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Beyond the plate: How socio-culture and economics drive sustainable diets globally

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ABSTRACT

Background: Sustainable diets play a powerful catalyst in unlocking and scaling health and climate solutions. Many studies on the diets focus only on health and environmental concerns, but barely consider related socio-cultural and economic determinants.

Objective: The present systematic review provides an overview of socio-cultural and economic determinants on sustainable diets across income countries.

Methods: Electronic databases, including MDPI, PubMed, Science Direct, and The Lancet Planetary, were performed. The systematic review was conducted following the PRISMA principles. Human studies among all population groups in income countries were included, and require at least one socio-cultural and economic determinant on sustainable diet. The search focused on studies that were peer-reviewed and published in English between 2010 and 2024. The Newcastle-Ottawa scale and its modified version were used to assess the methodological quality (risk of bias).

Results: Forty-two of the 2,443 articles identified attained the inclusion criteria. Almost all included studies were cross-sectional (n=39; 92.8%) and 3 cohort studies. The publications covered 56 country-based study settings, five of which were conducted as multi-site studies. Most studies focused on high-income countries, mostly in Europe, Central Asia, and North America. All included studies found 15 socio-cultural and economic determinants; 10 studies of socio-cultural determinants and 5 studies of economic determinants on sustainable diets. The systematic review found that socio-cultural and economic determinants on sustainable diets were divided into external drivers (ethnicity, gender, cultural belief, spiritual belief, geographical settings, political ideology, and food price) and personal drivers (educational level, nutritional knowledge, marital status, household size, income level, occupation, food expenditure, and household food security status).

Conclusion: Addressing the social, cultural, and economic determinants is prerequisite for transforming more-sustainable diets. Food sustainability and food and nutrition security are aligned at the individual and household level. Comprehensive strategies targeting multiple levels, and multiple settings are required to enhance dietary changes on sustainable diets.

Keywords: Determinant; economic; food choice; socio-culture; sustainable diets

BACKGROUND

Imbalanced diets represent a lower intake of fruits, vegetables, nuts, and whole grains and a high intake of processed animal-based diets, which may contribute to most global diseases.[1] The 2019 Global Burden Diseases, Injuries, and Risk Factor study estimated that high meat intake was responsible for 896,000 deaths and 23.9 million disability-adjusted life years globally in 2019.[2] Several studies reported that imbalanced diets involve a high animal-based diet, comparing plant-based diets, which have been strongly correlated with non-communicable diseases (NCDs), including obesity, cardiovascular diseases, ischemic heart diseases, cancer, and diabetes mellitus.[3–6]

To tackle global NCDs cases, a healthier diet must improve. However, the task is challenging. High meat consumption is also associated with a large range of environmental costs that threaten sustainability, including greenhouse gas emissions, land degradations, scarcity-weight water uses, pesticide uses, plant-nutrient pollutants, and consumer-level food waste along the entire chains.[7,8] The *EAT-Lancet* Commission calculated that red meat production is influenced by a large proportion of carbon dioxide, methane, and nitrous oxide, which may lead to extreme weather and climate change.[9] The global NCDs pandemic and climate crisis are the world's most pressing and interconnected issues. And, diet plays a powerful catalyst in unlocking and scaling health and climate solutions.

Sustainable diets include environmental sustainability and health concerns; simultaneously connecting food consumption with the dietary requirements within social, cultural, and economic considerations enclosed by sheltered planetary boundaries. The *EAT-Lancet* Committee defined the scientific goal of globally applying and quantifying the framework of a safe operating space for food systems and promoting human health and

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stable planetary systems. The universal health reference diet is a plant-based diet consisting primarily of fruits and vegetables, whole grains, legumes, nuts, and unsaturated fatty acids, with small amounts of fish products and white meats, added sugars, refined grains, and starchy vegetables, or as a "Planetary Health Diet."[9]

Accomplishing a sustainable diet aligns with the 2nd, 3rd, and 12th objectives of Sustainable Development Goals, namely "Zero Hunger", "Good Health", and "Responsible Consumption and Production." These ideas were generated on the premise that transforming dietary behavior into sustainable diets can reduce environmental and health issues.[10,11]

According to Springmann et al. [12] typical sustainable diets nowadays include flexitarians (semi-vegetarian diets with infrequent meat consumption) and pescatarians (fish and seafood consumption), along with several related diets, such as vegetarian and vegan diets. Specific traditional and local dietary patterns can also improve health and well-being. These diets are known as the "Blue Zone" and include the Mediterranean, Nordic, and Okinawa.[13] These traditional diets have evolved over the last fifty centuries and proportionally contain a lot of olive oil, fruit, vegetables, grain (mostly unrefined), legumes and nuts, medium portions of fish and dairy products, and barely any meat.[14] Nevertheless, some regional specific diets currently have disappeared. For instance, younger Okinawans now eat a more Western diet. The Nordic diet is also disappearing because it is inaccessible for many people to consume regularly.[15]

There are many determinants in shaping the sustainable diet, including health, social, cultural, economic, and environmental factors.[16–20] Most studies on sustainable diets focus only on health and environmental concerns, barely considering related social, cultural, and economic determinants. These determinants require to be addressed or better understood in the study on sustainability of food system, food production, and societies.[21,22] Since 2001, the FAO has defined *food security* as socio-cultural, physical, and economic access.[23] Diet quality suffers when food access is restricted, and high comparative costs for nutrient-dense dietary products, as opposed to nutrient-poor, energy-dense diets, are aligned to double-burden of malnutrition, including obesity and micronutrient deficiencies across socio-economic factors.[24–26]

Socio-cultural determinants have an essential role in encouraging dietary change, for example food habits reflect one's personal identity, culture, and social tradition. Diet, which includes food variety, meal preparation, and eating habits, is critical in creating a food culture. Food choices can also reflect an individual's social status, religious views, and cultural background.[27] In addition, cultural traditions, beliefs, and preferences all have a significant influence on food consumption. Thus, incorporating sustainable eating behaviors into various social and cultural situations requires careful consideration.

