Using Evidence Mapping to Examine Motivations for Following Plant-Based Diets

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ABSTRACT

Motivations to adopt plant-based diets are of great public health interest. We used evidence mapping to identify methods that capture motivations to follow plant-based diets and summarize demographic trends in dietary motivations. We identified 56 publications that described 90 samples of plant-based diet followers and their dietary motivations. We categorized the samples by type of plant-based diet: vegan (19%), vegetarian (33%), semivegetarian (24%), and other, unspecified plant-based diet followers (23%). Of 90 studies examined, 31% administered multiple-choice questions to capture motivations, followed by rate items (23%), Food Choice Questionnaire (17%), free response (9%), and rank choices (10%). Commonly reported motivations were health, sensory/taste/disgust, animal welfare, environmental concern, and weight loss. The methodological variation highlights the importance of using a structured questionnaire to investigate dietary motivations in epidemiological studies. Motivations among plant-based diet followers appear distinct, but evidence on the association between age and motivations appears limited. *Curr Dev Nutr* 2020;4:nzaa013.

Keywords: vegetarian, vegan, flexitarian, plant-based diets, motivations, Food Choice Questionnaire, evidence mapping

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Introduction

The term "plant-based diet" is typically used to describe dietary patterns primarily limited to foods derived from plants (i.e., fruits, vegetables, legumes, whole grains, nuts, and seeds), but that can include various types and amounts of animal products (i.e., honey, eggs, dairy, meat, and fish) (1). Followers of plant-based diets can adapt their dietary patterns to personal preference, resulting in a spectrum of abstention from animal products that ranges from strict veganism (no animal products) to semivegetarianism (occasional inclusion of meat) (2, 3).

Diet-related chronic diseases have been a major focus of public health efforts (4). However, progress is still slow because the prevalence of these diseases remains high. In the United States, ~40% of adults and ~19% of youth are classified as obese (5). Additionally, ~12% of adults have diabetes (6) and ~12% have heart disease (7). In light of the growing burden of chronic illnesses, plant-based diets are a growing area of interest in public health because there is some evidence that they offer a healthier (2, 8, 9) and more sustainable (10–12) alternative to the typical Western diet consumed in the United States (13–15). In particular, meta-analyses of observational studies found that plant-based diets were associated with reduced risks of ischemic heart disease (16), cancer (16), and type 2 diabetes (17).

Despite these potential benefits, consumption of plant-based diets remains low. Less than 10% of Americans reported following a vegetarian or vegan diet (18, 19), and an analysis of the NHANES 2007–2012 found that <2% of US adults were non–meat eaters (20). At the same time, however, interest in reducing meat consumption is growing: a Nielsen survey in 2017 found that 39% of Americans strived to eat more plant-based foods (18). This interest is expected to continue increasing and, thus, an examination of the motivations for adopting a plant-based diet could offer insight into the current appeal of these dietary patterns and inform strategies that empower individuals to decrease meat consumption and increase fruit and vegetable intake.

There are various reasons for choosing and customizing a plant-based diet, including to improve health, promote animal welfare, and/or curb the environmental impact of meat and dairy production (21). In recent decades, motivations to adopt plant-based diets have been widely studied in the fields of sociology, psychology, and nutrition. For instance, researchers have investigated possible relationships between dietary motivation for choosing plant-based diets and: dietary restraint

(22–37), personality (26, 38, 39), disgust sensitivity (32, 40–42), attitudes toward animals and pets (41, 43–47), dietary intake (34, 40, 48–51), physical activity (23, 29, 33, 34, 49–51), and other potential attributes related to psychological traits and health behavior (23, 50–53).

However, the methods of capturing dietary motivations are diverse, making it difficult to organize and assess across the literature. Methods range from the Food Choice Questionnaire (FCQ) (25, 26, 31, 54–58), which asks participants to rate their level of agreement (on a Likert scale) with 36 statements related to determinants of their food choices, to questionnaires that list motivations for selection (27, 28, 33, 34, 38, 40, 43, 45–47, 49, 50, 52, 59–61) or provide a free response option (35, 44, 48, 62–65). Given the heterogeneity of these methods, evidence mapping would be appropriate for summarizing the available evidence on motivations to adopt plant-based diets.

Evidence mapping is an emerging technique in nutritional epidemiology and has been used to review and summarize published research in a variety of investigative fields (66–73). Evidence mapping is a type of mapping review (74), and its process often consists of a systematic search for publications on a broad topic, a presentation of the results (such as a table or diagram), and the identification of the gaps in the knowledge (75). Unlike systematic reviews, evidence mapping does not typically focus on a specific research question or analyze data on study results (69, 70, 76). Rather, as a more comprehensive approach, evidence mapping aims to capture the overview of the existing research on the topic, especially the trajectory of investigation and variations in methodology (70). Typically, PICO (population, intervention, comparator, outcomes) information is captured (76).

We used evidence mapping to summarize the existing research on motivations to adopt a plant-based diet. Specifically, the diversity in research questions and methods of examining dietary motivations warrants a comprehensive picture of the current evidence on motivations to follow a plant-based diet. Thus, our first objective was to determine how methods of capturing motivations to adopt plant-based diets have evolved over time. Our second objective was to identify key motivations for following plant-based diets and determine which populations—namely, age groups and types of plant-based diet followers—require further investigation. Our final objective was to determine whether dietary motivation is related to age. This aim expands our work beyond the typical scope of an evidence map and includes an assessment of results with the purpose of summarizing the trends in dietary motivations in the context of age and type of plant-based diet with the available evidence. Our evidence maps identified gaps in the research and recommended strategies for future studies that would help elucidate the demographic trends in dietary motivations.

Methods

We followed the 3 main steps of evidence mapping outlined by previous studies employing this technique (69, 70, 72, 73, 76). First, we (AJM and NMM) specified our topics of investigation, which were *1*) the evolving methods of capturing dietary motivations of plant-based diet followers, and *2*) the possible association between age and motivation to adopt a plant-based diet.

As the second step, 1 investigator (AJM) systematically searched and screened relevant publications based on established criteria. Finally, data were extracted from these studies and reported on variables of interest in 2 comprehensive "maps" of evidence from existing research, one describing the evolution of methods to capture plant-based diets and another showing possible associations among dietary motivation, type of plant-based diet, and age.

