G. W., & Johnstone, A. M. (2022). Self-reported purchasing behaviour, sociodemographic predictors of plant-based protein purchasing and knowledge about protein in Scotland and England. *Nutrients, 14*(21), 4706. https://doi.org/10.3390/nu14214706

Brayden, W. C., Noblet, C. L., Evans, K. S., & Rickard, L. (2018). Consumer preferences for seafood attributes of wild-harvested and farm-raised products. *Aquaculture Economics & Management, 22*(3), 362–382. https://doi.org/10.1080/13657305.2018.1449270

*Bryant, C., & Sanctorum, H. (2021). Alternative proteins, evolving attitudes: Comparing consumer attitudes to plant-based and cultured meat in Belgium in two consecutive years. *Appetite, 161*, Article 105161. https://doi.org/10.1016/j.appet.2021.105161

Campbell, M., Katikireddi, S. V., Sowden, A., & Thomson, H. (2019). Lack of transparency in reporting narrative synthesis of quantitative data: A methodological assessment of systematic reviews. *Journal of Clinical Epidemiology, 105*, 1–9. https://doi.org/10.1016/j.jclinepi.2018.08.019

Deller, S. C., Lamie, D., & Stickel, M. (2017). Local foods systems and community economic development. *Community Development, 48*(5), 612–638. https://doi.org/10.1080/15575330.2017.1373136

DiClemente, C. C., & Prochaska, J. O. (1998). Toward a comprehensive, transtheoretical model of change: Stages of change and addictive behaviors. In W. R. Miller, & N. Heather (Eds.), *Treating addictive behaviors* (pp. 3–24). Plenum Press. https://doi.org/10.1007/978-1-4899-1934-2_1.

Downs, S. M., Ahmed, S., Fanzo, J., & Herforth, A. (2020). food environment typology: Advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. *Foods, 9*, 532. https://doi.org/10.3390/foods9040532

Enthoven, L., & Van den Broeck, G. (2021). Local food systems: Reviewing two decades of research. *Agricultural Systems, 193*, Article 103226. https://doi.org/10.1016/j.agsy.2021.103226

European Union (2024). European Union vocabularies. 7206 Europe. Retreived from https://op.europa.eu/en/web/eu-vocabularies/concept-scheme/-/resource?uri=http://eurovoc.europa.eu/100277.

FAO (2023). *FAOSTAT*. Retrieved August 27, 2023, from https://www.fao.org/faostat/en/#data.

*Florença, S. G., Correia, P. M. R., Costa, C. A., & Guiné, R. P. F. (2021). edible insects: Preliminary study about perceptions, attitudes, and knowledge on a sample of Portuguese citizens. *Foods, 10*(4), 709. https://doi.org/10.3390/foods10040709

Giannakis, E., & Bruggeman, A. (2020). Regional disparities in economic resilience in the European Union across the urban–rural divide. *Regional Studies, 54*(9), 1200–1213. https://doi.org/10.1080/00343404.2019.1698720

Giovannucci, D., Barham, E., & Pirog, R. (2010). Defining and marketing "local" foods: Geographical indications for US products. *The Journal of World Intellectual Property, 13*(2), 94–120. https://doi.org/10.1111/j.1747-1796.2009.00370.x

*Gómez-Luciano, C. A., de Aguiar, L. K., Vriesekoop, F., & Urbano, B. (2019). Consumers' willingness to purchase three alternatives to meat proteins in the United Kingdom, Spain, Brazil and the Dominican Republic. *Food Quality and Preference, 78*, Article 103732. https://doi.org/10.1016/j.foodqual.2019.103732

Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology, 91*, 380–390. https://doi.org/10.1016/j.tifs.2019.07.046

*Grasso, S., Asioli, D., & Smith, R. (2022). Consumer co-creation of hybrid meat products: A cross-country European survey. *Food Quality and Preference, 100*, Article 104586. https://doi.org/10.1016/j.foodqual.2022.104586

Grossmann, L., & Weiss, J. (2021). alternative protein sources as technofunctional food ingredients. *Annual Review of Food Science and Technology, 12*, 93–117. https://doi.org/10.1146/annurev-food-062520-093642

*Henn, K., Bøye Olsen, S., Goddyn, H., & Bredie, W. L. P. (2022). Willingness to replace animal-based products with pulses among consumers in different European countries. *Food Research International, 157*, Article 111403. https://doi.org/10.1016/j.foodres.2022.111403

Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2022). *Cochrane handbook for systematic reviews of interventions (version 6.3)*. Cochrane. www.training.cochrane.org/handbook.

*Hoek, A. C., Elzerman, J. E., Hageman, R., Kok, F. J., Luning, P. A., & de Graaf, C. (2013). Are meat substitutes liked better over time? A repeated in-home use test with meat substitutes or meat in meals. *Food Quality and Preference, 28*(1), 253–263. https://doi.org/10.1016/j.foodqual.2012.07.002

*Hoerterer, C., Petereit, J., & Krause, G. (2022). Informed choice: The role of knowledge in the willingness to consume aquaculture products of different groups in Germany. *Aquaculture, 556*, Article 738319. https://doi.org/10.1016/j.aquaculture.2022.738319

Kim, T. K., Yong, H. I., Kim, Y. B., Kim, H. W., & Choi, Y. S. (2019). edible insects as a protein source: A review of public perception, processing technology, and research trends. *Food Science of Animal Resources, 39*(4), 521–540. https://doi.org/10.5851/kosfa.2019.e53

Kneafsey, M., Venn, L., Schmutz, U., Balasz, B., Trenchard, L., Eyden-Wood, T., Bos, E., Sutton, G., & Blackett, M. (2013). *Short food supply chains and local food systems in the EU. A state of play of their socio-economic characteristics*. Publications Office of the European Union. https://data.europa.eu/doi/10.2791/88784.

*Lucas, S., Gouin, S., & Lesueur, M. (2019). Seaweed consumption and label preferences in France. *Marine Resource Economics, 34*(2), 143–162. https://doi.org/10.1086/704078

Luszczynska, A., & Schwarzer, R. (2020). Changing behavior using social cognitive theory. In M. Hagger, L. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The Handbook of behavior change* (pp. 32–45). Cambridge University Press. https://doi.org/10.1017/9781108677318.

Mancini, M. C., & Antonioli, F. (2022). Italian consumers standing at the crossroads of alternative protein sources: Cultivated meat, insect-based and novel plant-based foods. *Meat Science, 193*, Article 108942. https://doi.org/10.1016/j.meatsci.2022.108942

Mancini, S., Moruzzo, R., Riccioli, F., & Paci, G. (2019). European consumers' readiness to adopt insects as food. A review. *Food Research International, 122*, 661–678. https://doi.org/10.1016/j.foodres.2019.01.041

*Menozzi, D., Sogari, G., Veneziani, M., Simoni, E., & Mora, C. (2017). Eating novel foods: An application of the theory of planned behaviour to predict the consumption of an insect-based product. *Food Quality and Preference, 59*, 27–34. https://doi.org/10.1016/j.foodqual.2017.02.001

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Lisy, K., Qureshi, R., Mattis, P., & Mu P. (2020). Systematic reviews of etiology and risk. In E. Aromataris, & Z. Munn (Eds.), *JBI Manual for Evidence Synthesis*. JBI. https://doi.org/10.46658/JBIMES-20-08.

Mullan, B., Allom, V., Brogan, A., Kothe, E., & Todd, J. (2014). Self-regulation and the intention behaviour gap. Exploring dietary behaviours in university students. *Appetite, 73*, 7–14. https://doi.org/10.1016/j.appet.2013.10.010

*Naranjo-Guevara, N., Fanter, M., Conconi, A. M., & Floto-Stammen, S. (2021). Consumer acceptance among Dutch and German students of insects in feed and food. *Food Science & Nutrition, 9*(1), 414–428. https://doi.org/10.1002/fsn3.2006

*Nevalainen, E., Niva, M., & Vainio, A. (2023). A transition towards plant-based diets on its way? Consumers' substitutions of meat in their diets in Finland. *Food Quality and Preference, 104*, Article 104754. https://doi.org/10.1016/j.foodqual.2022.104754

Nguyen, J., Ferraro, C., Sands, S., & Luxton, S. (2022). Alternative protein consumption: A systematic review and future research directions. *International Journal of Consumer Studies, 46*(5), 1691–1717. https://doi.org/10.1111/ijcs.12797.

Onwezen, M. C., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite, 159*, Article 105058. https://doi.org/10.1016/j.appet.2020.105058

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *The British Medical Journal, 372*, Article n71. https://doi.org/10.1136/bmj.n71

Pérez-Lloréns, J. L. (2020). Microalgae: From staple foodstuff to avant-garde cuisine. *International Journal of Gastronomy and Food Science, 21*, Article 100221. https://doi.org/10.1016/j.ijgfs.2020.100221

Pfadenhauer, L. M., Gerhardus, A., Mozygemba, K., Lysdahl, K. B., Booth, A., Hofmann, B., Wahlster, P., Polus, S., Burns, J., Brereton, L., & Rehfuess, E. (2017). Making sense of complexity in context and implementation: The context and implementation of complex interventions (CICI) framework. *Implementation Science, 12*(1), 21. https://doi.org/10.1186/s13012-017-0552-5

*Piha, S., Pohjanheimo, T., Lähteenmäki-Uutela, A., Křečková, Z., & Otterbring, T. (2018). The effects of consumer knowledge on the willingness to buy insect food: An exploratory cross-regional study in Northern and Central Europe. *Food Quality and Preference, 70*, 1–10. https://doi.org/10.1016/j.foodqual.2016.12.006

Pinho, M. G. M., Mackenbach, J. D., den Braver, N. R., Beulens, J. J. W., Brug, J., & Lakerveld, J. (2020). Recent changes in the Dutch foodscape: Socio-economic and urban-rural differences. *International Journal of Behavioral Nutrition and Physical Activity, 17*(1), 43. https://doi.org/10.1186/s12966-020-00944-5

Pippinato, L., Gasco, L., Di Vita, G., & Mancuso, T. (2020). Current scenario in the European edible-insect industry: A preliminary study. *Journal of Insects as Food and Feed, 6*(4), 371–381. https://doi.org/10.3920/JIFF2020.0008

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). *Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC Methods Programme*. https://doi.org/10.13140/2.1.1018.4643.