Socio-cultural determinants of sustainable food choice notwithstanding, individuals generally eat what they can afford. The cost, availability, and accessibility of food impact an individual's ability to make sustainable dietary choices. According to the previous *EAT-Lancet* findings, the cheapest sustainable diet in 2011 cost on average $2.84 each day worldwide, with fruits and vegetables accounting for the largest share (31.2 per cent), followed by legumes and nuts (18.7 per cent), meat, egg, fish (15.2 per cent), and dairy products (13.2 per cent). They also found that the diet was, on average, 1.60 times more expensive than the lowest cost of the nutritional adequacy diet.[17]

Socio-economic status is a significant determinant of diets across income countries. Lower socio-economic individuals in Australia reported poorer diet-related health.[28] Conversely, higher socio-economic status may improve the quality of diets.[29] Nevertheless, a higher socio-economic level associated to a raising intake of unhealthy diets in some cases.[30] Considering eating patterns are significantly correlated with socio-economic determinants, the transformation to sustainable diets often raises affordability concerns across income countries.[31] Therefore, the present systematic review overviews the socio-cultural and economic determinants on sustainable diets across income countries.

MATERIALS AND METHODS

The PRISMA (The Preferred Reporting Items for Systematic Reviews and Meta-Analysis) framework was performed on the present review. In addition, the present review has been registered in the International Prospective Register of Systematic Review (PROSPERO) database: No.CRD42024589714. The systematic review was performed from March to April 2024.

Eligibility Criteria

Based on population, exposure/independent variable, comparison, outcome and setting (PECOS) framework (Table 1), the included studies were human studies conducted among all population group in income countries that assessed the association between at least one socio-cultural and economic factors and

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diet-related behaviors on the sustainable diet; the search also limited to study were peer-reviewed and published in English, year 2010-2024. The study further investigates the determinants used to assess dietary patterns, focusing on measures that demonstrate both validity and reliability. This approach ensures that the evaluation of diets is both accurate and consistent.

Table 1. The PECOS Criteria for Inclusion and Exclusion of Studies

PECOS criteria	Inclusion	Exclusion
Population	All population group	Nonhuman studies
Exposure	Social, cultural and economic indicators	Articles not evaluating social, cultural and economic indicators
Comparator	No comparator	
Outcome	Diet-related behaviors for sustainable diets, e.g. food choice, food preferences, diet adherence	Not diet-related behavior for sustainable diets
Setting	All settings (low income-, lower-middle income-, upper-middle income-, and high income-countries)	

Case reports, personal opinions, reviews, book chapters, reports, comments, editorials, letters to the editors, theses and dissertations, conference annals, papers not subjected to peer review, protocols, future projects, and research approved for publication nevertheless not yet published were all eliminated. To reduce reporting bias, at least two reviewers participated in each publication's abstract and free-full-text screening, following standard guidelines for systematic reviews.[32,33]

Information Sources

A search for English-language articles published in peer-reviewed journals between 2010 and 2024 was performed on four databases, including MDPI, PubMed, Science Direct and *The Lancet* Planetary Health, which are the most relevant in food and nutrition research. An initial period (year) of the study was determined regarding the definition of sustainable diets widely accepted in 2010.

Search Strategy

A sensitive search strategy was applied to retrieve relevant studies. The Medical Subject Headings controlled vocabulary system was used to define the keywords. The search was undertaken with search terms, along with Boolean logic modified to the select database. The Boolean logic operators – AND and OR – provided a method for combining, focusing, refining and enlarging keywords from the database search. The search queries were differentiated according to the selected databases and composed by combination of keywords and terms as follow: ("sustainable diet*" OR "sustainable healthy diet*" OR "planetary diet*" OR "planetary healthy diet*" OR "plant-based diet*" OR "Mediterranean diet*" OR "vegetarian" OR "flexitarian" OR "pescatarian") AND (socio* OR culture* OR tradition OR custom OR belief OR religion OR ethnic* OR education OR knowledge OR economy* OR afford* OR available* OR access* OR market OR cost OR price OR income OR expenditure OR occupation OR poverty OR resource OR supply*) AND (intent* OR attitude* OR behave* OR eat* OR consumption OR intake OR choice OR habit* OR pattern OR prefer*) AND (diet* OR food OR drink* OR beverage OR nutri*). All databases were performed filters to be applied regarding human population study, article type, language and year of the publication.

Selection Process and Data Extraction

All extracted articles were imported into Mendeley Reference Manager (version 2.112) and de-duplicated. The pre-selected publications underwent full-text analysis to determine which comply with the inclusion criteria. *The Rayyan Intelligent Systematic Review*® software (a web-based tool for screening research papers in collaborative and anonymous systematic reviews) was used to record the decisions. The data collected, recorded, and analyzed was omitted using Microsoft Excel. The following information was retrieved from the studies selected for this review: reference, objective of the study, sample size, study site (country), study design, data source, determinant tool measurement, and key finding.