Search strategy

Our aim was to obtain all observational studies that investigated the dietary motivations of plant-based diet followers. Two systematic and reproducible searches were conducted in each of these databases: MEDLINE, CINAHL, and PsycINFO. For the first search (MEDLINE, August 25, 2018; CINAHL, October 27, 2018; and PsycINFO, October 27, 2018), keywords related to motivations and plant-based diets were used. Possible relationships between motivations for adopting a vegetarian diet and risks of eating disorders had been widely studied (22–36, 77), so for the second search (MEDLINE, August 26, 2018; CINAHL, November 26, 2018; and PsycINFO, November 18, 2018), keywords related to eating disorders and plant-based diets were also used. However, studies on populations with diagnosed eating disorders were excluded. The search terms are listed in **Supplemental Table 1**. These terms were searched in all fields including title, abstract, subject heading words, and keyword heading words. The searches extended from the inception of each database (1946 for MEDLINE, 1981 for CINAHL, and 1967 for PsycINFO).

Abstract screening and hand search

The publications collected from the 6 searches (2 searches per database) were screened in 2 phases using a priori selection criteria. For the first phase, the abstracts of the publications identified in the databases were screened. A low threshold of inclusion was used to consider all potentially relevant publications. For a publication to be selected at this phase, its study (or studies) must have: *1*) been published in English; *2*) been observational; *3*) investigated a sample of healthy plant-based diet followers (i.e., not having any diagnosed conditions such as eating disorder); and *4*) reported quantitative data on dietary motivations. Qualitative studies were excluded because their objectives were primarily to investigate the complexities of dietary motivations (i.e., personal experiences that motivate an individual's decision to adopt a plant-based diet; how an individual modifies his or her motivations over time) through in-depth interviews and not necessarily to assess the dietary motivations in large samples. Bibliographies, reviews, case reports, letters, animal studies, and clinical studies were also excluded. The inclusion and exclusion criteria of abstract and full-text screenings are listed in **Supplemental Table 2**.

We examined the reference list of each publication selected in the abstract screening. If a title included a word related to plant-based diets or motivations, we screened the corresponding abstract based on the same selection criteria.

Full-text screening

Full-text manuscripts of the results from abstract screening were obtained, and additional inclusion criteria were applied to further restrict the results to studies that investigated multiple motivations and reported sufficient data for analysis. For a publication to be selected at this phase, its study (or studies) must have reported data on: *1*) motiva-

tions of plant-based diet followers; and *2*) ≥1 health motivation and ≥1 ethical motivation.

Data extraction

We examined the eligible publications and extracted data on publication year, demographic profile of the sample, categories of plant-based diet followers, methods of capturing data on dietary motivations, and categories of dietary motivations. For 4 of the identified publications with analyses on dietary motivations, we retrieved information about the research methods and demographic profile of participants from previous publications (49, 60, 78–83).

Identification of plant-based dietary patterns

For each publication, we documented the terms and their definitions that each publication used to describe followers of plant-based diets. These were grouped into 4 broad categories: *vegan* (excludes all animal products), *vegetarian* (excludes all animal flesh, including red meat, poultry, and seafood but can or cannot include dairy and/or eggs), *semivegetarian* (limits animal flesh to an extent), and *plant-based diet followers* (data available only on mixed samples of *vegan*, *vegetarian*, and *semivegetarian*).

Categorizing methods of capturing dietary motivation

We extracted the method reported to capture dietary motivations and grouped the methods into 6 categories—free response, multiple choice, rank choices, rate items, FCQ, and not reported.

Determining and categorizing the most prevalent motivations

We determined the most prevalent motivation for adopting a plant-based diet in each category of plant-based diet followers (vegan, vegetarian, semivegetarian, or plant-based diet followers). Data on the motivations were presented differently across publications. For studies that reported the distribution of responses, the motivation with the highest frequency of endorsement was determined as the most prevalent. For studies that prompted participants to assign a value (often on a Likert scale) to each motivation, data were then reported as the mean value in the sample, and the motivation with the most favorable mean value was determined as the most prevalent. For studies that prompted participants to assign a value to each motivation and, subsequently, performed a regression analysis that predicted choice of dietary pattern, the motivation with the greatest significant effect was determined as the most prevalent. We grouped the most prevalent motivation observed in each sample into 3 broad categories: *ethical*, *health*, or *other* (which included a diverse group of motivators such as sensory factors, politics, finances or cost, social influences, familiarity, habit, mood, convenience, natural content, and so forth, that were investigated in a limited number of studies). There were insufficient data to isolate and group the specific *other* motivations that were less prevalent or not investigated as part of the questionnaire administered to participants. Furthermore, several studies reported data on these broad health categories compared with ethical categories without providing a breakdown of specific motivations (28, 29, 41, 45–48, 51, 61). By grouping motivations into 3 categories (health, ethical, and other), we allowed the inclusion of the maximum number of studies.

Describing the age profile of each sample

For each sample of plant-based diet followers, the reported mean or median age (years) was recorded. If the age range of the sample was reported to be ≤5 y, the midpoint was recorded and presented as the estimated median age. Some publications provided the demographics separately by dietary pattern, whereas others reported the combined demographics of both plant-based diet followers and omnivores. Wherever possible, the mean or median age of the plant-based diet followers was recorded ($n = 46$). Otherwise, the combined age of plant-based diet followers and omnivores was recorded because in these studies, age was presented for the overall sample ($n = 35$). Publications that did not report a mean age, median age, or an age range within 5 y were excluded from analyses examining age (35, 43, 50, 52, 84).

Constructing evidence maps

Forms of evidence mapping include descriptive (66) or visual (69, 70, 72) representations of data compiled from the literature. For the present study, 2 weighted scatter plots were constructed in Microsoft Excel, and they convey data in 4 dimensions (*x*-axis, *y*-axis, bubble color, and bubble size). In both plots, each bubble represents a sample of plant-based diet followers. Bubble color conveys the type of plant-based diet (vegan, vegetarian, semivegetarian, or plant-based diet follower), and bubble size conveys sample size. One weighted scatter plot depicts the publication year on the *x*-axis and the method of capturing dietary motivation on the *y*-axis, and the other plot depicts age on the *x*-axis and the most prevalent motivation on the *y*-axis.

Results

Literature search and screening

Figure 1 shows the results of systematic searches for publications on quantitative and observational studies of motivations to adopt plant-based diets (1946 to November 2018). The searches in MEDLINE, CINAHL, and PsycINFO identified 631, 331, and 545 publications, respectively, resulting in a total of 1507 publications. This total number includes publications that were extracted from >1 database and hence does not represent the number of unique publications. The 1507 abstracts were screened, yielding 45 potentially relevant publications. An additional 25 potentially relevant publications were identified via hand search. The 70 (45 + 25) publications were reviewed at the full-text level, and 56 were identified as meeting the defined inclusion criteria.