Porretta, S., Gere, A., Radványi, D., & Moskowitz, H. (2019). Mind Genomics (Conjoint Analysis): The new concept research in the analysis of consumer behaviour and choice. *Trends in Food Science & Technology, 84*, 29–33. https://doi.org/10.1016/j.tifs.2018.01.004

Pucci, T., Casprini, E., Sogari, G., & Zanni, L. (2021). Exploring the attitude towards the adoption of a sustainable diet: A cross-country comparison. *British Food Journal, 124*(13), 290–304. https://doi.org/10.1108/BFJ-04-2021-0426

*Ribeiro, J. C., Gonçalves, A. T. S., Moura, A. P., Varela, P., & Cunha, L. M. (2022). Insects as food and feed in Portugal and Norway – Cross-cultural comparison of determinants of acceptance. *Food Quality and Preference, 102*, Article 104650. https://doi.org/10.1016/j.foodqual.2022.104650

Schwark, N., Tiberius, V., & Fabro, M. (2020). How will we dine? Prospective shifts in international haute cuisine and innovation beyond kitchen and plate. *Foods, 9*(10), 1369. https://doi.org/10.3390/foods9101369

Siddiqui, S. A., Bahmid, N. A., Mahmud, C. M. M., Boukid, F., Lamri, M., & Gagaoua, M. (2022). Consumer acceptability of plant-, seaweed-, and insect-based foods as alternatives to meat: A critical compilation of a decade of research. *Critical Reviews in Food Science and Nutrition, 1–22*. https://doi.org/10.1080/10408398.2022.2036096

Stiles, G., Collins, J., & Beck, K. L. (2022). effectiveness of strategies to decrease animal-sourced protein and/or increase plant-sourced protein in foodservice settings: A systematic literature review. *Journal of the Academy of Nutrition and Dietetics, 122*(5), 1013–1048. https://doi.org/10.1016/j.jand.2021.12.010

*Szendrő, K., Tóth, K., & Nagy, M. Z. (2020). Opinions on insect consumption in Hungary. *Foods, 9*(12), 1829. https://doi.org/10.3390/foods9121829

*Tzompa-Sosa, D. A., Sogari, G., Copelotti, E., Andreani, G., Schouteten, J. J., Moruzzo, R., Liu, A., Li, J., & Mancini, S. (2023). What motivates consumers to accept whole and processed mealworms in their diets? A five-country study. *Future Foods, 7*, Article 100225. https://doi.org/10.1016/j.fufo.2023.100225

Vandecandelaere, É., Arfini, F., Belletti, G., Marescotti, A., Allaire, G., Cadilhon, J. J., Casabianca, F., Damary, P., Estève, M., Hilmi, M., Jull, C., Coent, A. L., Lecourtois, E., Mounsey, J. P., Perret, A. O., Sautier, D., Tartanac, F., Thévenod-Mottet, E., & Wallet, F. (2009). *Linking people, places and products*. Food and Agriculture Organization of the United Nations (FAO) and SINER-GI. https://www.fao.org/3/i1760e/i1760e.pdf.

*Vartiainen, O., Elorinne, A.-L., Niva, M., & Väisänen, P. (2020). Finnish consumers' intentions to consume insect-based foods. *Journal of Insects as Food and Feed, 6*(3), 261–272. https://doi.org/10.3920/JIFF2019.0042

*Verneau, F., La Barbera, F., Amato, M., Riverso, R., & Grunert, K. G. (2020). assessing the role of food related lifestyle in predicting intention towards edible insects. *Insects, 11*(10), 660. https://doi.org/10.3390/insects11100660

*Verneau, F., La Barbera, F., Kolle, S., Amato, M., Del Giudice, T., & Grunert, K. (2016). The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy. *Appetite, 106*, 30–36. https://doi.org/10.1016/j.appet.2016.02.006

*Weinrich, R., & Elshiewy, O. (2019). Preference and willingness to pay for meat substitutes based on micro-algae. *Appetite, 142*, Article 104353. https://doi.org/10.1016/j.appet.2019.104353

*Weinrich, R., & Elshiewy, O. (2023). A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption. *Algal Research, 70*, Article 102999. https://doi.org/10.1016/j.algal.2023.102999

*Zabrocki, R. (2017). A comparative analysis of the determinants of behaviours of polish and german consumers aged 55+ in the innovative food market. *Handel Wewnętrzny, 1*(366), 413–423.

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Mapping determinants of alternative protein food intake across 13 European countries: food system stakeholders' perspectives

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Abstract

Background Using the system mapping approach, this study aimed to map the system of potential determinants of including alternative protein food (APF) into the daily diet across 13 European countries. We also aimed to identify key leverage points in the systems, which are determinants that are most interconnected with other determinants in the system. Similarities in leverage points and feedback loops found across the system maps were investigated.

Methods Food system stakeholders ($N = 166$; including food producers, food processors, policy makers, nutritionists, consumers, etc.) participated in 17 system mapping workshops, conducted in Austria, the Czech Republic, Denmark, France, Germany, Greece, Italy, Norway, Portugal, Slovenia, Spain, Turkey, and Poland. Group model building methods were applied to develop 17 maps. Centrality indices were calculated, feedback loops were identified, and similarities between countries were explored.

Results Key leverage points that were common across 6–8 maps included: consumer education and knowledge about APF, social norms, encouragement, advertising and influencers' impact. Other common identified leverage points (present in 3–4 maps) were: health-related perceptions, curiosity/fear of novelty, national food culture, perceptions of ultra-processing, sustainability issues, and animal welfare issues. Overall, stakeholders emphasized consumers as central actors in the food system. Feedback loops identified in the study, revealed some common within-country pathways. For example, half of the feedback loops shown in the Italian maps included a potentially reinforcing upward spiral. Stakeholders perceived that higher APF product safety may facilitate advertising APF (e.g., as healthy), which in turn could increase consumers' curiosity and/or beliefs that APF is healthy and sustainable. This was perceived as facilitating local development and job creation, food prices reduction, and further developments in food safety.

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Conclusions The findings offer new insights into the complexities of European food systems and may contribute to the broader uptake of APF. Identifying leverage points and feedback loops may inspire food system stakeholders to design novel interventions. For example, these interventions could involve influencers to familiarize consumers with APF, promote knowledge about healthiness and safety of APF, as well as link APF consumption with positive emotions and social approval.

Keywords Alternative protein food, Stakeholder, System mapping

Background

Across European countries, animal products, such as eggs, dairy, and meat, are the most common, traditional protein choices [1]. However, nutritional choices based on these traditional proteins are not sustainable, as they are the main drivers of environmental degradation, ecosystem destruction, and climate change [1]. For example, compared to animal-based proteins, production of plant proteins is sustainable due to lower water consumption, lower fossil energy use, and lower waste generation, whereas microorganism-based protein production utilizes minimal resources and offers a method for reducing agricultural and industrial waste [2]. *Alternative protein food (APF)* products include protein concentrates obtained from processing plants (e.g., fava beans), as well as insects, krill, microbial biomass, and fungi [3]. Furthermore, the term "alternative" may refer to sources of proteins with a lower environmental impact compared to traditional protein sources [3]. Thus, APF may currently exclude cultured meat due to its high energy-demanding production [3, 4].

As evidence of sustainability-related benefits of APF continues to accumulate, research should also aim to identify the determinants of APF choice. These determinants should be perceived by stakeholders as important "leverage points"—that is, determinants which, if modified, may trigger substantial changes across the system of determinants, because they are highly interconnected with other operating factors within the complex food system. Since it remains unknown how food system stakeholders perceive the system of APF determinants, this study aims to explore this issue. Understanding stakeholders' perspectives is crucial, as it allows the content of APF-promoting interventions to be aligned with stakeholders' views, thereby securing their approval and support for the implementation of such actions.

Changes in consumers' nutrition behaviors, such as selecting more sustainable types of proteins, may shape the actions of other food system stakeholders and, thus, open pathways toward sustainable food systems [1, 5, 6]. Although previous research on stakeholders transforming European food systems into more sustainable ones indicates that food producers are considered the most important stakeholders [7], recent studies observe a power shift toward consumer influence on the food system. Consequently, there is an increased interest in research on determinants of consumer actions [7]. Furthermore, according to the *complex system approach models applied to food systems* (cf. [8–12]), a change initiated by one type of system actor (e.g., consumers) may cause changes reverberating throughout the system, mobilizing responses from other actors. One open question is how various food system stakeholders (e.g., food producers, food processors, nutrition specialists, etc.) perceive the key determinants that potentially enable consumers to choose alternative protein food.

According to socio-ecological models of human behavior [13–15], determinants of nutrition behaviors can be combined into broader categories of: (i) individual-level characteristics (e.g., beliefs, emotions); (ii) meso-level factors encompassing characteristics of family, local community, and workplace; and (iii) macro-level factors referring to characteristics of broader environment (e.g., national policies). Research on sustainable food choices, including APF, provides tentative support for socio-ecological models. A systematic review by Hoek et al. [16] on sustainable nutrition choices indicates that important types of determinants include individual-level factors such as "beliefs" and "attitudes," as well as socioeconomic characteristics, taste, convenience, and familiarity. Environmental determinants include the availability of APF in local shops, social norms shared by family and friends, and family preferences, geographical characteristics (such as urbanization) and information in the environment (including advertising) [16]. Finally, macro-environmental factors may include national dietary guidelines and public policies [16]. Other systematic reviews have used the socio-ecological model to provide lists of specific individual-level determinants of APF intake such as neophobia, perceived environmental benefits or perceived health risks [17–19]. Unfortunately, it remains unclear which of these determinants of APF choices may be the most relevant.

Socio-ecological models and the research that uses them to map the determinants of APF choices lack specific predictions about how these determinants may be interconnected. However, closer analysis of these models suggests that they are aligned with a complex system perspective, assuming multi-level interdependent determinants. In particular, *complex systems thinking* considers interdependent relationships between determinants of behavior and views a problem as a dynamic,

interdependent, and ongoing process [20, 21]. A change in one element is assumed to affect other parts of the system. Furthermore, these connections form feedback loops, which are non-linear associations that can lead to the growth or decline of a respective action (i.e., reinforcing loops), or they can have a stabilizing effect and may result in the system maintaining its status quo [20, 21]. System thinking is used to identify a set of determinants and their connections in the context of a specific target behavior. In other words, a set of determinants and their connections are specific to the target behavior such as the intake of APF [22].