Methodological Quality Assessment

The methodological quality was assessed using the Newcastle-Ottawa scale [34] in cohort studies and modified Newcastle-Ottawa scale [35] in cross-sectional studies. The Newcastle-Ottawa scale is a statistical

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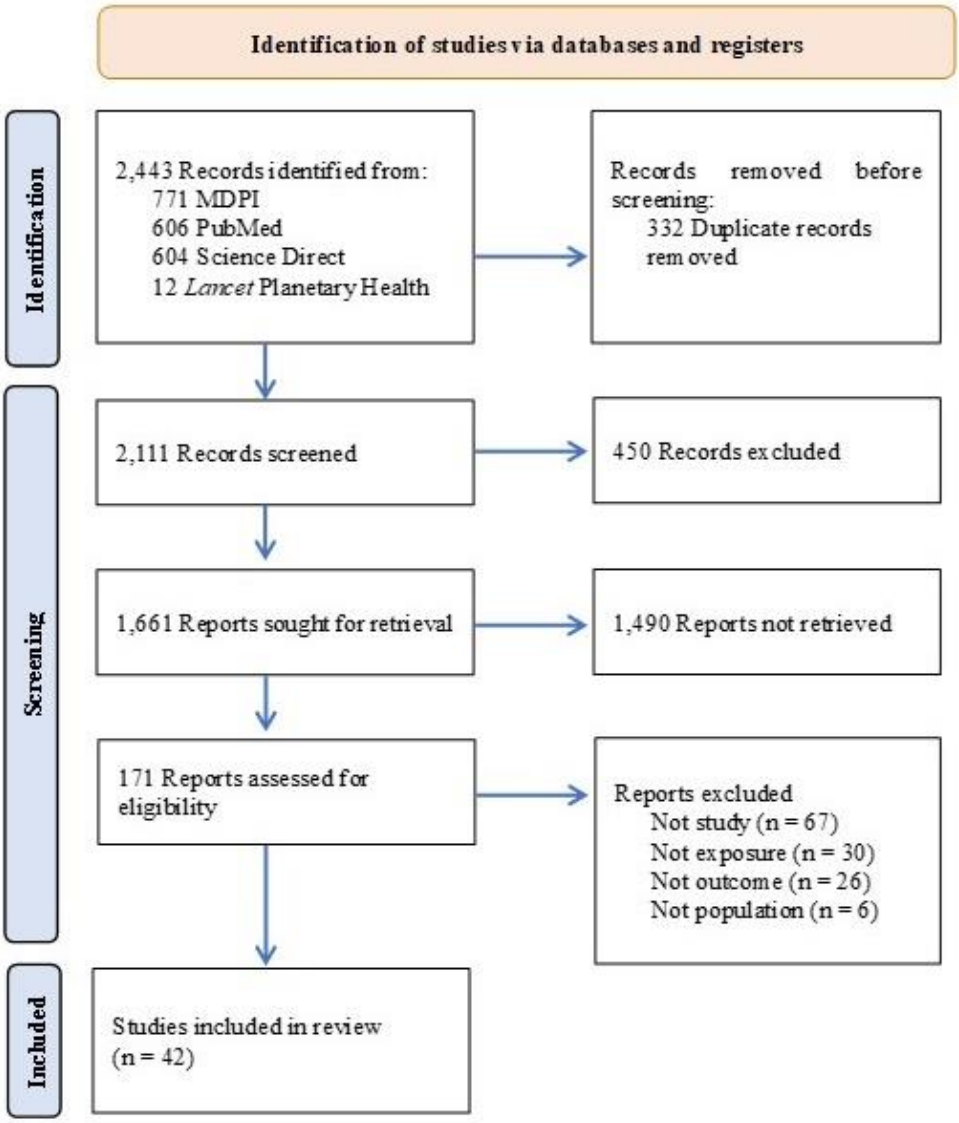

Figure 1. PRISMA Flow Diagram for a Systematic Review of Socio-cultural and Economic Determinants on Sustainable Diets

method for examining the risk of bias representing the quality of the study included in the present systematic reviews. Each study is assessed using three assessment scales, divided into eight indicators for cohort studies and ten indicators for cross-sectional study. The assessment scale was performed following: (1) Study selection; (2) Comparability; and (3) Outcomes.[34,35] There are three quality levels: good, fair, and poor, characterized based on a score from zero to nine stars for each cohort study and zero to ten stars for each cross-sectional study, with more stars indicating a higher-quality study.

RESULTS

Characteristics of Included Studies

The database search retrieved 2,445 articles. After deleting duplicates, 2,113 articles remained. The initial round of title and abstract submissions attained 1,661 papers. A further round of full-text screening yielded 171 eligible papers. Finally, 42 relevant publications were selected using the inclusion criteria. A total of 129 articles did not meet the inclusion criteria: 67 were literature reviews, protocols, conference proceedings, or theses; 30 studies did not examine the socio-cultural and economic context of sustainable diets; 26 studies did not address sustainable diet-related practices; and 6 studies were non-human studies. The flow

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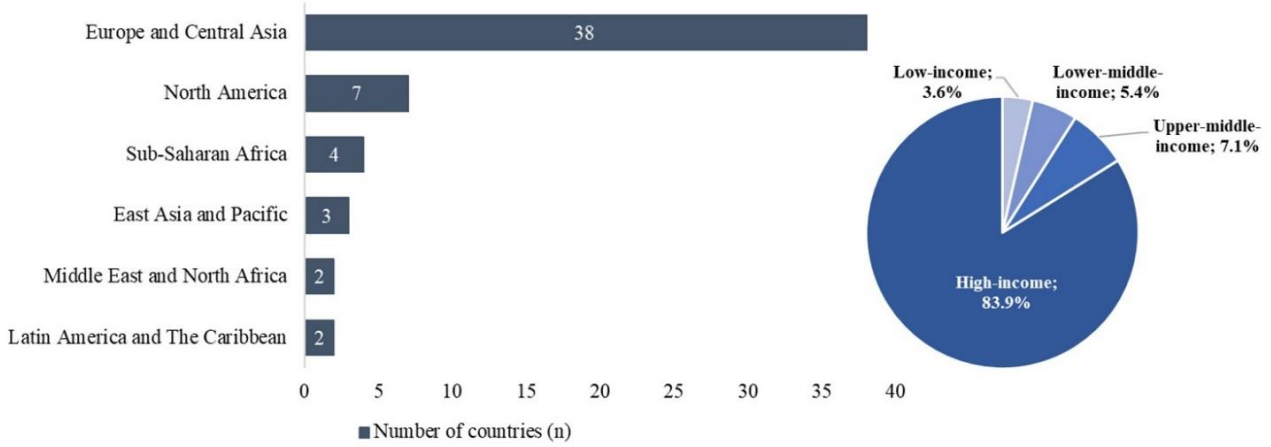
diagram of studies using PRISMA guideline was presented in Figure 1. Any disagreements among independent reviewers about the eligibility of articles for inclusion was resolved through in-depth discussion among the reviewers until consensus was established. S1 provides an overview of all publications included in the present systematic review.