Characteristics of samples

The 56 identified publications included 90 samples of plant-based diet followers, because certain publications provided data on >1 plant-based diet population. All observational studies were cross-sectional. Several publications grouped participants by type of plant-based diet (36%, $n = 20$). In some analyses on motivations, participants were grouped by gender (32), age (34), or ethnicity (59). Other studies recruited plant-based diet followers at 2 different points in time (37, 55, 84). Regardless of how participants were recruited and grouped for analyses, each separate group with reported data on motivations was considered as a "sample." As a result, 25 publications (44%) contained multiple samples. The studies were classified into 3 target populations based on age range and/or recruitment: adolescents, college students, and those recruited

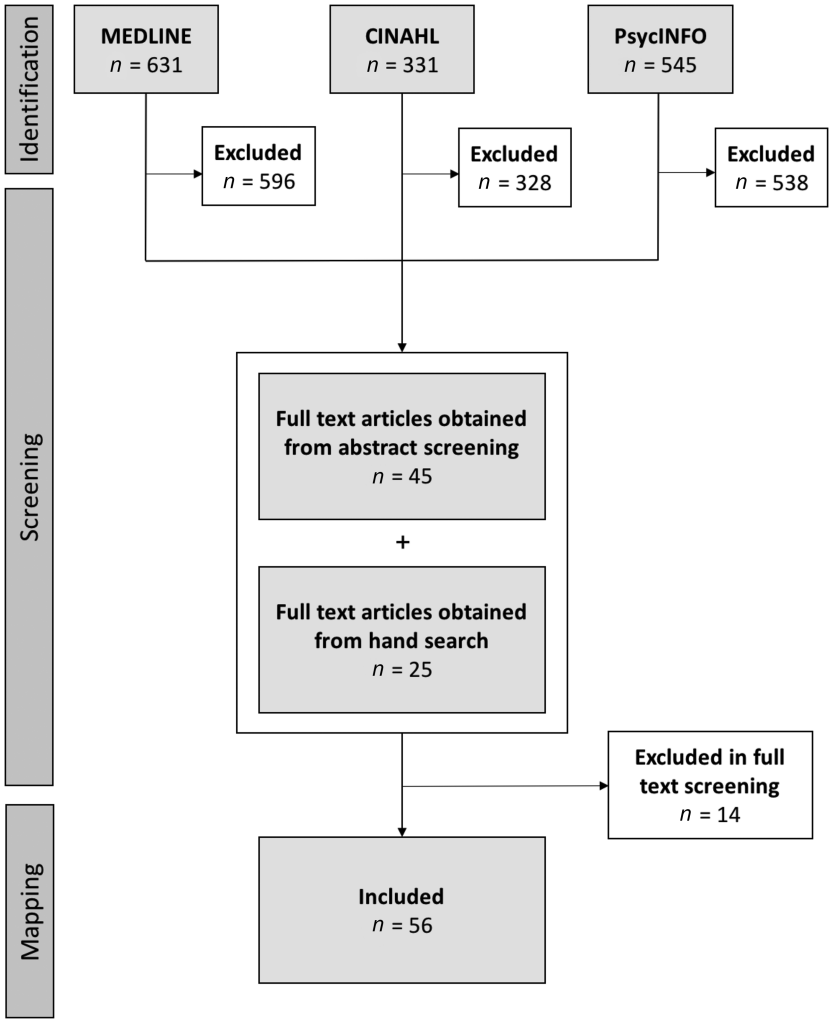

FIGURE 1 Flow diagram of literature search and screening results.

from the general population that included both adolescents and adults. Two studies combined data on adolescents and young adults (aged 11 to 20 y) (33, 48). Five samples were recruited from middle schools and high schools (31, 33, 36, 48, 85), and 3 samples were recruited by mailing questionnaires (34, 64). In all, 8 samples consisted primarily of adolescents. Nineteen samples were recruited from university students (22, 25–27, 30, 32, 34, 35, 37, 43, 62, 86). The age range was not reported in 13 (68%) of these samples, but we estimated the age range of this category to be about 18–23 y. Sixty-three samples were recruited from the general population. The estimated age range was 13–99 y with missing information about the age range in 34 samples (54%). **Table 1** summarizes the characteristics (sample size, percentage female, and region) of all 90 samples organized by the target population (adolescents, college students, and general population). We defined "small" sample sizes as $n = <200$, "medium" as $n = 200–400$, and "large" as $n > 400$. The education profile (percentage with bachelor's degree or higher) is also reported for samples of the general population. Mean BMI was omitted because it was reported for only 27% ($n = 24$) of the samples.

Plant-based dietary patterns

Different approaches were used to categorize followers of plant-based diets in observational studies. For instance, studies asked participants to self-identify their dietary pattern (22, 24, 27, 29, 30, 34, 35, 38, 41, 46, 47, 49, 50, 53, 55, 56, 61, 64, 85–89), to indicate the animal-based foods that they consumed or avoided (32, 39, 40, 45, 51, 52, 62, 84, 90, 91), or to complete a questionnaire about their frequency of meat consumption (26, 60, 65, 92, 93). Other studies applied a combination of the above (25, 28, 33, 36, 37, 43, 44, 54, 57, 59, 79, 82, 94).

The studies used various terms to describe plant-based diet followers. The publications, terms, definitions, and categories are listed in **Table 2**. The definition of the term *vegan* was consistent across studies and was defined as a dietary pattern that excludes all animal products, including red meat, poultry, seafood, dairy, and eggs. Only 1 study made the distinction between *strict vegan* and *moderate vegan* (90). All samples that were labeled with the term *vegan* were compiled under 1 category. Nineteen percent ($n = 17$) of the samples were categorized as *vegan*.