Applying a complex system lens, this study aims to better understand how different factors within the food system are connected and how they influence people's decisions to include alternative protein food in their daily diets. In particular, advancement of prior research on determinants of APF consumption [16–19] may be achieved through the use of the *system mapping approach*, which represents an innovative participatory action research process to advance theory development and sets the targets for public health interventions [23]. To date, system mapping has been used to explain the determinants of food sector development and food acceptability or availability in the context of energy-dense and ultra-processed foods, cocoa, and traditional proteins [24, 25]. However, maps of the system of determinants of sustainable food uptake, such as APF, are lacking.

A system mapping approach allows to connect stakeholder-identified determinants by showing how they intersect within a food system, while accounting for their interdependence. System mapping uses a participatory approach, which involves a group of stakeholders exploring how a system works using a structured, step-by-step process to create a map of proposed causal-loop diagrams of a complex system. Subsequently, these system maps help to inform responses to an investigated issue [26].

System maps allow for the identification of so-called leverage points - determinants that are most likely to trigger a change in the whole system [27, 28]. When altered, these leverage points have ripple effects throughout the system and can therefore evoke substantial changes [27]. The leverage points may be the main target of interventions, promoting higher uptake of APF by consumers.

Study aims

The study aimed at mapping the system of determinants of an individual's nutrition behavior, including the incorporation of APF into daily diets, and exploring the associations between these determinants. First, we focused on discovering the types of determinants that constitute common leverage points – identified across more than one country. Specifically, we aimed to identify determinants from the perspective of the major food system stakeholders, including food producers, food processors, retailers, health and education professionals, policymakers, and consumers. Second, the study investigated the interconnections between these determinants. Specifically, we aimed to find the common sequences of determinants that occur in the feedback loops proposed by the stakeholders.

We mapped the determinants and their relationships across 13 countries representing all major European regions: Austria, the Czech Republic, Denmark, France, Germany, Greece, Italy, Norway, Poland, Portugal, Slovenia, Spain, and Turkey.

Methods

Materials and general procedures

The *community-based system dynamics* (CBSD) [20] approach was applied as the overarching model, guiding the study design and procedures. This approach actively engages stakeholders in addressing the challenge at hand, positioning them as "experts" on how the system works before identifying potential actions that could be taken to improve the food system [20]. One of the structured formats used in CBSD is Group Model Building [29]. Group Model Building employs system mapping to create *causal loop diagrams* (CLDs), which provide a graphic representation of the complexity of a problem's drivers (or determinants), from the food system stakeholders' perspective [29, 30]. GMB guides stakeholders to collectively map their perceived drivers of a complex issue [20, 26] and encompasses a group's collective ideas in a CLD (a system map). When developed using the CBSD model, these system maps are part of an iterative consensus process of examining a dynamic hypothesis to identify and revise postulated causal links [29, 30].

Group model building workshops

Seventeen workshops were conducted to develop 17 system maps, with one workshop held in each of the following 12 countries: Austria, the Czech Republic, Denmark, France, Germany, Greece, Italy, Norway, Portugal, Slovenia, Spain, and Turkey. Five workshops were held in Poland. The study was approved by the Ethics Committee at SWPS University in Wroclaw, Poland (approval no. 01/E/03/2023). Additional approval was obtained in Norway in accordance with the MOREFORSKING institutional guidelines (approval no. 301103, SIKT).

Workshop material development and facilitator training

The research team (ZS, EK, AL) developed a step-by-step workshop manual for use by the workshop facilitators (see Additional File 1). The manual explained the roles of facilitators, provided general rules of engagement,

followed the principles of participatory research, specified the overall research questions, clarified the order and the timeline of the workshop preparations, and provided step-by-step instructions on how to conduct the workshop. Two facilitators – representing local non-governmental organizations – were selected by the local collaborating teams to lead the workshops in each of 13 countries. The facilitators participated in a one-day training session and received a recording of the workshop.

Participant recruitment and pre-workshop information

The local teams recruited stakeholders of the food system, representatives of food producers and processors, policymakers, consumers, healthcare and education professionals working in the context of healthy diet promotion, representatives of NGOs operating in the food system, etc. At least two types of key food system stakeholders were recruited in each country. Another guiding rule was to ensure a balanced participation to avoid the dominance of one type of stakeholder over another type (e.g., avoiding one policymaker facing ten representatives of food producers).

The invitation was sent via email or delivered in person. It included standardized information about the LIKE-A-PRO project (https://cordis.europa.eu/project/id/101083961), information about the workshop content, procedures, dates, times, and location, as well as informed consent forms.

Two weeks prior to the workshop, participants who agreed to take part received a set of preparatory materials (see Additional File 1) and were asked to reflect critically on the information provided. The preparatory materials included: (i) definitions and examples of APF; (ii) definitions of system mapping and food systems; (iii) a framework used to categorize potential determinants of APF consumption; and (iv) an evidence-based list of examples of factors influencing consumers' APF choices. Participants were instructed to review the content critically and consider which determinants may be the most important based on their own knowledge and professional experience. Similar pre-workshop strategies—designed to ensure a shared vocabulary and consistent access to evidence-based information among participants—have been used in previous system mapping studies [22, 29].

Workshop conduct

The workshops took place from October to December 2023. Across 13 countries, the same workshop procedures (see Additional File 2) were followed. Sociodemographic data were collected in a post-workshop anonymous online survey. The post-workshop survey also included additional questions, addressing other aims of the study. Four workshops were organized in-person, one used a mixed delivery format combining online participation and in-person attendance, and the remaining 12 workshops were conducted using online teleconferencing.

The standardized workshop procedures involved four stages: (i) identifying the key determinants and defining them, as well as reaching consensus regarding the list of included determinants of APF intake; (ii) identifying the causal links between the determinants (A facilitates B) and reaching the consensus regarding the causal links; (iii) transforming the list of determinants and connections into an initial version of a system map, representing the consensus views of the group resulting from the discussion; (iv) reviewing the system map and refining the connections (e.g., adding any missing connections) by the stakeholders; and (v) a group consensus process and approval of the final system map. As the organizing principle, the intake of APF was not included in the system map, assuming that all determinants are connected to this variable [22, 29]. The support team was organized to ensure that any technical or organizational problems were resolved. For details see the workshop manual (Additional File 1).

STICKE 3.0 software (System Thinking in Community Knowledge Exchange; [31]), developed to facilitate workshop-based visualizations of system maps and conduct network analysis, was applied to draw the maps. This software was applied in previous stakeholder research in the context of nutrition, obesity, and other public health issues [29, 30].

Participant characteristics

Altogether, 166 stakeholders took part in the workshops (for descriptive information see Table 1). Participants represented various food system stakeholders, including the food processing industry (22.7%), the scientific research sector (16.0%), the healthcare sector (12.7%, particularly clinical nutrition), food industry companies engaged in both production, technology development and food research (12.0%), young consumers aged 18–19 (8.7%), the food ingredients industry (6.7%), industrial agriculture and aquaculture (6.0%), retail and catering (5.2%), non-governmental organizations supporting consumer rights (3.3%), governmental agencies (3.3%, such as food industry regulators, commerce chambers, and consumer rights protection organizations), marketing (2.0%), and other sectors (1.4%). In each country, the workshops included representatives from at least three different sectors, except in Italy, where only food production sector stakeholders participated, and in Poland, where only young consumers participated in two workshops.

Table 1 Characteristics of workshops' participants in 13 countries

Country	*N*	*N* of participants who provided their data (% of original *N*)	Gender	Distribution of age (in years)	Years of work experience[a]
All countries	166	150 (and 93%)	39 M (26%); 111 F (74%).	18–25–13% 25–35–32% 36–45–27% 46–65–26% > 65–3%.	1–5–31% 6–15–31% ≥ 16–29% not provided – 9%
Austria	11	11 (100%)	5 M (45.4%); 6 F (54.5%)	26–35–27% 36–45–36% 46–55–36%	1–5–9% 6–10–9% 11–15–27% 16–20–45% > 20–9%
the Czech Republic	12	7 (58.3%)	1 M (14.2%); 6 F (85.7%)	18–25–14% 26–35–28% 36–45–28% 46–55–14% 56–65–14%	< 1–42% 1–5–14% 11–15–14% 16–20–14% > 20–14%
Denmark	13	6 (46.2%)	3 M (50.0%); 3 F (50.0%)	26–35–16% 36–45–33% 56–65–16% > 65–33%	1–5–33% 6–10–33% 11–15–16% > 20–16%
France	16	16 (100%)	16 F (100%)	18–25–6% 26–35–12% 36–45–50% 46–55–6% 56–65–25%	1–5–25% 6–10–12% 11–15–6% 16–20–25% > 20–31%
Germany	8	6 (75.0%)	2 M (33.3%); 4 F (66.6%)	18–25–16% 26–35–50% 36–45–33%	1–5–66% 6–10–16% 16–20–16%
Greece	10	10 (100%)	4 M (40.0%); 6 F (60.0%)	26–35–40% 36–45–20% 46–55–10% 56–65–30%	1–5–40% 6–10–10% 16–20–20% > 20–30%
Italy	13	13 (100%)	5 M (38.4%); 8 F (61.5%)	26–35–30% 36–45–38% 46–55–15% 56–65–7% > 65–7%	
Norway	9	9 (100%)	3 M (33.3%); 6 F (66.6%)	26–35–44% 36–45–22% 46–55–22% > 65–11%	< 1–11% 1–5–22% 6–10–33% > 20–33%
Poland	38	37 (97.3%)	5 M (13.5%); 32 F (86.4%)	18–25–43% 26–35–32% 36–45–13% 46–55–10%	< 1–21% 1–5–29% 6–10–21% 11–15–24% > 20–2%
Portugal	11	10 (90.9%)	2 M (20.0%); 8 F (80.-%)	36–45–20% 46–55–50% 56–65–30%	1–5–10% 11–15–10% 16–20–20% > 20–60%
Slovenia	7	7 (100%)	2 M (28.5%); 5 F (71.5%)	26–35–28% 36–45–57% 46–55–14%	1–5–42% 11–15–28% > 20–28%