Definitions of Sustainable Diets

There was 11.9 per cent (*n*=5 articles) referred to or cited the 2010 definition of sustainable diets. More than forty-per cent included articles (*n*=17 articles; 40.5 per cent) defined as Mediterranean diet. Another alternative definition was stated as planetary healthy diet, vegetarian or vegan or flexitarian or pescatarian, plant-based diet, and climate-friendly food. S2 describes the definitions of sustainable diets and alternative definition-related to sustainable diets.

A total of 56 country-based study settings was included in the articles, of which there are five investigations conducted multi-site studies. The large number of studies were conducted in high-income countries (83.9 per cent), particularly Europe and Central Asia and North America (Figure 2).



Low-income economies are defined as those with GNI (gross national income) per capita of $1,135 or less in 2022; lower middle-income economies (GNI per capita: $1,136 and $4,465); upper middle-income economies (GNI per capita: $4.466 and $13,845); high-income economies (GNI per capita: $13.846 or more) Group region and income group classification is based on the World Bank's 2024 fiscal year classification (World Bank Country and Lending Groups, 2024)

Figure 2. Distribution of Countries Contributing to Included Articles (by Region and Income Group)

Methods and Data Sources Used Across Studies

Most of the included study was cross-sectional study (*n*=39; 92.8 per cent) and three cohort studies, with over a half of study published after 2019. The dietary measurement was used over all studies, such as FFQ (food frequency questionnaire), Mediterranean Diet Score, Healthy Eating Index (HEI), KIDMED (Mediterranean diet quality index for children and adolescents), PDHI (Planetary Health Diet Index), etc. The determinant was measured by self-reported and interview.

The data collected primary from national surveys at the individual and household level, for instance United States National Interview Survey, Canadian Community Health Survey-Nutrition, *Bus Sante* Study (a cross-sectional population-based study in the State of Geneva, Switzerland), Longitudinal Aging Study Amsterdam, Belgian National Food Consumption Survey, Nutri-Net Sante Study, Health and Use of Health Cre in Italy, Italian Household Survey, Households Income and Expenditure Survey, National Health and Nutrition Survey, Italian Nutrition and Health Survey, 2nd Israeli Youth and Nutrition Survey, and National Health and Nutrition Examination Survey. Socio-economic data relied largely on household consumption, income and expenditure survey, cost of living survey, price (e.g. the 2014 GfK Consumer Scan Panel food price data) and market research (e.g. Survey Monkey, Discrete Choice Experiment).

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Socio-cultural and Economic Determinants on Sustainable Diets

A total of fifteen socio-cultural and economic determinants were identified within all included studies; ten for socio-cultural determinants and five for economic determinants. The main socio-cultural determinants measured were educational level (*n*= 34 articles; 30.1 per cent), gender (*n*= 31 articles; 27.4 per cent) and marital status (*n*= 18 articles; 15.9 percent). Furthermore, the major economic determinants were income level (*n*= 19 articles; 31.7 percent), food price (*n*= 14 articles; 23.3 percent), food security (*n*= 11 articles; 18.3 percent) and occupation (*n*= 11 articles; 18.3 percent). Table 2 provides socio-cultural and economic determinants included and frequency of use in the present review.

Table 2. Socio-cultural and Economic Determinants Included and Frequency of Use in The Present Review

Determinant	Description	Frequency count, *n*
Socio-cultural (*n*= 113)		
Educational level	Highers education attained (e.g. high school, certificate or diploma, bachelor's degree/ college, etc.)	34
Gender (social construct)	Either of two sexes (Female and male), considered with reference to socio-cultural differences rather than biological ones	31
Marital status	Married or in correlation, single-parents	18
Ethnicity	People who share a common cultural background (e.g. Asian, Hispanic, Black, White, Chinese, Korean, Japanese, etc.)	8
Geographical setting	Rural or urban residential location	7
Household size	Number of household member	5
Nutritional knowledge	Previous nutritional education/ knowledge attained	4
Cultural belief	Shared values, norm, custom that guide the group of people behavior	3
Religion/ spiritual belief	The belief in God (e.g. Christian, Seven-days Adventist, Buddhist, etc.)	2
Political ideology	Political decision, public policy, regulation, etc.	1
Economic (*n*= 60)		
Income level	Total household income	19
Food price	Price level of food, price for reference amount (cost), price of basket of food commodities	14
Food security status	Experience of food sufficiency for determined of time, e.g. food supply or food availability, food access	11
Occupation	A job or profession or working status (e.g. managerial or professional, technical, etc.)	11
Food expenditure	Range/ average/ total of expenditure for food purchased elsewhere	5

The finding also shows that socio-cultural and economic determinants were categorized into external and internal (personal and/or households) drivers. External drivers identified from socio-cultural determinants were ethnicity, gender, cultural belief (social norm), religion or spiritual belief, political interference and geographical settings. Furthermore, the internal drivers of socio-cultural determinants in the present systematic review were educational level, marital status, household size, and nutritional knowledge.