TABLE 1 Characteristics of study participants in research samples of plant-based diet followers

Characteristic	Total ($n = 90$)	Adolescents ($n = 8$)	College students ($n = 19$)	General population ($n = 63$)
Sample size, *n* (%)				
≤50	35 (39)	3 (38)	13 (68)	19 (30)
51–300	40 (44)	4 (50)	5 (26)	31 (49)
301–600	7 (8)	0 (0)	0 (0)	7 (11)
601–900	4 (4)	1 (13)	0 (0)	3 (5)
>900	4 (4)	0 (0)	1 (5)	3 (5)
Percentage female, *n* (%)[1,2]				
≤25	1 (1)	0 (0)	1 (5)	0 (0)
26–50	2 (2)	1 (13)	0 (0)	1 (2)
51–75	19 (21)	2 (25)	5 (26)	12 (19)
76–100	53 (59)	5 (63)	13 (68)	35 (56)
Percentage with bachelor's degree or higher, *n* (%)[3,4]				
≤40	—	—	—	6 (10)
41–60	—	—	—	6 (10)
61–80	—	—	—	10 (16)
Region, *n* (%)				
North America	51 (57)	3 (38)	12 (63)	36 (57)
Europe	31 (34)	4 (50)	3 (16)	24 (38)
Australia/New Zealand	4 (4)	1 (13)	0 (0)	3 (5)
Middle East	1 (1)	0 (0)	1 (5)	0 (0)
Multiple	3 (3)	0 (0)	3 (16)	0 (0)

[1]Thirteen studies did not report the sex proportion of the plant-based diet followers or the overall sample.
[2]Five studies reported the sex proportion of plant-based diet followers. Other studies reported the sex proportion of the overall sample combining omnivores and plant-based diet followers. This table reports the sex proportion of plant-based diet followers wherever data are available. If unavailable, the sex proportion of the overall sample is reported.
[3]Nineteen studies reported the education level of the recruited participants. This table excludes information on 3 studies that reported mean education level in years, and 2 studies with ambiguous descriptions of education level.
[4]Ten studies reported the education level of plant-based diet followers, and the remaining 4 studies reported the education level of the overall sample combining omnivores and plant-based diet followers.

Discrepancies in the definition of the term *vegetarian* were observed. For the purpose of this review, *vegetarian* is a dietary pattern that completely excludes all animal flesh, including red meat, poultry, and seafood but can include dairy and/or eggs (31, 37, 43, 52, 56, 57, 59, 62, 82, 92). Hoffman et al. (52) noted that "[a]ll vegans are vegetarians but not all vegetarians are vegans." Using the commonly accepted definition of *vegetarian*, the aforementioned studies included individuals abstaining from meat, some of whom might have been vegan. Some studies had samples that included vegetarians but excluded vegans (37, 39, 41, 43, 45–47, 54, 61, 82), whereas others combined vegetarians and vegans for analyses (24, 26, 33, 52, 65, 77, 78, 84). Some studies used other terms to describe what we classify as *vegetarian,* such as *strict vegetarian* (45), *full vegetarian* (24), *restricted vegetarian* (33), *lacto-/ovo-/lacto-ovo-vegetarian* (26, 39, 54, 65, 84), *meat avoider* (32), and *meat abstainer* (93). Regardless of the term used, if a sample of plant-based diet followers was described to be completely abstaining from all types of animal flesh (and was or was not following a vegan diet), the sample was included in the category of *vegetarian*. Thirty-three percent ($n = 30$) of the samples were *vegetarian*.

Compared with *vegan* and *vegetarian, semivegetarian* is the least stringent and the most diverse family of plant-based diets. In this study, we defined *semivegetarian* as a plant-based dietary pattern that allows intake of animal flesh to a limited extent. *Semivegetarian* diets have variation in the permitted types of animal flesh: fish and/or poultry (24, 26, 33, 77), fish only (24, 26), and specific type(s) of meat chosen by the individual (37, 45, 62). *Semivegetarian* can also refer to diets that limit the overall intake of meat and do not necessarily restrict a certain type of meat (92). Other studies used various terms to describe limited intake of meat: *flexitarian* (26, 95), *low meat eater* (59), and *reduce meat consumption* (88). We included a sample in the category of *semivegetarian* if the described dietary pattern: *1*) excluded or restricted red meat; *2*) included fish and/or chicken as the permitted type of meat; *3*) avoided a certain type of meat; or *4*) restricted intake of meat in general. Twenty-four percent ($n = 22$) of the samples were categorized as *semivegetarian*.

Data on the remaining samples extracted from the publications were collapsed into the general category of *plant-based diet followers*, because the recruitment strategies and/or statistical analyses did not distinguish between *vegan*, *vegetarian*, *and semivegetarian* ($n = 9$) and hence combined them into 1 sample (25, 27, 30, 35, 36, 55, 64, 86). Other studies defined *vegetarian* as a group of plant-based diets with a spectrum of abstention from animal products ranging from *vegan* to *semivegetarian* and labeled the samples with this general term ($n = 6$) (22, 34, 38, 40, 42). Lea et al. (94) described their sample as followers of "plant-based diets." The remaining studies used "vegetarian" to describe their samples without defining the term ($n = 5$) (53, 57, 63, 85, 87). Twenty-three percent ($n = 21$) of the samples were placed in the general category of *plant-based diet followers*. In their analyses of motivations, these studies did not differentiate between types of plant-based diet followers, and thus this category represents a broad range of diets.

TABLE 2 Categories of plant-based diets

Dietary groups (determined for present study)	Definitions	Terms used in publications	Study with relevant sample
Vegan	Excludes all animal products	Vegan	Heiss et al., 2018 (28) Heiss et al., 2017 (29) Janssen et al., 2016 (44) Kessler et al., 2016 (39) Kerschke-Risch, 2015 (89) Radnitz et al., 2015 (51) Rothgerber, 2015 (41) Rothgerber, 2014 (47) Rothgerber, 2014 (61) Rothgerber, 2013 (46) Dyett et al., 2013[1] (50) Hoffman et al., 2013[1] (52) Haverstock and Forgays, 2012 (54) Timko et al., 2012 (37) Izmirli and Phillips, 2011[1] (43) Waldmann et al., 2003 (90) Larsson and Johansson, 2002 (48)
Vegetarian	Excludes all red meat, poultry, and seafood. Includes dairy and/or eggs (i.e., not follow a vegan diet)	Vegetarian Strict vegetarian Lacto-ovo-vegetarian Ovo-vegetarian Lacto-vegetarian	Kessler et al., 2016 (39) Rothgerber, 2015 (41) Rothgerber, 2014 (45) Rothgerber, 2014 (47) Rothgerber, 2014 (61) Rothgerber, 2013 (46) Haverstock and Forgays, 2012 (54) Timko et al., 2012 (37) Izmirli and Phillips, 2011[1] (43)
	Excludes all red meat, poultry, and seafood. Can or cannot include dairy and/or eggs (i.e., can or cannot follow a vegan diet)	Vegetarian Full vegetarian Restricted vegetarian Vegan Meat abstainer Meat avoider	Lentz et al., 2018 (93) de Boer et al., 2017 (59) Asher et al., 2014[2] (78) Brinkman et al., 2014 (77) de Backer and Hudders, 2014 (92) Hoffman et al., 2013[1] (52) Forestell et al., 2012 (26) Spencer et al., 2007[2] (82) Curtis and Comer, 2006 (24) Mooney and Walbourn, 2001 (32) Perry et al., 2001 (33) Lindeman and Väänänen, 2000 (56) Lindeman et al., 2000 (31) Kim et al., 1999[1] (84) White et al., 1999[2] (49) Santos and Booth, 1996 (62) Janelle and Barr, 1995 (65)
Semivegetarian	Excludes or restricts red meat. Includes fish and/or chicken	Semivegetarian Low in red meat Less beef and pork, more chicken and vegetables Pescatarian Pesco-vegetarian Less beef and pork, more chicken and vegetables	Brinkman et al., 2014 (77) Forestell et al., 2012 (26) Haverstock and Forgays, 2012 (54) Latvala et al., 2012 (91) Curtis and Comer, 2006 (24) Perry et al., 2001 (33) Pollard et al., 1998 (57)
	Avoids a certain type of meat	Semivegetarian Some meats avoided Partial meat avoider	Rothgerber, 2014 (45) Timko et al., 2012 (37) Izmirli and Phillips, 2011[1] (43) Santos and Booth, 1996 (62)
	Restricts amount of meat	Semivegetarian Flexitarian Meat reducer Reduce meat consumption Less all meat, more vegetables Low meat-eater Low frequency of eating meat	Lentz et al., 2018 (93) de Boer et al., 2017 (59) de Backer and Hudders, 2014 (92) Schösler et al., 2014[2] (60) Latvala et al., 2012 (91) Forestell et al., 2012 (26) Tobler et al., 2011 (88)
Plant-based diet followers	Describes samples that combine multiple types of plant-based diet followers in analyses		Parviainen et al., 2017 (64) Trautmann et al., 2008[1] (35) Fisak et al., 2006 (25) Klopp et al., 2003 (30) Lindeman and Sirelius, 2001 (55) Smith et al., 2000 (86)