Table 1 (continued)

Country	*N*	*N* of participants who provided their data (% of original *N*)	Gender	Distribution of age (in years)	Years of work experience[a]
Spain	10	10 (100%)	5 M (50.0%); 5 F (50.0%)	26–35–60% 36–45–10% 46–55–20% 56–65–10%	1–5 -60% 6–10–10% 11–15–10% > 20–20%
Turkey	8	8 (100%)	2 M (25.0%); 6 F (75.0%)	26–35–50% 36–45–25% 46–55–25%	1–5–25% 6–10–37% 11–15–37%

17 workshops were conducted, including 5 in Poland and 12 in each of the 12 remaining countries

F female gender, *M* male gender

a – the distribution excluding young consumers (18–19 years old; all students, not employed) participating in 1st and 2nd workshops conducted in Poland

Data analysis: identifying common leverage points across 17 system maps

In the first step, the analysis aimed to identify leverage points, which are defined as system determinants that exhibit high structural influence and, therefore, have a high potential for future intervention. Network analysis, conducted with STICKE 3.0 software, was used to calculate values of four types of centrality indicators: (i) *eigenvector*, with high values representing the leverage points in the system; (ii) *degree*, with high-degree elements indicating the system elements that are sensitive to change; (iii) *closeness*, with high values representing resilient elements; and (iv) *betweenness*, with high values representing bottlenecks/gateways into the system [28]. The analysis focused on identifying the leverage points, that is determinants which are characterized by high eigenvector values [27, 28], accompanied by high values of closeness and betweenness (for similar approach see [22, 28]). Next, the leverage points (determinants with the highest values of eigenvector, but also high values of betweenness and closeness) were grouped into broader categories, representing higher-level shared characteristics.

Analysis of feedback loops in system maps

In the second step, feedback loops were identified using KUMU software [32]. Specifically, we focused on identifying loops that included at least one leverage point and its associations with other determinants in the system. After the initial identification of all feedback loops, two approaches were taken: (i) summarizing all feedback loops in maps with < 50 loops and (ii) a reduction procedure applied in case of ≥ 50 loops. The reduction procedure aimed at decreasing the number of loops by extracting all loops that involved the ten variables with the highest values of centrality indicators (eigenvector, closeness, and betweenness), and by removing the variables with centrality indicator values lower than the ten highest values for any of the centrality indicators. This strategy resulted in obtaining feedback loops that provided information on how the leverage points, identified in each country, are linked with other determinants in the system map. Common patterns in the feedback loops were identified.

Results

Descriptive results

The $k = 17$ maps of food system determinants of consumers' APF choices (see Additional file 2) included 10–34 variables (total $N = 336$ determinants; $M = 19.76$; Austria = 12 determinants; the Czech Republic = 10; Denmark = 23; France = 23; Germany = 19; Greece = 17; Italy = 14; Norway = 34; Poland, first workshop = 23; Poland, second workshop = 17; Poland, third workshop = 26; Poland, fourth workshop = 20; Poland, fifth workshop = 17; Portugal = 21; Slovenia = 23; Spain = 23; Turkey = 14). Table S1 in Additional File 2 provides a complete list of determinants, their definitions, and system map. Examples of maps developed in Northern Europe (Norway), Southern Europe (Greece), Eastern Europe (Poland 2), and Western Europe (France) are presented in Figs. 1-4, respectively.

Common leverage points identified across system maps

The determinants that were identified as leverage points are reported in Table 2 (for more details see Additional file 2 in Table S2). Each of the $k = 17$ maps included a unique set of determinants. However, several broader categories of leverage points were common across ≥ 3 system maps.

Consumers' knowledge and educating consumers about alternative protein food as leverage points

Stakeholders suggested that various aspects of knowledge about APF may influence its intake. In general, knowledge can be categorized as conceptual, procedural, and experiential [33, 34]. Conceptual knowledge refers to cognitive understanding of a product and its effects [34]. In the case of APF, it includes the ability to correctly identify APF, understand its nutritional value, and recognize the health consequences of consuming it, consistent

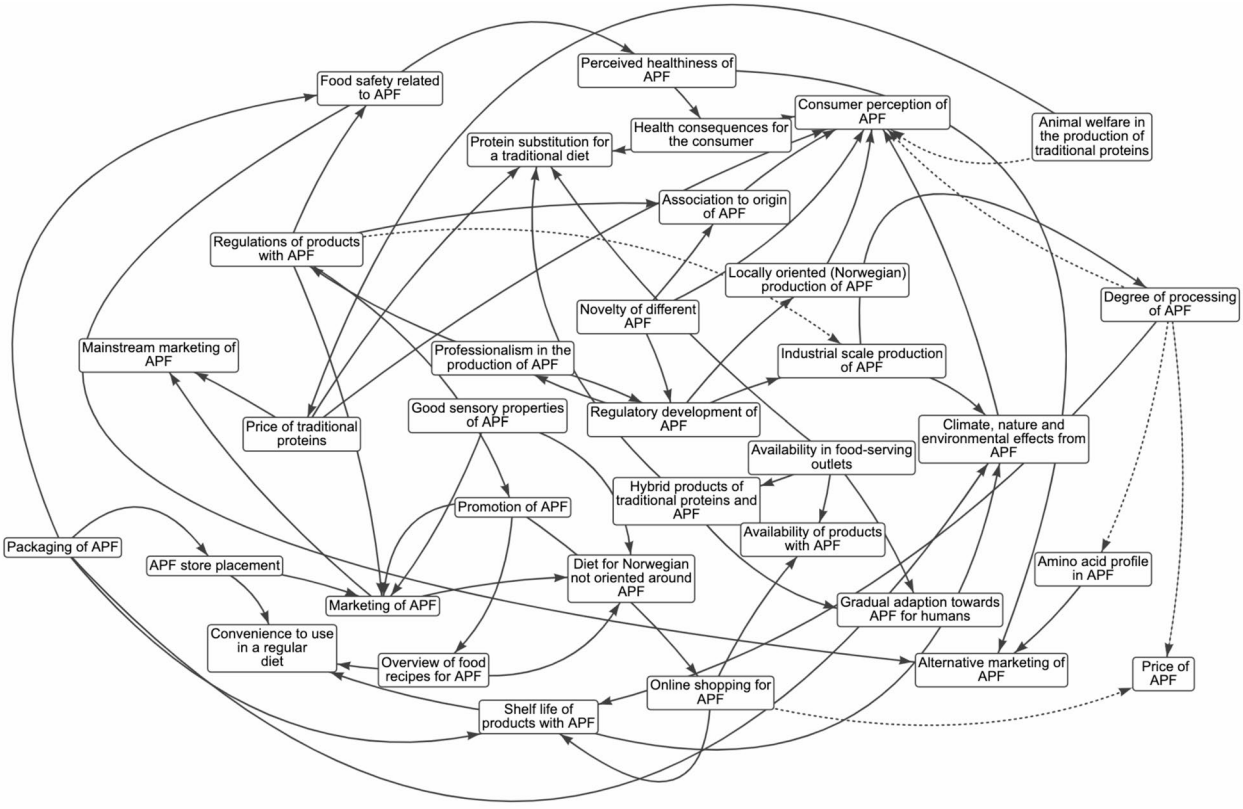

Fig. 1 The system map of determinants of alternative protein food intake: the mapping workshop in Norway
Note. Solid lines represent the positive edge; Dotted lines represent the negative edge. APF = alternative protein food. Definitions of determinants identified during system mapping workshops: Overview of food recipes for APF = recipes and tutorials on how to prepare APF meals; Association to origin of APF = implicit associations about the source of APF (e.g., insect powder -> unpleasant insects); Good sensory properties of APF = taste, smell and texture; Availability in food-serving outlets = availability of APF in food serving locations (e.g., restaurants); Alternative marketing of APF = tailoring marketing of APF for specific groups e.g., athletes; Regulatory development of APF = regular updates of APF product regulations

with existing scientific evidence. Procedural knowledge, a subtype of conceptual knowledge, relates to the methods of using a product [34]. For example it refers to knowing how to cook or prepare a meal with APF. Experiential knowledge, in contrast, pertains to personal experience with a product, including its attributes or the consequences of its consumption [33]. This type of knowledge may encompass sensory memories, such as the smell or taste of a specific APF product that an individual has recently tried.

Determinants from the category referring to conceptual or experiential knowledge and educating the consumers were identified in $k = 8$ system maps: Denmark, France, Germany, Greece, 3x Poland, and Portugal (see Table 2 and Additional file 2). The definitions of these determinants indicate that stakeholders referred to limited APF literacy, low knowledge of how to prepare/cook APF, and low dissemination of knowledge about APF.

Familiarity with the product, which encompasses knowledge defined as personal experience with the attributes of a specific food, was also indicated on the maps developed in Germany and Greece. Knowledge of how to cook or prepare APF (e.g., as indicated in the Danish map), may be a determinant that encompasses both formal and experiential knowledge of APF. Actions aiming at dissemination of knowledge by means of education policies were identified as leverage points in two system maps in Poland.