Economic determinants were classified into external and internal drivers. Food price was an external driver identified as an economic determinant in a present systematic review. The internal drivers identified as economic determinants were income level, food security status (household), occupation, and food expenditure. Eventually, socio-cultural and economic determinants on sustainable diets was presented on Figure 3.

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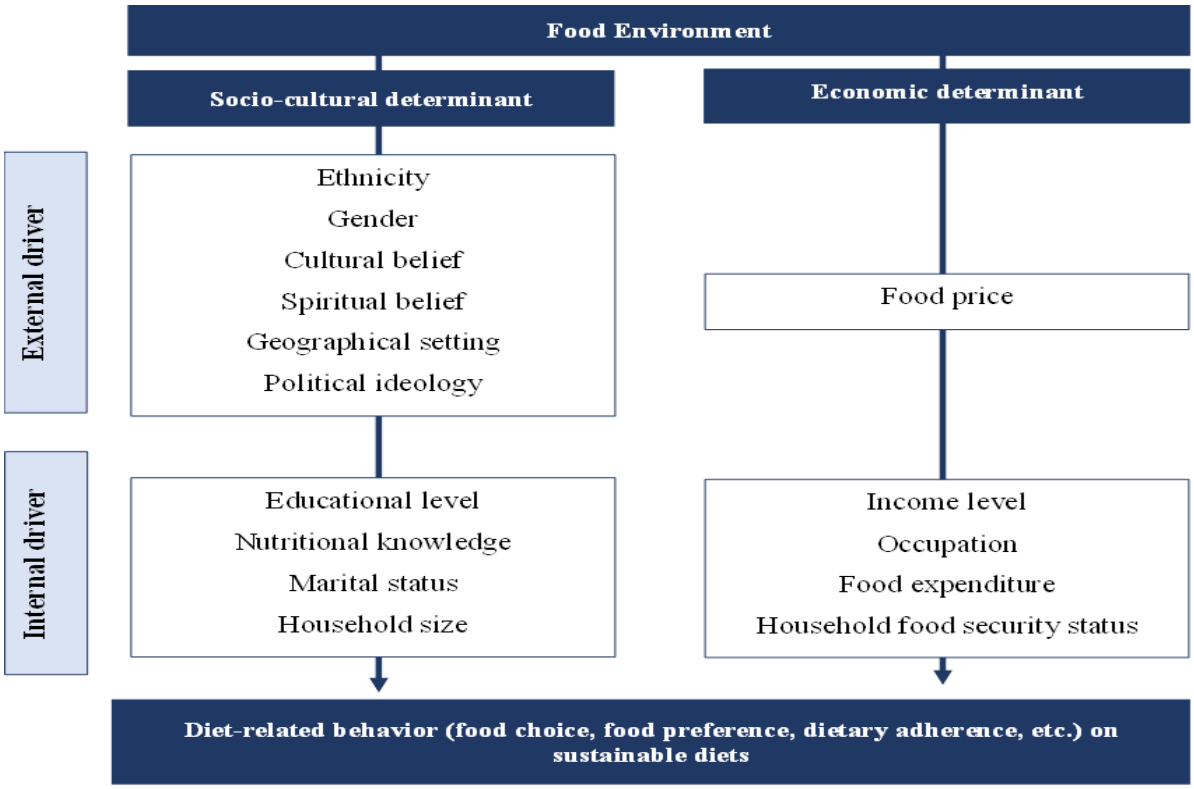

Figure 3. Socio-cultural and Economic Determinants on Sustainable Diets

Methodological Quality Assessment

The quality assessment result of included studies can be viewed in Figure 4 and S3. The result shows that cohort studies are less likely to indicate bias compared the cross-sectional studies in analytical epidemiology. However, the limitation of the present review was that the quantity of cohort studies differed from that of cross-sectional studies. The selection of the study was an essential indicator that must be established from the commencement of the study to prevent biases, such as the representativeness of exposed cohort or sample, sample size, and ascertainment of exposure.

In cohort studies, non-response or non-participation bias can influence findings, even in prospective designs with rigorous follow-up protocols, while retrospective cohorts are particularly susceptible to missing data from previously collected records. Cross-sectional studies are prone to systematic bias when using dietary questionnaires, which may be affected by recall errors and often require validation tailored to specific study populations and locations. These biases have the potential to overestimate or underestimate associations, highlighting the importance of cautious interpretation of results and the need for improved methodological rigor in future research.