(*Continued*)

TABLE 2 (*Continued*)

Dietary groups (determined for present study)	Definitions	Terms used in publications	Study with relevant sample
			Gilbody et al., 1999 (27)
			Worsley and Skrzypiec, 1997 (36)
	Uses a definition of "vegetarian" or "plant-based" that can encompass various dietary patterns		Bobić et al., 2012 (38)
			Robinson-O'Brien et al., 2009 (34)
			Lea et al., 2006 (94)
			Baş et al., 2005 (22)
			Fessler et al., 2003 (40)
			Rozin, 1997 (42)
	Uses term "vegetarian" without defining it		Ogden et al., 2007 (53)
			Kalof et al., 1999 (87)
			Pollard et al., 1998 (57)
			Ryan, 1997 (85)
			Cooper et al., 1985 (63)

[1]Indicates studies that were included in Figure 2 but excluded from Figure 4 because of incomplete demographic data.
[2]Indicates publications with analyses on dietary motivations that had descriptions of research methods and demographic profiles in previous publications submitted by the same research team.

Methods of capturing motivations to adopt plant-based diets

We examined the methods used to capture data on motivations to adopt plant-based diets. As described in **Table 3**, we classified the methods into 5 categories: free response, multiple choice, rank choices, rate items, and the FCQ. Most studies administered multiple choice (31%, $n = 28$), followed by rate items (23%, $n = 21$), FCQ (17%, $n = 15$), free response (9%, $n = 8$), and rank choices (10%, $n = 9$). The method was not reported for 10% ($n = 9$) of the samples. The formats of reporting data on motivations were frequency (64%, $n = 58$), mean values (32%, $n = 29$), and regression (3%, $n = 3$). **Figure 2** is a weighted scatter plot that displays the samples ($n = 90$) by the method of capturing dietary motivation and publication year. Each bubble represents a single sample, and the color indicates the type of plant-based dietary pattern.

Most prevalent motivation by age

For this present review, we categorized each motivation as *ethical*, *health*, or *other*. We categorized a motivation as *ethical* if a study described it as one of the following: ethical, moral, ideological, animal welfare, environmental concern, ecological, religion, spiritual belief, world hunger, or social justice. We categorized a motivation as *health* if a study described it as a motivation to improve some aspect of health or to lose weight. We categorized a motivation as *other* if it was related to sensory factors, political, finances/cost, social influences, familiarity/habit, mood, convenience, or natural content (i.e., absence of artificial ingredients). **Table 4** lists the motivations that have been investigated and their designations (ethical, health, or other). **Figure 3** shows the distribution of samples of studies that have investigated each type of motivation. The most commonly measured motivations were health (100%, $n = 90$), sensory/taste/disgust (69%, $n = 62$), animal welfare (58%, $n = 52$), environmental concern (59%, $n = 53$), weight loss (53%, $n = 48$), and unspecified ethics (41%, $n = 37$).

Figure 4 is a weighted scatter plot that displays the samples ($n = 81$) by the most prevalent motivation and mean or median age of the sample. The reported mean age is displayed for 93% ($n = 75$) of the samples, and the reported median is displayed for 4% ($n = 3$) of the samples. The median estimated from the reported age range is displayed for 4% ($n = 3$) of the samples. Demographic data on plant-based diet followers were extracted for 57% ($n = 46$) of the samples. For studies that did not report demographic data on plant-based diet followers, the combined data on plant-based diet followers and omnivores were extracted (43%, $n = 35$). Samples of *vegan* and *vegetarian* tended to endorse ethical motivations, whereas samples of *semivegetarian* tended to endorse health motivations. We observed many large samples with a mean age between 30 and 40 y, whereas samples with younger and older populations tended to be smaller.

Discussion

We used evidence mapping to summarize the complex and growing literature on motivations to adopt plant-based diets. We observed

TABLE 3 Common methods of capturing motivations of plant-based diet followers

Method	Description
Free response	Asks the participant to list their motivations for following their diet
Multiple choice	Lists the common motivations for following a diet and asks the participant to choose ≥1 of the applicable options
Rank choices	Lists the common motivations for following a diet and asks the participant to rank order each motivation
Rate items	Lists motivations or statements related to motivations and asks the participant to indicate their level of agreement with each item, usually on a Likert scale
Food Choice Questionnaire (FCQ)	This questionnaire, which was developed by Steptoe et al. (1995) (58), has the format of "rate items"