Social encouragement and social norms as leverage points

This category includes determinants related to the approval of APF by important others (e.g., family, friends, admired models), beliefs that APF choices are important to family/friends, as well as perceptions of APF as popular and "trendy" among important others. These determinants were found in $k = 7$ system maps (Denmark, France, Germany, 3 x Poland, Portugal) (see Table 2 and Additional file 2). Beliefs about family habits were indicated in France and Denmark; social norms – in Germany; trends, defined as the popularity of trying APF among important others, were identified in the map developed in Portugal. Social encouragement to choose APF or perceiving eating APF as a social norm (a behavior popular among

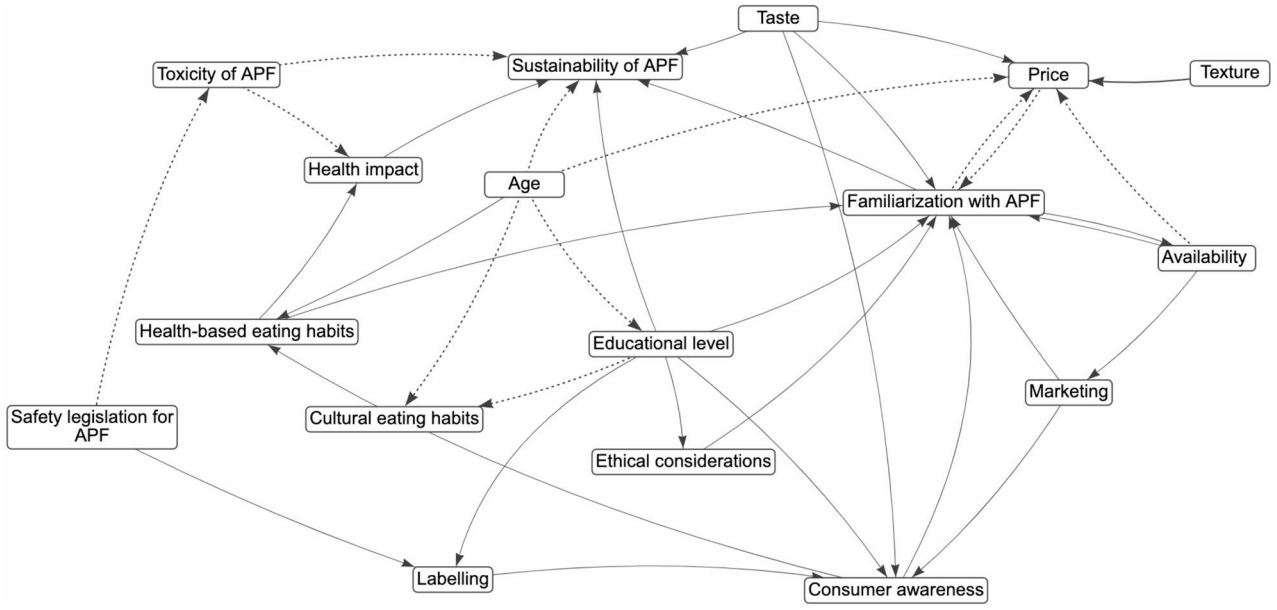

Fig. 2 The system map of determinants of alternative protein food intake: the mapping workshop in Greece
Note. Solid lines represent the positive edge; Dotted lines represent the negative edge. APF = alternative protein food; Ethical considerations = ethical considerations for animal welfare and environmental protection; Marketing = visibility of product promotions/attempts to overcome stereotypes; Familiarization with APF = the level of familiarity with APF products, in the context of cultural background; Sustainability of APF = the level of sustainability of the final APF product; Consumer awareness = consumers' awareness of sustainability and health effects of APF; Health-based eating habits = eating restrictions that can limit individual's food choices; Educational level = education about food; Labelling = information about sustainability on the label

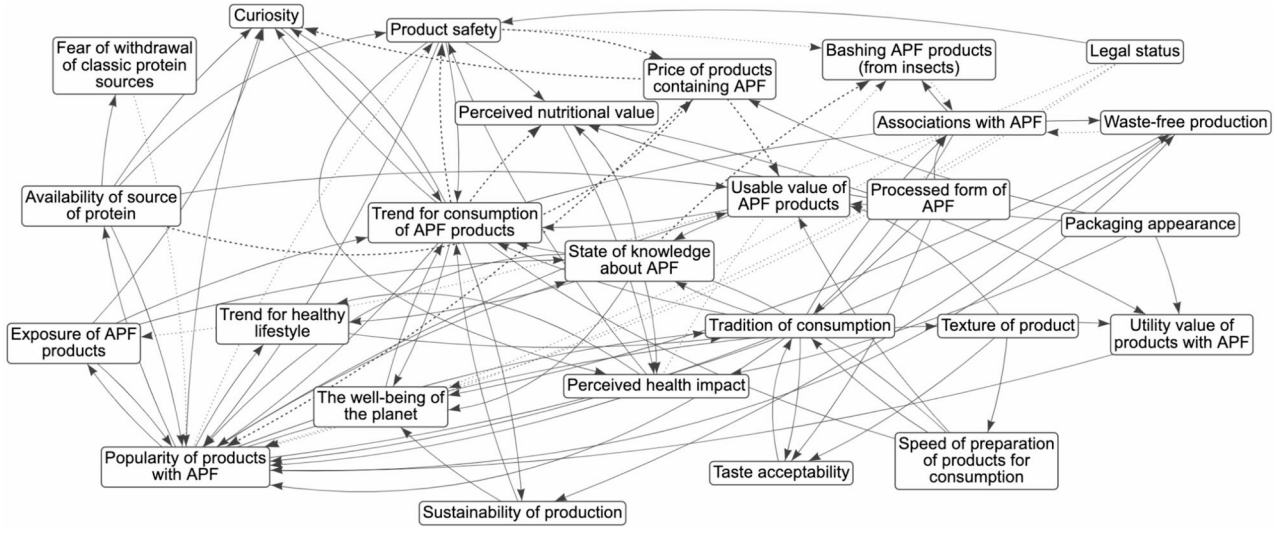

Fig. 3 The system map of determinants of alternative protein food intake: The 2nd mapping workshop in Poland
Note. Solid lines represent the positive edge; Dotted lines represent the negative edge. APF = alternative protein food. Definitions of determinants identified during system mapping workshops: Tradition of consumption = regional/national culinary traditions; Availability of source of protein = the availability of components to produce APF; Associations with APF = implicit associations about APF, e.g. insects -> pests; Popularity of products with APF = one person's consumption of APF encourages others; Processed form of APF = un/processed sources of APF; Usable value of APF products = dishes that can be prepared from APF; Trend for healthy lifestyle = associating APF products with healthy lifestyle; Trend for consumption of APF products = the effect of influencers on the desire to buy APF; Packaging appearance = attractiveness of packaging; Texture of product = preference for a specific texture of APF product; Utility value of products with APF = knowledge of recipes with APF; Fear of withdrawal from classic protein sources = the concern that if APF becomes popular, it will limit the availability of traditional protein products; Bashing APF products (made from insects) = negative opinions/hateful comments regarding APF on social media; Exposure of APF products = exposure in TV/social media; Legal status = laws affecting supply, popularity, and safety of APF; Waste-free production = limited waste in APF production

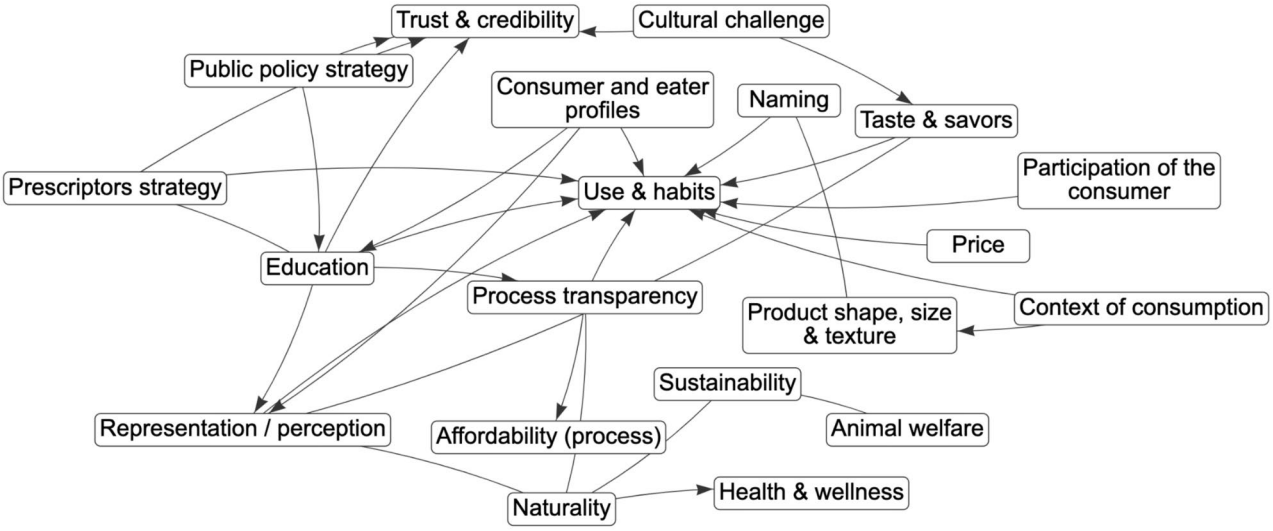

Fig. 4 The system map of determinants of alternative protein food intake: the mapping workshop in France
Note. Solid lines represent the positive edge; Dotted lines represent the negative edge. APF = alternative protein food, Definitions of determinants identified during system mapping workshops: Process transparency = explanation of how products are made step by step; Cultural challenge = knowledge of APF products within cultures favoring traditional proteins; Naming = names of APF products (e.g., a vegan sausage); Price = affordable prices; Affordability (process) = cost of the technology used in APF production; Public policy strategy = policies promoting APF/educating about APF; Use and habits = culinary habits; Education = knowledge on how to cook with APF; Sustainability = environmental impact of APF; Health and wellness = nutritional benefits of APF; Category management = shelf strategy for product placement; Trust and credibility = trust in producer/product; Participation of the consumer = consumer participation in a product creation; Context of consumption = places where APF are consumed; Consumer and eater profiles = specific consumer profiles, e.g., young people; Representation/perception = visual/perceptual representation of an APF product

important others) was indicated in $k = 3$ maps developed in Poland.

Advertising, promotion, and actions of influencers as leverage points

The determinants included in this category refer to campaigns that encourage APF consumption (other than educational campaigns), delivered by individuals (e.g., influencers), organizations, institutions, or governments/local authorities. They were identified in $k = 7$ system maps (the Czech Republic, Italy, 2 x Poland, Slovenia, Spain, and Turkey). $K = 4$ maps included marketing, advertising, and/or promotion of APF as the key leverage points (the Czech Republic, Italy, Spain, and Turkey; Table 2 and Additional file 2). The promotion of APF by influencers was determined as a leverage point in $k = 3$ maps (Slovenia, and 2x Poland).

Perceptions of healthy, balanced, and safe alternative protein food as leverage points

The respective category of determinants refers to various health and safety issues, including consumers' beliefs about healthiness, the actual nutritional content, and the regulations regarding the content of APF ($k = 5$ system maps; Austria, Italy, Portugal, Norway, and Turkey). Four system maps included leverage points related to the content of APF, which can be perceived as an example of choosing a healthier and balanced diet (Austria, Italy, Portugal, and Turkey). A lack of harm related to the product's healthiness and safety may also be a key component of trust in producers of APF, which was classified as a leverage point in Portugal. Regulations around APF were indicated in a map from Norway.