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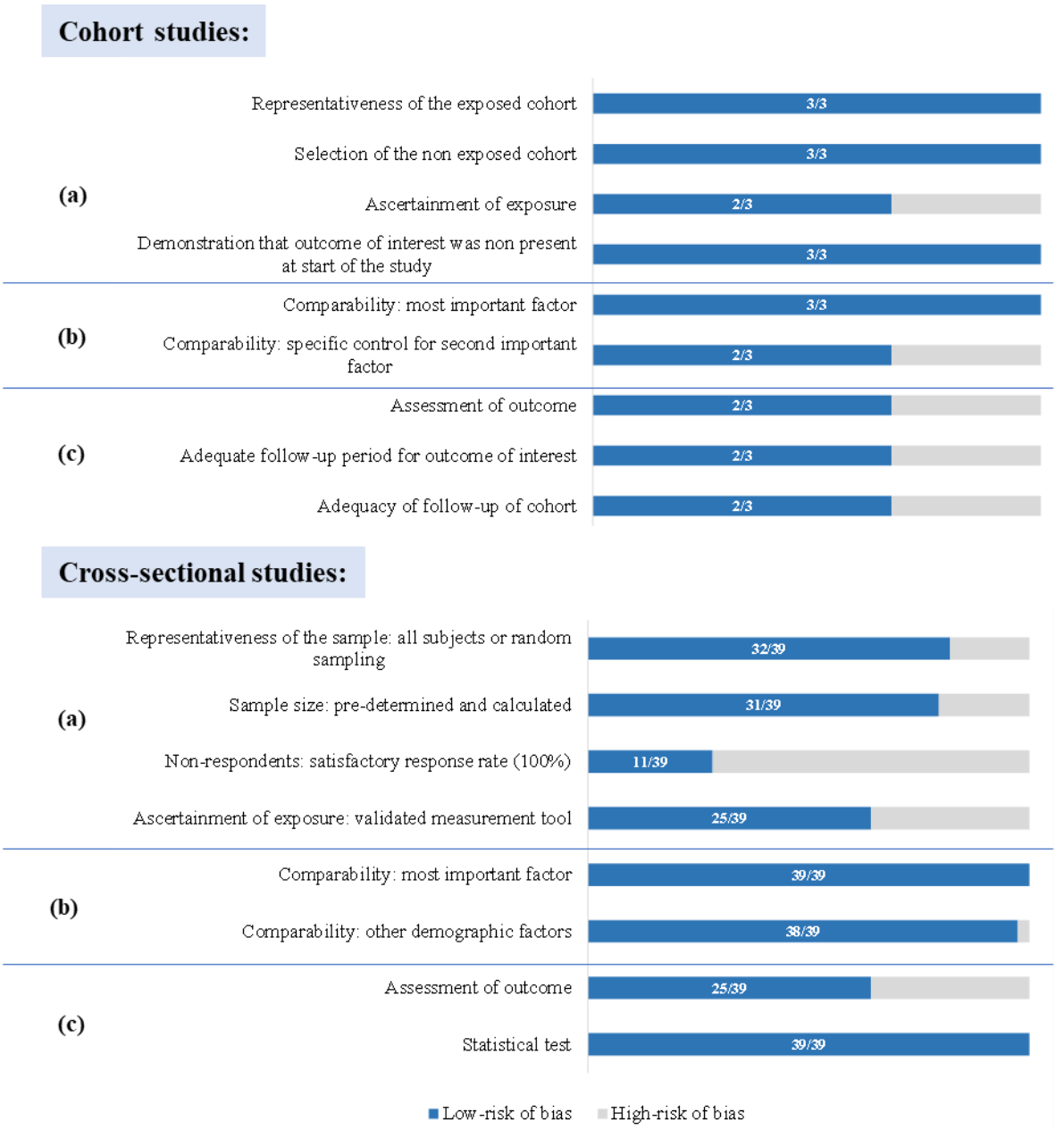

Figure 4. Risk of Bias Assessment of Included Studies on the Present Systematic Review

DISCUSSION

The varied definitions of "sustainable diets" show that this approach is adaptable across diverse settings and income levels, reflecting unique environmental, cultural, economic, and social contexts in each region. While there is no universal definition, sustainable diets are generally recognized as those that support health, minimize environmental impact, and are economically and culturally viable. High-income countries often emphasize reducing meat and increasing plant-based foods, while lower-income regions may prioritize food security, local food systems, and affordability. Despite these differences, sustainable diets share a common goal: promoting practices that benefit both human and environmental health in adaptable ways across regions.

Sustainable diet practices are found in all income countries. However, most investigations are still conducted in high-income countries. It aligns with the finding that most of the study was conducted in Europe, Central Asia, and North America, where most countries have a GNI (gross national income) per capita of $13,846 or more. Similar finding was found in a previous review that identified indicators of sustainable diets

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widely used also in high-income countries.[36] Since the present review provides an overview of sustainable diets, the result cannot be stated that the most prevalent sustainable diet practices are in high-income countries.

The review reveals a significant concentration of studies conducted in high-income countries, which could limit the generalizability of findings to lower-income settings. Future research should focus on expanding studies within low-income regions to develop a more comprehensive understanding of sustainable diets that consider plant-based local food systems, affordability, and access constraints. Such research could inform policies and interventions tailored to diverse economic contexts, promoting more globally applicable sustainable dietary practices.

Transforming the current diet to the sustainable eating pattern requires a comprehensive understanding towards external and the individuals' acceptance is essential consideration. Sustainable diets are defined as eating patterns that promote beyond individual health dimensions, particularly declining environmental consequence. These diets also need to be socio-culturally acceptable and economically accessible for individuals.[18,37–39]

Understanding diet-related behaviors such as food choice, food preference, and dietary adherence is essential for dietary and health transformation, and environmental sustainability.[40] The food environment has been characterized and recognized as an important factor influencing dietary decisions. Swinburn et al., [41] describe the food environment as the physical, economic, policy, and sociocultural contexts, opportunities, and conditions influencing people's food choices and nutritional status. Income, price, personal preferences and beliefs, cultural traditions, and geographical, environmental, social, and economic determinants all have a multiple impact on food consumption patterns.[42–44]

Socio-cultural Determinant: External Drivers

Overall, studies identifying ethnicity as a determinant in sustainable dietary practices are predominantly focused on Asian populations, even when conducted in Canada and the United States. Cultural identity significantly influences sustainable food choices in many societies, yet research has primarily examined this relationship within the context of maintaining cultural traditions among migrant populations.[45] The significant prevalence of meat-free eating patterns among Asians migrant population in North America might be attributed to cultural or religious factors, with components of meat exclusion seen in Hinduism and Jainism.[46] The current cultural transmission of planetary diet practitioners may differ in Western societies (Canadian and American), where the practitioner is frequently framed as a personal dietary choice made for health or ethical reasons rather than a spiritual or cultural concern.[47]

Another social construct that forms the social determinants of sustainable diets is gender. Thirty-one articles stating that women are the highest proportion practicing sustainable diets, particularly in vegetarian, plant-based, or Mediterranean diets. Gender represents many of the conceptual and normative dimensions of dietary behaviors. Beliefs about femininity or masculinity influence gendered food selection, such as the power and masculinity associated with meats.[48,49] Women, for example, consume fewer calories but lighter meals with delicate foods like vegetables and fruits.[49] In patrilineal civilizations, men are given preferential treatment for prestigious animal-based diets.