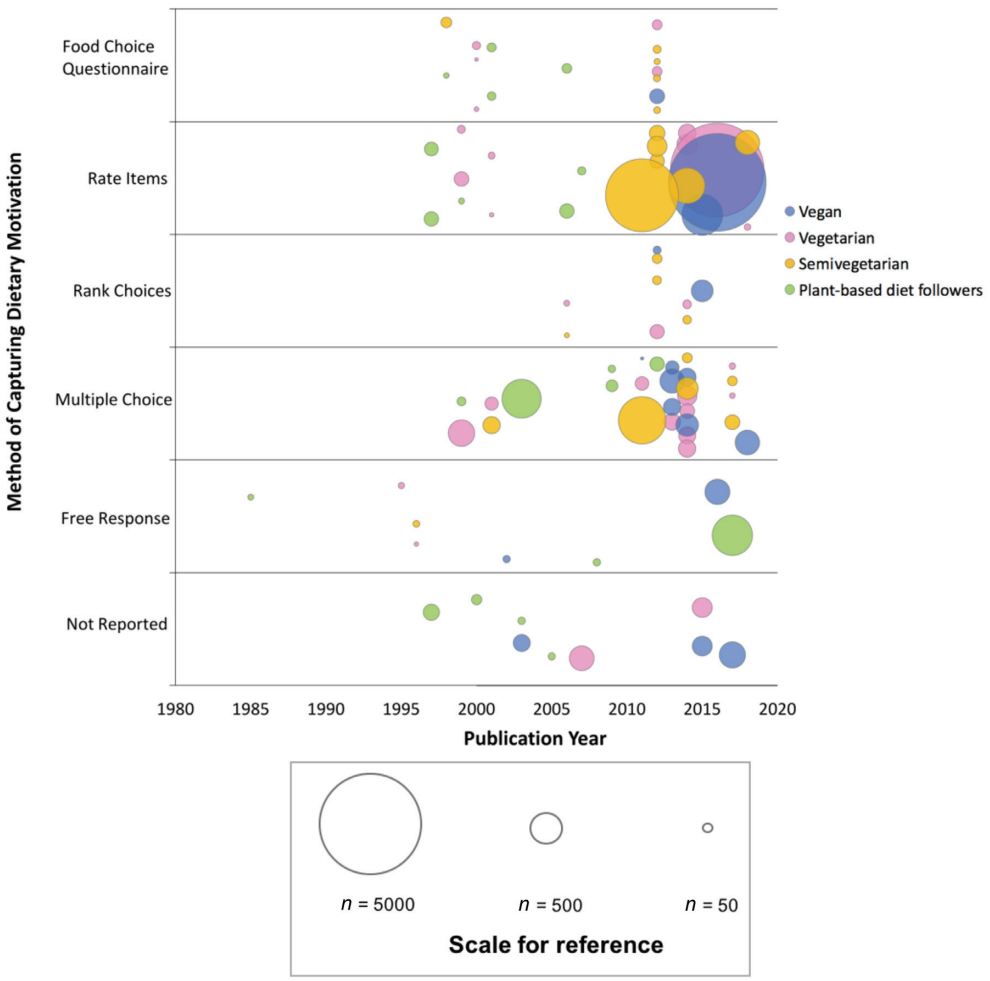

FIGURE 2 Weighted scatter plot of method of capturing dietary motivation vs. publication year. Each bubble represents a single sample of plant-based diet followers, and its size corresponds to the sample size. The sample bubbles ($n = 90$) are colored by plant-based dietary pattern (vegan, vegetarian, semivegetarian, and plant-based diet followers), and they are separated by the reported method of capturing data on dietary motivation.

heterogeneity in methods to capture dietary motivations and possible differences in dietary motivations across types of plant-based diets and age groups. In addition, we identified populations that require further investigation and observed variation in how plant-based diet followers were identified.

As previously noted, definitions of *vegetarian* and *semivegetarian* have been largely inconsistent (21, 96). Plant-based diets exist as a spectrum of abstention from animal products, and self-chosen labels such as *flexitarian* and eating practices are often not based on discrete categories. Despite these limitations, however, classifying plant-based diet followers for purposes of epidemiological research and understanding dietary motivations can still be useful. Specifically, prompting participants to indicate the animal products that they consume or avoid (32, 39, 40, 45, 51, 52, 62, 79, 84, 90, 91), or to complete a questionnaire about their frequency of meat consumption (26, 60, 65, 92, 93) can allow researchers to more accurately identify their dietary patterns based on actual intake rather than self-reported eating practices or self-chosen labels. This approach can help to address the discrepancies among dietary motivation, aspiration to adopt a plant-based diet, and actual food choices made by individuals. An example of best practice, as illustrated by Asher and colleagues (79), is to employ a multistep process to identify current vegetarians and vegans, in which the participants indicate the types of meat and/or animal products that they exclude from their diet as well as whether they self-identify as vegetarian, vegan, or neither. This comprehensive methodology minimizes the ambiguities of classifying plant-based diet followers via self-report alone.

Evolution of methods and their heterogeneity

Methods of capturing data on dietary motivations to adopt plant-based diets have evolved over time. Starting around 2010, multiple choice and rate items were prominent question formats compared with free response and rank choices, especially because online recruitment methods result in large samples (Figure 2) (28, 29, 39–41, 45–47, 51, 61, 78, 89, 92, 93). As suggested by qualitative studies, followers of plant-based diets often have multiple dietary motivations, and these dietary

TABLE 4 Commonly identified motivations to adopt plant-based diets

Motivation group	Motivations
Ethical	Ethical
	Moral
	Ideological
	Animal welfare
	Environmental concern
	Ecological
	Religion
	Spiritual belief
	World hunger
	Social justice
Health	Health
	Weight
Other	Other
	Sensory
	Taste
	Disgust
	Political
	Finances
	Social influence
	Familiarity
	Habit
	Mood
	Convenience
	Natural content

motivations are dynamic because they are modified over time (21, 96–99). The rate items method is optimal for analyzing the dynamic nature of dietary motivations because it allows participants to indicate the relative importance of multiple motivations. Moreover, the assignment of values on a Likert scale provides quantitative data that are suitable for statistical analyses.

Using the rate items format, Steptoe et al. (58) developed the FCQ, which measures 9 types of dietary motivations: health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern (which has subscales for political values and environmental welfare). This questionnaire was designed to assess the main determinants of a person's food choices and capture a wide array of motivations, but its development did not consider ethical motivations specific to plant-based followers. Recognizing this limitation and noting the growing popularity of vegetarianism, Lindeman and Väänänen (56) created new scales to replace the original ethical concern scale: ecological welfare (which includes subscales for animal welfare and environment protection), political values, and religion. This revised FCQ is comprehensive, because it measures the dietary motivations that are the most frequently measured in studies involving plant-based diet followers, though it excludes social influence (Figure 3 and Table 4). Furthermore, depending on the objectives of the study, new scales can be added to the FCQ (100–102). The FCQ is a reliable and versatile tool for measuring motivations for adopting plant-based diets, but it has not been widely used in research studies on plant-based diet followers. Among studies that recruited plant-based diet followers, 2 studies (26, 57) used the original FCQ, and 5 studies (25, 31, 54–56) used the revised FCQ by Lindeman and Väänänen.