Positive and negative emotions as leverage points

Leverage points referring to complex emotions were identified in four countries: the Czech Republic, Germany, Italy, and Poland. In particular, neophobia (the fear of novel or unknown foods) and curiosity about unknown foods were identified as leverage points (see Table 2 and Additional File 2).

Other common types of leverage points

National food culture and a presence or lack of APF in local cuisines were identified as leverage points in $k = 3$ system maps (Denmark, France, and Greece; Table 2 and Additional File 2). Categorizing APF products *as ultra-processed foods* was identified as a leverage point in $k = 3$ system maps, developed in Austria, Norway, and Spain. Leverage points referring to the *environmental benefits* of including APF in the daily diet were identified in $k = 3$ system maps (Italy, Norway, and Turkey; Table 2 and Additional File 2). Finally, the leverage points referring to *concerns about animal welfare or ethical issues* (e.g., animal suffering) related to the consumption of traditional

Table 2 Results of network analysis for system maps of determinants of consumers' choices of alternative protein food: determinants included in 17 system maps with the highest eigenvector values (i.e., leverage points)

Country	Determinants with the highest values of the eigenvector centrality measure included in the system maps
Austria	Ingredient overload in APF products = 0.49; health effects of APF products = 0.49; nutritional factor of plant proteins (PER) = 0.41; ultra-processed foods = 0.41
the Czech Republic	Fear of the unknown = 0.58; price = 0.49; promotion and advertisement of APF = 0.45
Denmark	Family suitability = 0.49; Danish food culture = 0.38; knowledge of preparation = 0.38
France	Use and habits (cultural familiarity and tradition, family habits) = 0.51; education (on how to cook) = 0.45; visual representation /presentation/ perception of the APF product = 0.35
Germany	Familiarity (opposite to fear of new products) = 0.32; availability = 0.36; social norms = 0.36
Greece	Familiarization with APF (culture-related factor) = 0.47; educational level (low cognitive ability and rigidness in food choices) = 0.37; age = 0.26
Italy	Advertising = 0.43; curiosity = 0.38; environmental impact = 0.32; APF intake perceived as good and balanced diet = 0.32
Norway	Regulations of products with APF = 0.28; climate, nature and environmental effects of APF = 0.28; degree of processing of APF = 0.26
Poland (1st workshop)	Nutritional diversity (dietary habits rich in various types of proteins) = 0.35; popularity of APF (social encouragement, social norm) = 0.35; positive attitude towards (e.g., ethics of not eating meat) APF = 0.35
Poland (2nd workshop)	Educating consumers about APF = 0.44; norms of APF in terms of USP* = 0.37; social approval = 0.37
Poland (3rd workshop)	Popularity of products with APF (social encouragement, social norm) = 0.47; trend for consumption (due to influencers) = 0.32; knowledge about APF = 0.30
Poland (4th workshop)	Readiness for culinary variety = 0.37; disgust = 0.33; availability of APF = 0.32
Poland (5th workshop)	Dissemination of knowledge about APF = 0.33; normalization of the APF topic in mass media/social media = 0.32; concern for welfare of livestock = 0.26
Portugal	Trust (of consumers in APF) = 0.44; social trends (popularity of trying APF) = 0.40; literacy about APF = 0.36; nutritional profile of APF = 0.35
Slovenia	Taste = 0.39; influence of influencers = 0.30; advertising = 0.32
Spain	Promotion of consumption = 0.50; lack of knowledge = 0.37; perception of ultra-processed foods = 0.28
Turkey	Preference of APF due to health, environment and ethics = 0.49; marketing influencing consumer perception = 0.35; taste = 0.30

APF alternative protein food

*USP - a uniqueness of a product (unique selling proposition; the essence of what makes your product better than competitors)

proteins were identified in $k = 3$ system maps (2 x Poland and Turkey).

Results of feedback loops analysis

The maps developed in the five countries (the Czech Republic, Denmark, France, Portugal, and Slovenia) included unidirectional connections only, with no feedback loops. In the $k = 3$ system maps (Norway, 1 x Poland, and Spain), only one feedback loop per country was identified, each with two connections only (i.e., from A to B and from B to A). The remaining system maps, developed in six countries (Austria, Germany, Greece, Italy, 4 x Poland, and Turkey), included at least three feedback loops. Across the feedback loops identified in six countries (Austria, Germany, Greece, Italy, Poland, and Turkey), we found that specific chains of associations were common to at least half of the feedback loops.

The full list of the feedback loops identified in each of 13 countries is reported in Additional file 2, Tables S3–S14. All feedback loops include at least one leverage point (see Table 2 and Additional File, Table S2) and other determinants, as well as connections between them, as proposed by stakeholders in each respective country.

Feedback loops in Austrian map

The majority (4 out of 5) of feedback loops included variables (overload with ingredients, ultra-processed character, healthiness, and being curious about novel food) linked in a specific order. A high number of ingredients in APF was perceived by the stakeholders as related either to (i) perceiving APF as ultra-processed foods, and/or (ii) perceiving the food as of low health value. These two determinants (ultra-processed and unhealthy character) were, in turn, perceived as associated with lower curiosity and interest in trying something new. Next, stakeholders believed that low curiosity about novel foods could be related to perceiving APF as overloaded with ingredients and low interest in trying new foods. The feedback loops were reinforcing (two negative connections, with the remaining connections positive). Reinforcing feedback loops represent a mechanism of a downward spiral that hinders consumer interest in APF and reinforces low intake of respective foods.

Feedback loops in German map

The system map involved feedback loops in which availability and social norms (or the presence of social

pressure to try APF) were linked to acceptance of APF. In particular, German stakeholders suggested that higher availability of APF may prompt consumers to consider that eating APF may be a social norm (both approved and popular among important others). Stakeholders also noted that these social norms could, in turn, contribute to greater acceptance of APF. Across the feedback loops identified in the German system maps, 50% included the respective sequence (availability-> social norm-> acceptance), representing a reinforcing feedback loop that may promote APF intake.

Feedback loops in Greek map

3 out of 4 feedback loops identified in the Greek system map suggest three sequentially connected variables. Greek stakeholders linked greater familiarity with certain products, such as specific types of legumes, with greater availability of alternative protein products based on respective plants. This, in turn, was seen as supporting product marketability and efforts to popularize the products. Marketing efforts were perceived as related to higher consumer awareness of a variety of APF products or consumers' familiarity with APF. Finally, Greek stakeholders indicated that such awareness and familiarity could promote the increased availability of various APF products. These connections formed reinforcing feedback loops that represent a potential upward spiral, which contributes to an increase in APF intake.

Feedback loops in Italian map

Half of the feedback loops in Italian maps involved a potentially reinforcing upward spiral that promoted increased consumption of APF. According to Italian stakeholders, higher food safety of APF products may facilitate advertising of APF (e.g., as valuable foods). This, in turn, may increase consumers' curiosity or prompt beliefs that APFs are the healthy choices, and promote consumers' preference for food choices that may have a lower impact on the natural environment and/or a higher impact on local development and job creation. According to stakeholders, these dynamics may subsequently contribute to lower food prices and further advances in food safety.

Feedback loops in Poland's map (workshop #2)

10 out of 12 feedback loops included yet another reinforcing upward spiral that was identified as a determinant prompting APF intake. In particular, Polish stakeholders suggested that further research on APF products, addressing safety and nutrition qualities, for instance, may increase product shelf life and/or facilitate marketability. A long shelf life and/or higher marketability could, in turn, positively affect influencers' interest in APF and/or consumers' curiosity and desire to try novel, alternative, protein-based foods. Finally, stakeholders suggested that consumers' and/or influencers' interest, in turn, may intensify research to further develop/improve APF products.

Feedback loops in Turkish map

All feedback loops included in a system map developed in Turkey featured a reinforcing upward spiral, which could potentially increase APF intake. The participants connected well-developed marketing and promotional strategies to changes in social and cultural narratives around APF products. These shifts were, in turn, linked to changes in individual beliefs about the benefits of an alternative, protein-based diet, specifically with regard to health, environmental sustainability, and animal welfare. Participants also noted that favorable consumer perceptions could facilitate continued marketing and promotional efforts, creating a reinforcing cycle.

Discussion

This study provides novel insights into the network of determinants of APF intake. These insights were obtained by conducting system mapping workshops with food system stakeholders from 13 European countries. The findings allow us to draw conclusions regarding the key leverage points in the system of determinants of APF choices, as well as the chains of associations that were common components of feedback loops, identified in the respective countries.

The maps developed across countries are characterized by a high degree of heterogeneity among determinants, differences in connections between determinants, and a variety of feedback loops that may either balance the system or push the respective systems towards a change in APF uptake. These system maps can be considered case studies that provide information about the interplay of determinants which represent certain stakeholder perspectives in a given country. However, it should be noted that some types of leverage points were common across several system maps and appeared across different geographical regions of Europe. In particular, the three most frequently indicated leverage points –knowledge, social norms/social encouragement, and advertising approaches – were found in maps developed in Northern, Eastern, Southern, and Western European countries.

Leverage points: experiential knowledge, "normalizing" and advertising APF intake

Regarding knowledge, it is important to note that, in addition to cognitive understanding of what APF is and its health and environmental consequences, stakeholders emphasized experiential and procedural knowledge of APF. In particular, knowing how to cook or prepare a meal with APF emerged as a relevant leverage point.

Cooking with APF reflects both procedural knowledge (knowing how to use the product) and experiential knowledge (personal exposure through trying and tasting APF). This finding aligns with systematic reviews indicating that familiarity with APF and cooking/preparation skills are significant individual-level determinants of consumer choices, whereas conceptual knowledge plays a less substantial role [17, 35, 36].

The second type of leverage points refer to positive social norms, social approval of APF intake, and encouragement by important others (i.e., important role models, friends, and family who approve of APF and are willing to consume APF themselves). These social determinants highlight the importance of behaviors and beliefs of members of close social networks. Systematic reviews [17, 36] provided strong evidence of the links between social norms and consumers' choices of APF. For example, encouragement from an important other (e.g., a romantic partner) may prompt unwilling young consumers to try new APF in restaurants [37].