Spiritual beliefs still influence diet-related behaviors; one example of how culture shapes food choices.[50] Given that religions have set criteria for what is permissible or forbidden to consume and how food should be considered.[51] The finding shows that five articles concerning cultural and spiritual beliefs in shaping sustainable dietary patterns. According to Scannell et al.,[52] the Mediterranean diet can be challenging for some people to follow because of differences in food flavors and social norms. Cultural food traditions often create barriers, as people may find it hard to adjust to the unique flavors and customs of the Mediterranean diet. However, the findings may be correlated with non-Mediterranean study settings.

In Loma Linda, United States, there was 65.1 per cent of plant-based diet participants reported spiritual beliefs. The study site may influence the findings, as Loma Linda is one of the world's five Blue Zone cities, defined by people living a healthy lifestyle and having a higher life expectancy.[53] Loma Linda is mostly a Seventh-day Adventist community that encourages a plant-based diet while allowing eggs and dairy products. Pork, shellfish, and other animal-derived items are strictly discouraged.[53,54]

Geographical differences, measured by residency, are also one of the findings in the present review in transitioning sustainable diet choices. Most of the articles show that urban residential locations positively impact shaping plant-based consumption behavior. The results may correlate with food availability (supply chain), accessibility, personal knowledge and lifestyle, and food cultural settings. Furthermore, urban

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cultivation systems in and around the city are mainly influenced by the food availability and cost of resources (e.g., land), the prevailing (and often limiting) climatic conditions, types of energy sources and market prices.[55]

Hence, another finding showed that more sustainable diets were consumed by rural individuals with higher socio-economic status.[56] The findings may represent that accessibility towards sustainable diets in rural settings is also high. The food systems perspective in rural settings is critical because it considers the processes and people involved in food production, distribution, marketing, and regulation. However, relatively few studies have directly engaged with the local food environment as the bridge connecting food production and dietary choices.[57–59] The difference in findings is most likely due to the distinct socio-cultural and economic situations in which these studies were conducted in different strategies, topics, and settings.

Political ideology is an external socio-cultural determinant that influence plant-based diets. Tiganis et al.,[60] stated that political ideology may influences food preferences and food choices. In Copenhagen, political motivation estimated for one point six per cent of people starting the sustainable diets.[61] Moreover, several previous research concluded critical considerations to the socio-political and cultural barriers may influence on the diets.[62,63] It was provoking to further research, since most study investigated that health is still the primary concern in consumer behavior on the sustainable diets.[64]

Specific interventions targeting socio-cultural determinants, in term of awareness of the addressing between people, planet, and food are essential recommendations for transforming to more sustainable.[64–67] Consequently, a demand to revert to more traditional diets, which occasionally may not require with ecological and healthy concern, may also warrant some considerations.[68] Appealing to transitioning from traditional diets to more sustainable dietary habits necessitates country-specific consideration and a better understanding of national food systems and their impact on food cultures and dietary pattern.[67]

Socio-cultural Determinant: Internal Drivers

The educational level was the essential dietary-internal driver for socio-cultural determinants of long-term diets (n = 34). One possible reason for the association between vegetarianism and higher educational level is that more education indicates a higher socio-economic status.[69] Another possible explanation is that better-educated individuals are more knowledgeable about the unsustainability of animal-based foods, which may affect their decision to avoid meat products. The correlation between vegetarianism and a higher level of education might also be explained by the fact that individuals with a higher level of education are more conscious about health and the environment.[70] In addition, the correlation might be attributed to secular trends in education, which suggest that individuals have a greater educational level.[71,72]

According to Davey et al.,[71] education is strongly associated with adopting meatless diets. Furthermore, research has shown that education influences dietary choices by either facilitating or restricting the ability to take the information offered in nutrition education.[73] Social status differences in the barrier to healthy eating have been defined, where low-educational individuals lack knowledge about healthy eating compared with higher-educational individuals.[69]

The finding also shows that four articles stated that nutritional knowledge had influenced sustainable diet practices. In the previous study, increased perceived knowledge was associated with increased Mediterranean diet score.[74] Another study conducted in Belgium, Denmark, the Netherlands, and Spain also found that knowledge about plant-based diets and perceiving such diets as tasty and enjoyable contributed significantly to the likelihood of perceiving plant-based diets as more appealing than vegetarian and vegan diets.[75] Attitudes that could assume intentions to perform a particular behavior and knowledge are necessary, but more steps toward behavioral change are needed.

Evidence from Poland described that individuals are unfamiliar with the term of "sustainable diets" and those with a limited understanding regarding the meaning, such as perceiving a sustainable diet as an "energy-balanced diet."[63] Therefore, public health professionals must continue to re-align the term with its multifaceted meaning, as well as advocate for and be involved in an ecological public health strategy to encourage more sustainable consumption, from raising awareness to developing policies.[67]

Marital status and household size are another food-internal-social determinant towards sustainable diets. According to Cramer et al.,[69] individuals in correlation were 0.73 times more likely to adopt a vegan diet than individuals not in correlation. However, another study concluded that marital status was unrelated to the Mediterranean diet adherence.[76]

Marital status is considered a social network measure and may be correlated with dietary adherence. Furthermore, how the construct is operationalized determines whether social support is related to favorable or

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adverse health outcomes and health behaviors. Expected social support (potential availability) and the network's size frequently encourage connections; however, experienced social support (retrospective appraisal of support received) tends to have a negative correlation with health and health-related behaviors, including dietary practice.[77]