Trends in types of plant-based diets, dietary motivations, and age

Despite the observed heterogeneity in methodology, our evidence map on prevalent motivations compared with age shows noteworthy trends (Figure 4). Literature reviews have noted the widespread use of the ethical-health framework of understanding motivations to adopt plant-based diets (21, 103). Based on this framework, we saw that vegans and vegetarians tended to endorse ethical motivations, whereas semivegetarians tended to endorse health motivations. Notably, Kessler and colleagues (39) found that vegetarians and vegans gave the most favorable ratings for *Love of animals* and *Global importance for humanity* as initial motivators, suggesting a possible relationship between strict plant-based diets and ethical motivations. On the other hand, Tobler and colleagues (88) found that individuals who were reducing meat consumption tended to give favorable ratings to *Reducing meat consumption is healthier* as a motivation. These findings suggest potential distinctions among the dietary motivations of vegan, vegetarian, and semivegetarian diet followers. This observation demonstrates the importance of accurate identification of dietary patterns when analyzing motivations.

Regarding the link between age and motivation to adopt a plant-based diet, the evidence remains inconclusive due to limited data captured from relatively few studies, small sample sizes, and underrepresentation of certain types of plant-based diet followers. The most robust evidence is available for people in their 30s and 40s, and several studies on this age group included vegans or vegetarians (Figure 4). Many sample sizes for this age group were medium to large in scale. Several of these studies recruited participants online (28, 29, 39, 40, 41, 45, 46, 51, 61, 78, 89, 92, 93), and this method has been helpful for recruiting followers of stringent plant-based diets, who are an extreme minority (18, 19).

There are numerous studies of younger plant-based diet followers (samples with a mean age <30 y), but the samples tended to be small or combine different types of plant-based diet followers into 1 group for analyses. Many of these samples were recruited in middle schools (33, 34, 36, 85), high schools (31, 33, 34, 48), and universities (22, 25–27, 30, 32, 35, 37, 43, 62, 86), and restricting the target population to such settings resulted in small sample sizes. Notably, Parviainen et al. (64) recruited young participants by mailing questionnaires to households throughout Finland, which allowed them to obtain large sample sizes. Instead of restricting the target population to students of select schools, future studies could mail questionnaires nationwide or post online surveys to recruit large samples of adolescents and college students who follow plant-based diets, because online research has been shown to be successful among followers of plant-based diets (104).

The effect of family influence on motivation to adopt plant-based diets appears to be minimal among secondary school students, because studies estimated that only 3–14% of adolescent vegetarians lived with $\geq$1 vegetarian family member (33, 34, 36). For comparison, Robinson-O'Brien et al. (34) found that in 19–23-y-old vegetarians, 13% reported that a family member was vegetarian. Data with respect to family influence on dietary motivation among young adults (aged 18–23 y) are limited, but researchers speculated that living away from home allowed more freedom for young adults to prepare their own meals and experiment with vegetarianism (35, 62). Studies of young plant-based diet followers often investigated associations among vegetarian-

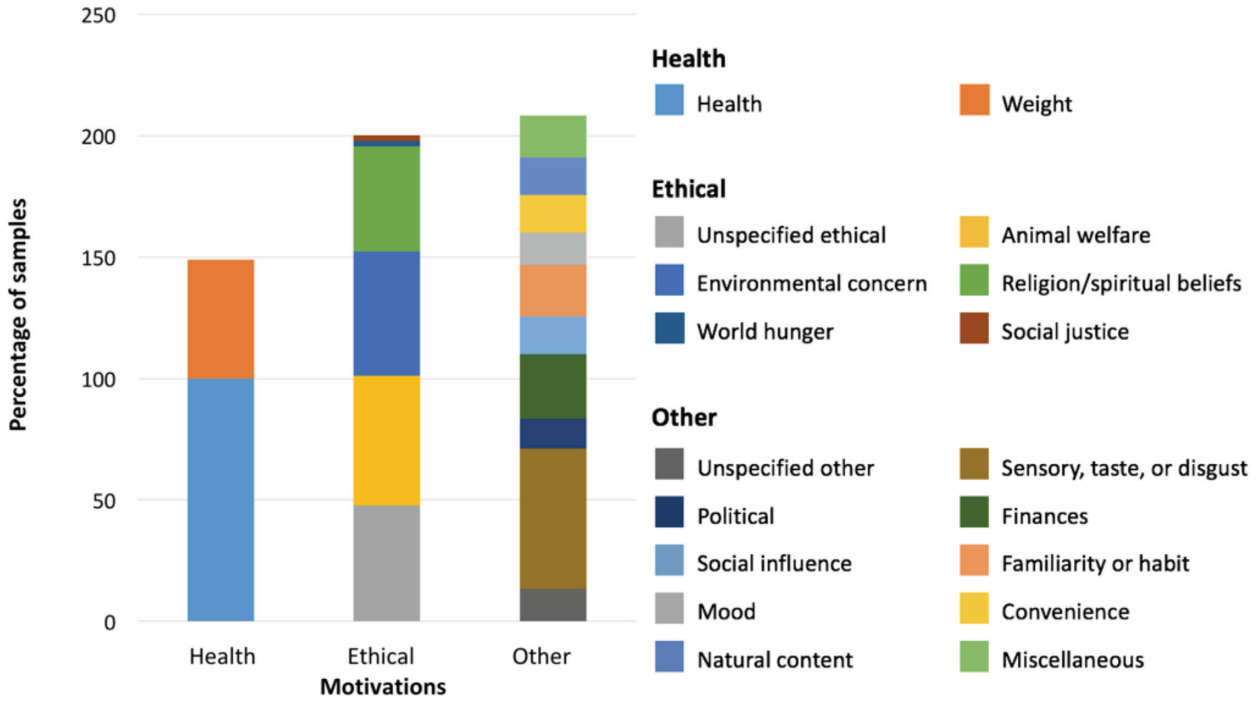

FIGURE 3 Measured motivations by percentage of samples. Studies captured data on various combinations of motivations. This graph shows the breakdown of studies that measured broad motivations (health, ethical, and other) and specific motivations (weight, animal welfare, environmental concern, etc.) of plant-based diet followers.

ism, weight concerns, and disordered eating (22, 24–27, 30–37), which might be motivated by the perceived link between vegetarianism and unhealthy lifestyle behaviors in adolescents and young adults. However, the American Academy of Pediatrics and the Academy of Nutrition and Dietetics confirmed that well-planned vegetarian and vegan diets are nutritionally adequate for infants, children, and adolescents (105, 106).