The third type of leverage points, which obtained the most support in our study, refers to encouraging APF intake through advertising, promotion, and influencer marketing. The focus on the need to advertise APF products, along with the focus on knowledge-related factors and the social normalization of APF (perceiving others as APF consumers), may indicate that stakeholders' assumed awareness of APF as viable protein source is low among European populations. Research on several types of APF (e.g., algae-based products) suggests that many Europeans may be unaware of this type of food [38]. Although awareness is not a central concept in health behavior change research, recent theoretical approaches and studies propose that *being aware* – observing oneself and noticing internal and external stimuli while allowing oneself to experience them – may serve as a focal point for shifting behavior from automatic to novel, autonomously motivated actions [39].

The findings regarding knowledge of APF also have practical implications. APF awareness campaigns and educational programs may need to include activities that facilitate procedural and experiential knowledge, that is, information on how to prepare a meal with APF, combined with APF sensory experience (observing and trying APF). These campaigns should also demonstrate approval of the APF intake by local influencers and relevant role models. Such interventions may have the potential to trigger a change in food system determinants.

Feedback loops: linking individual-level, social, and environmental micro-, meso-, and macro-level determinants

One of the key characteristics of the chains of associations identified in this study is the connection of determinants from different levels. The feedback loops included determinants referring to either the social or physical environment, or both, as well as individuals' characteristics. Several feedback loops are also linked to determinants from the micro-, meso-, and macro-levels. For example, feedback loops found in the system map developed by the Italian stakeholders linked individual, micro-level factors (such as consumer curiosity and orientation towards sustainable and local economy reinforcing products) with macro-level social factors (such as market/industry/retail responses of lowering prices, intensified advertising), as well as physical food environment factors (such as changes in food safety).

A similar example of cross-level links and the inclusion of social and physical environmental factors was identified by Polish stakeholders: individual-level factors (consumers' curiosity) were linked to meso-level social factors (research on APF safety and quality), which were then linked to physical environmental factors (changes in food shelf life). These cross-level links of psychological, social, and physical environment-related determinants support the core assumptions of socio-ecological models, highlighting that a valid prediction of a health behavior should account for multi-level social and physical environment context, not just within-individual processes [13–15].

The results regarding feedback loops suggest that the availability of APF is a crucial element of potential upward spirals, which may increase intake of APF. Feedback loops identified by Greek stakeholders link consumers' experience of familiarity with APF (a psychological variable at the individual level) and with the availability of APF (a factor of the physical environment), which, in turn, increases marketability of APF and marketing efforts (a social-environmental factor at the meso-level). Similarly, German stakeholders link the availability of APF with meso-level social-environmental factors, such as social pressure, approval, and popularity of APF, among others. These factors, in turn, were related to higher acceptance of APF (an individual-level factor). Previous research on the characteristics of the physical environment indicates that the actual availability of APF in local groceries, supermarkets, and restaurants is a crucial determinant of the intention to try, buy, and include APF into one's daily diet [37]. The present study is the first to propose a chain of associations that link availability to individual-level beliefs and meso-level social factors.

The majority of the feedback loops identified in the present study were classified as reinforcing feedback loops, or the upward spirals, that have the potential to cause positive changes in the food system in terms of the broader uptake of APF. Across the European countries, stakeholders participating in system mapping workshops

identified potential ways forward that could be pursued by various actors within food systems, including policy makers (e.g., by proposing food availability regulations), non-governmental organizations (e.g., by using social pressure instruments in social media), food marketing corporations (e.g., by intensifying APF marketing efforts), and novel food developers (e.g., by researching determinants of food safety).

Two system maps (Austria and the first map developed with adolescents in Poland) included downward spirals indicating how determinants operating within the food system may lead to a decline in APF intake, APF production, and APF availability. Furthermore, although most feedback loops were formulated by stakeholders as chains of determinants that promote APF intake, they can also be interpreted as explaining why APF is currently widely *not* adopted by consumers. For example, the chain of associations identified in the German system map suggest that lower availability of APF may be associated with a further decline in social approval of APF and perceptions that consuming APF is not something significant others would do (i.e., weak social norms), which in turn may contribute to lower acceptance of APF. This interpretative approach may help explain challenges faced by the food sector with respect to APF production and sales. For example, it may clarify how narratives promoted by high-profile individuals—suggesting that APF is something that "nobody important would eat" or expressing disapproval of APF—may contribute to lower consumer acceptance of APF and consequently reduced pressure from stakeholders to make APF more widely available.

The Austrian and Spanish system maps included perceptions of APF as ultra-processed foods as leverage points, hindering APF intake. Plant-based, microbial-based, and other APFs undergo extensive refinement and include processed ingredients to replicate texture, taste, and appearance of traditional protein food [40]. Therefore, some food classifications consider APF an example of ultra-processed food, which may result in consumers' reluctance to include APF into a daily diet. However, recently, food researchers suggested that classifying APF as a typical ultra-processed food is incorrect [40]. Many APF products, such as plant-based meat and dairy alternatives, offer high nutrition quality, similar or superior to unprocessed animal products [40]. The notion of ultra-processed food was originally developed as a category encompassing fast food, sweet and salty snacks high in saturated fat and sugar, or ultra-processed beverages, all of which have been proven to be associated with poor cardiometabolic health outcomes [40]. Due to their nutritional and health value, APF should not be included in the original category of ultra-processed foods. Instead, different types of processed foods should be grouped separately depending on their nutritional and health profiles. Respective educational actions targeting consumers and other stakeholders are needed.

The findings related to the identified feedback loops may support food system stakeholders in the development of policy-relevant interventions. For instance, these interventions could incorporate the strategic use of influencers to increase consumer familiarity with APF, raise awareness of their health and safety attributes, and frame APF consumption as socially acceptable and positively valued. APF promotion campaigns that are endorsed and discussed by popular influencers may consequently contribute to increased consumer demand for APF and, in turn, incentivize retailers to expand the availability of APF in local grocery stores and supermarkets.

Our study does not provide evidence regarding which stakeholders may be best positioned to act on the identified leverage points. However, previous research on interventions and policies aimed at changing dietary patterns suggests that multi-stakeholder engagement increases the likelihood of successful implementation, broad reach (e.g., in vulnerable communities), and long-term sustainability [41]. Therefore, diverse food system stakeholders—such as policymakers, consumers, retailers, clinical nutrition specialists, and producers—should collaborate to develop a consensus on how to act on key leverage points, that have a potential to trigger a broader uptake of APF.

Between-country differences in system maps

As the study was conducted in 13 countries, the findings might initially be interpreted as reflecting cross-country differences. However, it is likely that the observed differences across system maps primarily result from the composition of workshop participants. Each workshop had a distinct participant profile: for example, stakeholders in Italy were predominantly producers, whereas the first and second workshops in Poland included mainly young consumers. The content of the system maps, including the identified leverage points and feedback loops, is influenced by the participants' professional experience. Consumers are likely to identify different leverage points than producers: the latter may be most likely to identify barriers related to developing new safe APF, meeting all respective food safety regulations in a country.

Differences between maps are also shaped by participants' personal experiences. Even within the same country and among participants with similar professional backgrounds, variation can be substantial. For instance, the third, fourth, and fifth workshops conducted in Poland involved mostly clinical nutritionists, yet the resulting maps differed significantly in terms of identified leverage points and feedback loops.

Therefore, between-map differences should be interpreted with extreme caution, as multiple factors may

contribute to these variations. Instead, interpretations and conclusions may more reliably focus on similarities observed across maps, such as recurring leverage points.

Limitations

The system maps developed in this study were of remarkably high heterogeneity in terms of the included determinants, their connections, and the identified leverage points. Within-country differences were also present, as suggested by the findings obtained from the five workshops conducted in Poland. The chosen approach of system mapping data analysis, which focused on calculating eigenvector centrality indices, has its limitations and provides no insight into more complex associations. These limitations were partially reduced by a qualitative analysis of feedback loops, which better represent the system characteristics and its non-linear, circular associations [42].

The system mapping approach reflects the knowledge, beliefs, and experiences of the stakeholders who participated in the workshops. Small samples and a lack of representativeness of the stakeholders (for the overall national networks of food system stakeholders) are another limitation that hinders any generalizations. However, system mapping may be considered a first step toward more complex research that could ultimately inform policy and intervention practices. The findings for 17 system maps presented in this study focus on similarities between countries. However, national-level policies and interventions should be informed by within-country findings, which were not analyzed systematically in this study.

Our study focuses on the empirical analysis of a complex system, using APF intake as the key entry point. This allows us to understand the interrelations between the various elements of the food system. However, this approach has limitations because other relevant "entry points", such as the actions of food producers, were not investigated. Future research should broaden this perspective by investigating determinants of producers' choices to increase the production of APF, for example. Furthermore, translating our findings into practice requires further research to elucidate the key actions of other food system stakeholders (e.g., food producers and processors, retailers, marketing specialists, and policy makers), that may constitute leverage points to facilitate a system change. Addressing the leverage points that represent the actions of *all* food system stakeholders may substantially increase the likelihood of a food system transformation. This transformation is characterized by a broader uptake of APF by everybody and everywhere, followed by maintenance of new food habits (represented by common choices of APF) among consumers.

Conclusion

This study provides new insights into the complex systems of the determinants of APF choices. 17 system maps highlight the role of individual-level consumer characteristics, as well as meso-level and macro-level social and physical environmental determinants of APF intake. Changes in these determinants may trigger reverberating effects occurring throughout the system. Therefore, the leverage points identified in this study are potentially the most promising targets for interventions promoting APF. Stakeholders participating in this system mapping study identified several feedback loops that may encourage incorporation of alternative protein foods into daily diets. These feedback loops may inspire food system stakeholders, including food producers, marketing specialists, researchers, and consumers across Europe, to develop novel interventions and policies that drive changes in APF intake.

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

HZ, AL, EK, ZS, MS, AK, and JM contributed to the conception and design of the study; All authors contributed to the data acquisition; HZ, AL, EK, ZS, and AB analyzed data; HZ, EK, ZS, and AB contributed to the interpretation of data; HZ and AL have drafted the manuscript; All authors have revised the manuscript.