Economic Determinant: External Drivers

Since the relevance and advantages of eating habits that shift towards sustainable diets are widely acknowledged, more information is required regarding the economic determinants of such changes, such as diet affordability and costs.[9,78] Although health and sustainability are desired outcomes of consumer choices, affordability frequently takes precedence, which may influence the adoption of sustainable healthy diets, particularly among low-income consumers.[30,79]

Cost is generally a significant determinant of food choices. A perception of the average cost associated with diet selection and monthly income had a beneficial and substantial influence.[80] Price is one possible factor causing decreased adherence to a Mediterranean diet among low-income consumers. One study found that Mediterranean foods are more expensive than Western products. Consequently, low-income populations cannot afford them and frequently opt for a nutrient-poor diet.[81] Conversely, another research demonstrates that a low-environmental footprint diet is less expensive in urban and rural locations but has inferior food quality. More sustainable diets had outstanding diet quality, lower diet expenses, and a more considerable environmental impact in Mexico.[56]

Participants in the previous survey expressed a readiness to consume more plant-based diets provided markets offered a more comprehensive range of plant-based options.[61] Prices significantly impact individual's eating choices.[66] It was highlighted that no one adopted sustainable diets due to cost savings, implying that the foods may need to be more affordable in order to be a primary driver for dietary change. However, the availability and food price of plant-based foods varies depending on the product.

Plant-based foods, including legumes and grains are commonly available, accessible, and significantly affordable than animal-based foods for instance red meat. A widespread shift to sustainable diets requires support from government policy, health experts, and the food sector. It is recommended that the government focus on maintaining the stability of food supply and prices, particularly for local food products that align more closely with sustainable diets. This would ensure that such foods are readily accessible to the public, both physically and economically.[82] Furthermore, markets must provide a broader range of plant-based alternatives to meet the nutritional requirements of individuals following plant-based diets.

Economic Determinant: Internal Drivers

There were nineteen articles stating that income levels are associated with sustainable diets. Most studies found that the planetary healthy diet index positively correlates with per capita income, meaning the higher the income per capita, the higher the sustainable diet index score.[83] Previous studies also found that a higher household income level was significantly correlated with adherence to the Mediterranean diet.[84,85] Individuals in higher income levels have more affordable and accessible options to meet the healthy food.

Compared to meat-eating individuals, vegetarians were more likely to be young, have a higher education, and have a low income. Pescatarians were more likely to be women, whereas flexitarians were more likely to be women and have a lower income.[72] Eini-Zinab et al.,[86] found that lower socio-economic status (income households) has a more sustainable diet.

In a prior study, income was found to be adversely related to following a vegetarian diet, with those earning more being more likely to eat more animal-based foods. The correlation between income level and animal-based foods intake differs significantly depending on the settings or locations (countries). For example, German research showed no correlation between vegetarianism and income.[87] However, a Canadian and French study revealed a link between low income and vegetarianism.[79,88]

The economic status was also determined by occupation and food expenditure due to long-term healthy diet choices. Occupation also indicates the availability of monetary and food resources, precisely defining dietary quality.[81,86,89] The findings suggest that meat consumers had more significant food expenditures (both at home and away from home). Plant-based eaters do not spend more.[90] As a result, it might be a potential aspect for promoting plant-based diets, particularly for low-income countries, by assuring food security.

Low adherence to the Mediterranean diet correlates with increased food security.[91] Another study found that more plant-based diet practitioners are food secure rather than insecure.[92] Transforming sustainable

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food systems are widely acknowledged. Food system sustainability is necessary for long-term food and nutrition security regarding food availability, accessibility, utility (consumption), and stability.

All food environment components require to be more sustainable, resilient, and practical to ensure food and nutrition security for present and future generations. Food sustainability and nutrition and food security are aligned at the global, local, and household level. Many approaches may accomplish sustainable transitions in food systems, including catalyzing efficiency through sustainable diets.

Before re-formulating sustainability communication to encourage more sustainable diets, researches, policy-makers, and public health nutritionist are required to determine the gaps and intricacies of food systems and the multifaceted character of sustainability. A comprehensive framework could be an appropriate place to initiate the integrating barrier, challenge, outcome, determinant, and other multiple compromises. Furthermore, addressing individual behaviors, including shifting the dietary changes, is considered a more politically acceptable methods, but it requires a high level of government and has limited population impacts.[67,93]

CONCLUSIONS

Addressing the social, cultural, and economic determinants in community is prerequisite for transforming more-sustainable diets. Food sustainability and nutrition and food security are aligned at the individual and household level. To promote sustainable diets, programs should focus on the environment, social norms, and economic factors. Community-based education can help people understand the benefits of sustainable diets. Schools and workplaces can offer meals that introduce these foods, normalizing them for broader acceptance. Moreover, cooking classes and cultural food events can introduce new recipes in a familiar, enjoyable way, making sustainable diets easier and more appealing to adopt. Lastly, the government should ensure the stability of food supplies and prices, particularly for local foods that promote sustainable diets, to enhance public accessibility both physically and economically.

Many approaches may accomplish sustainable transitions in food systems, including catalyzing efficiency through sustainable diets. Furthermore, Comprehensive strategies targeting multiple levels, and multiple settings are required to enhance dietary changes on sustainable diets. Future research should focus on the cost-effectiveness of dietary transformations, especially in low- and middle-income countries. Key questions could include exploring the economic benefits of adopting sustainable diets at household and national levels, as well as assessing the long-term health and healthcare cost impacts. Research methods such as cost-benefit analysis, economic modeling, and randomized controlled trials could provide valuable data on the affordability and effectiveness of sustainable diets, helping to inform policies and interventions that can be applied in various economic contexts.

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