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Data availability

Data (system maps and definitions of included determinants) are included in the supplementary files.

Declarations

Ethics approval and consent to participate

The SWPS team submitted the study protocol for evaluation to the Ethics Committee at SWPS University, Wroclaw, Poland. The study was approved (decision no. 01/E/03/2023), assuming the workshops will be overseen and supported by the SWPS LIKE-A-PRO team. The MOREFORSKING team also sought the approval of their respective ethics committees, in line with the institutional guidelines (decision no. 301103, SIKT). Research teams from other countries declared that the approval obtained from the ethics committee at SWPS University, which addresses common procedures, is sufficient and meets the criteria required by their respective institutions.

Consent for publication
All authors consent for the publication of this manuscript.

Competing interests
The authors declare no competing interests.

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References

1. Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the anthropocene: the EAT–Lancet commission on healthy diets from sustainable food systems. Lancet. 2019;393(10170):447–92. https://doi.org/10.1016/S0140-6736(18)31788-4.
2. Nirmal N, Anyimadu CF, Khanashyam AC, Bekhit AEDA, Dhar BK. Alternative protein sources: addressing global food security and environmental sustainability. Sustain Dev. 2025;33(3):3958–69. https://doi.org/10.1002/sd.3338.
3. Grossmann L, Weiss J. Alternative protein sources as technofunctional food ingredients. Annu Rev Food Sci Technol. 2021;12(1):93–117. https://doi.org/10.1146/annurev-food-062520-093642.
4. Tuomisto HL, Ryynänen T. Environmental sustainability of cultivated meat. Advances in biochemical engineering/biotechnology. Berlin, Heidelberg: Springer; 2025. https://doi.org/10.1007/10_2025_293.
5. HLPE. Nutrition and food systems: A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome; 2017.
6. James SW, Friel S, Lawrence MA, Hoek AC, Pearson D. Inter-sectoral action to support healthy and environmentally sustainable food behaviours: a study of sectoral knowledge, governance and implementation opportunities. Sustain Sci. 2017;13(2):465–77. https://doi.org/10.1007/s11625-017-0459-8.
7. De Boer J, Aiking H. Do EU consumers think about meat reduction when considering to eat a healthy, sustainable diet and to have a role in food system change? Appetite. 2022;170:105880. https://doi.org/10.1016/j.appet.2021.105880.
8. Ericksen PJ. Conceptualizing food systems for global environmental change research. Glob Environ Change. 2008;18(1):234–45. https://doi.org/10.1016/j.gloenvcha.2007.09.002.
9. Gregory PJ, Ingram JSI, Brklacich M. Climate change and food security. Philos Trans R Soc Lon B Biol Sci. 2005;360(1463):2139–148. https://doi.org/10.1098/rstb.2005.1745.
10. Ingram J. A food systems approach to researching food security and its interactions with global environmental change. Food Secur. 2011;3(4):417–31. https://doi.org/10.1007/s12571-011-0149-9.
11. Rotz S, Fraser EDG. Resilience and the industrial food system: analyzing the impacts of agricultural industrialization on food system vulnerability. J Environ Stud Sci. 2015;5(3):459–73. https://doi.org/10.1007/s13412-015-0277-1.
12. Tendall DM, Joerin J, Kopainsky B, Edwards P, Shreck A, Le QB, et al. Food system resilience: defining the concept. Glob Food Sect. 2015;6:17–23. https://doi.org/10.1016/j.gfs.2015.08.001.
13. Bronfenbrenner U. Toward an experimental ecology of human development. Am Psychol. 1977;32(7):513–31. https://doi.org/10.1037/0003-066x.32.7.513.
14. McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. Health Educ Q. 1988;15(4):351–77. https://doi.org/10.1177/109019818801500401.
15. Stokols D. (1992). Establishing and maintaining healthy environments: Toward a social ecology of health promotion. Am Psychol. 1992;47(1):6–22. https://doi.org/10.1037//0003-066x.47.1.6
16. Hoek AC, Malekpour S, Raven R, Court E, Byrne E. Towards environmentally sustainable food systems: decision-making factors in sustainable food production and consumption. Sustain Prod Consum. 2020;26(4):610–26. https://doi.org/10.1016/j.spc.2020.12.009.
17. Onwezen MC, Bouwman EP, Reinders MJ, Dagevos H. A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. Appetite. 2021;159:105058. https://doi.org/10.1016/j.appet.2020.105058.
18. Onwezen MC, Dagevos H. A meta-review of consumer behaviour studies on meat reduction and alternative protein acceptance. Food Qua Prefer. 2023;114(23):105067. https://doi.org/10.1016/j.foodqual.2023.105067.
19. Zaleskiewicz H, Siwa M, Banik A, Szczuka Z, Kulis E, Grossi F, et al. Psychosocial determinants of alternative protein choices: a meta-review. Health Psychol Rev. 2025;19(1):97–122. https://doi.org/10.1080/17437199.2024.2412630.
20. Hovmand P. Community based systems dynamics. New York: Springer; 2013.
21. Meadows DH. Thinking in systems: a primer. Sustainability Institute; 2008.
22. Rhodes RE, Banik A, Szczuka Z, Aulbach MB, DeSmet A, Durand H, et al. Extending our Understanding of the social determinants of physical activity and sedentary behaviors in families: A systems mapping approach. J Phys Act Health. 2025;22(1):53–68. https://doi.org/10.1123/jpah.2024-0113.
23. Littlejohns LB, Hill C, Neudorf C. Diverse approaches to creating and using causal loop diagrams in public health research: recommendations from a scoping review. Public Health Rev. 2021;42:1604352. https://doi.org/10.3389/phrs.2021.1604352.
24. Dentoni D, Cucchi C, Roglic M, Lubberink R, Bender-Salazar R, Manyise T. Systems thinking, mapping and change in food and agriculture. BAE. 2022;11(4):277–301. https://oaj.fupress.net/index.php/bae/article/view/13930.
25. Sawyer ADM, van Lenthe F, Kamphuis CBM, Terragni L, Roos G, Poelman MP, et al. Dynamics of the complex food environment underlying dietary intake in low-income groups: a systems map of associations extracted from a systematic umbrella literature review. Int J Behav Nutr Phys Act. 2021;18(1):96. https://doi.org/10.1186/s12966-021-01164-1.
26. Király G, Miskolczi P. Dynamics of participation: system dynamics and participation-An empirical review. Syst Res Behav Sci. 2019;36(2):199–210. https://doi.org/10.1002/sres.2580.
27. Meadows D. Leverage points: places to intervene in a system. Sustainability Institute; 1999.
28. Murphy R, Jones P. Leverage analysis. Form Akademisk. 2020;13:1–25. https://doi.org/10.7577/formakademisk.3384.
29. Savona N, Macauley T, Aguiar A, Banik A, Boberska M, Brock J, et al. Identifying the views of adolescents in five European countries on the drivers of obesity using group model Building. Eur J Public Health. 2021;31(2):391–96. https://doi.org/10.1093/eurpub/ckaa251.
30. Savona N, Brown A, Macauley T, Aguiar A, Hayward J, Ayuandini S, et al. System mapping with adolescents: using group model Building to map the complexity of obesity. Obes Rev. 2023;24(S1):13506. https://doi.org/10.1111/obr.13506.
31. Hayward J, Morton S, Johnstone M, Creighton D, Allender S. Tools and analytic techniques to synthesise community knowledge in CBPR using computer-mediated participatory system modelling. NPJ Digit Med. 2020;3(22):32133423. https://doi.org/10.1038/s41746-020-0230-x.
32. Relationship Mapping Software. 2024. https://kumu.io. Accessed June 25, 2025.

33. Castro EM, Van Regenmortel T, Sermeus W, Vanhaecht K. Patients' experiential knowledge and expertise in health care: a hybrid concept analysis. Soc Theor Health. 2018;17(3):307–30. https://doi.org/10.1057/s41285-018-0081-6.
34. Gorzelsky G. Experiential knowledge: how literacy practices seek to mediate personal and systemic change. Coll Engl. 2013;75(4):398–419. https://doi.org/10.2307/24238181.
35. Dagevos H. A literature review of consumer research on edible insects: recent evidence and new vistas from 2019 studies. J Insects Food Feed. 2021;7(3):249–59. https://doi.org/10.3920/JIFF2020.0052.
36. Eckl MR, Biesbroek S, Van't Veer P, Geleijnse JM. Replacement of meat with non-meat protein sources: A review of the drivers and inhibitors in developed countries. Nutrients. 2021;13(10):3602. https://doi.org/10.3390/nu13103602.
37. Zaleskiewicz H, Kulis E, Siwa M, Szczuka Z, Banik A, Grossi F, et al. Characteristics of built food environments associated with alternative protein food choices: a systematic review. Int J Behav Nutr Phys Act. 2024;2158. https://doi.org/10.1186/s12966-024-01606-6.
38. Mellor C, Embling R, Neilson L, Randall T, Wakeham C, Lee MD, Murphy R, Jones P. Leverage analysis. Form Akademisk. 2020;13:1–25. https://doi.org/10.7577/formakademisk.3384.
39. Ludwig VU, Brown KW, Brewer JA. Self-regulation without force: can awareness leverage reward to drive behavior change? Perspect Psychol Sci. 2020;15(6):1–18. https://doi.org/10.1177/1745691620931460.
40. Lee SY, Lee DY, Hur SJ. Future perspectives: current trends and controversies of meat alternatives classified as ultra-processed foods. J Food Sci. 2024;89(11):7022–33. https://doi.org/10.1111/1750-3841.17355.
41. Bijlani C, Vrinten C, Junghans C, Chang K, Lewis E, Mulla U, et al. Changes in diet and physical activity following a community-wide pilot intervention to tackle childhood obesity in a deprived inner-London ward. BMC Public Health. 2024;24(1):800. https://doi.org/10.1186/s12889-024-18192-8.
42. Crielaard L, Quax R, Sawyer ADM, Vasconcelos VV, Nicolaou M, Stronks K, et al. Using network analysis to identify leverage points based on causal loop diagrams leads to false inference. Sci Rep. 2023;13(1):21046. https://doi.org/10.1038/s41598-023-46531-z.

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