As for older age groups (samples with a mean age >40 y), there are only a few studies, but they have medium- to large-scale samples that are predominantly semivegetarian followers. Considering the possible health benefits (2, 8, 9) and environmental sustainability (10–12) of reduced meat consumption, several of these studies took consumer- and population-oriented approaches to investigating motivations to adopt plant-based diets (60, 88, 91, 93, 94). These studies recruited individuals who had been reducing their meat consumption but did not necessarily identify themselves as vegans or vegetarians, and, thus, they were classified as *semivegetarian*. In contrast to studies of younger plant-based diet followers, these studies aimed to understand the reputation of plant-based diets and consumer awareness of their potential benefits.

Strengths and limitations

As visual representations, our evidence maps summarize the evolving research on motivations to adopt plant-based diets. The evidence map illustrating methods of capturing dietary motivation compared with publication year (Figure 2) shows how methods have evolved over time. The evidence map of the most prevalent motivation compared with age (Figure 4) shows trends in dietary motivations and highlights gaps in the research. Together, these evidence maps inform strategies for future investigations and provide guidance for systematic reviews and meta-analyses.

There are 4 main limitations to the evidence map for the most prevalent motivation compared with age (Figure 4). The first limitation is the representation of age. Information about the age profile of exclusively plant-based diet followers was available for only 46 samples (57%). The remaining studies reported the combined demographic profile of plant-based diet followers and omnivores (43%, $n = 35$). For studies that recruited adolescents and young adults, the demographic profiles of plant-based diet followers and the overall sample were highly similar. For studies that recruited individuals from the general population and reported only the combined demographic profile, however, the evidence map might not be a completely accurate representation of the age profiles of plant-based diet followers. Furthermore, only the mean or median age of the samples is represented, so information about the spread of the age distribution is not conveyed, which would be useful to consider particularly for large samples.

As for the second limitation, we did not examine the possible effects of gender and socioeconomic status on motivations to adopt plant-based diets. Notably, vegetarians in Western societies tend to be women and well educated (107, 108). In our review, almost three-fifths of the samples were >75% female (Table 1). Women, both vegetarian and omnivorous, are more likely than men to agree that reduced meat consumption is healthy, helps protect the environment, and minimizes animal suffering (87, 109, 110). Furthermore, perceived gender norms surrounding meat consumption could discourage men from adopting veg-

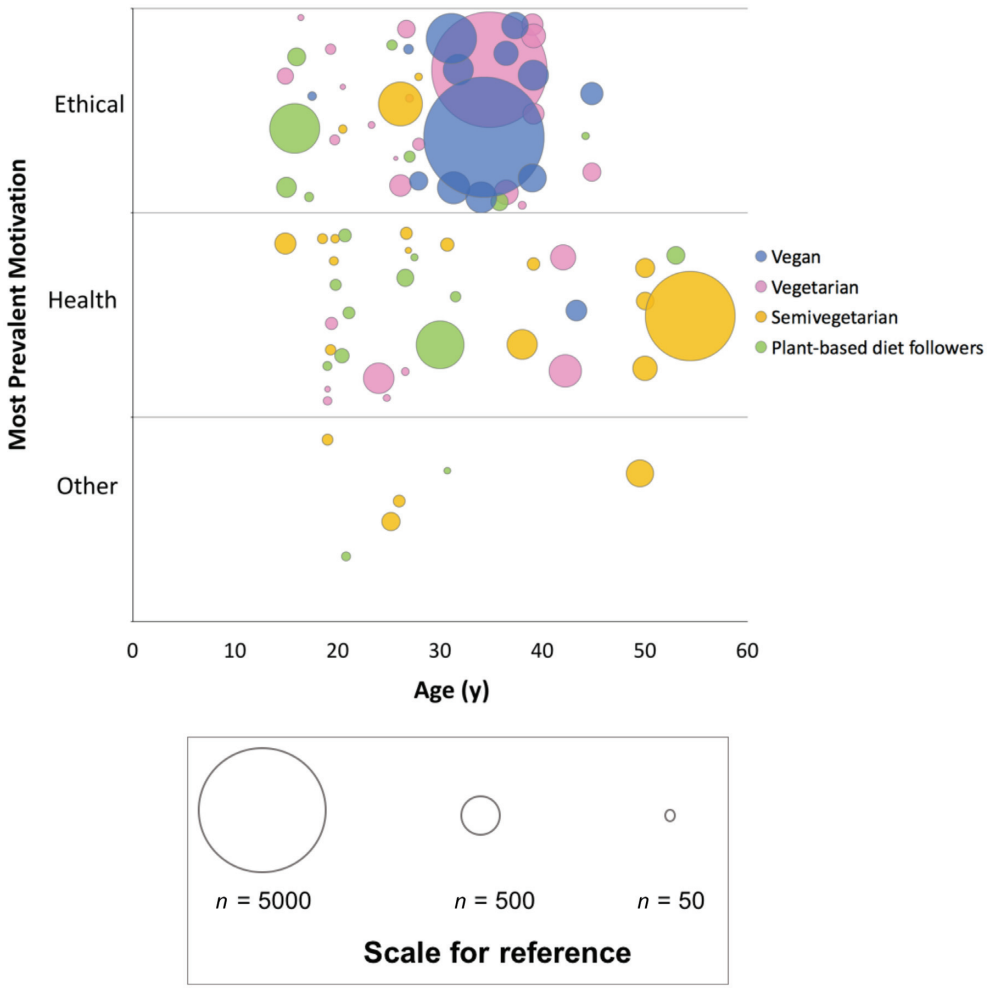

FIGURE 4 Weighted scatter plot of most prevalent motivation vs. age. Each bubble represents a single sample of plant-based diet followers, and its size corresponds to the sample size. The sample bubbles ($n = 81$) are colored by plant-based dietary pattern (vegan, vegetarian, semivegetarian, and plant-based dietary followers), and they are separated by the most prevalent motivation. "Other" motivations included sensory appeal, taste, and preference for eating a variety of foods. The mean age is displayed for 93% ($n = 75$) of the samples, and the median is displayed for 4% ($n = 3$) of the samples. The median estimated from the reported age range is displayed for 4% ($n = 3$) of the samples. Demographic data on plant-based diet followers were extracted for 57% ($n = 46$) of the samples. For studies that did not report demographic data on plant-based diet followers, the combined data on plant-based diet followers and omnivores were extracted (43%, $n = 35$).

etarianism (111). Men can face greater barriers to adopting plant-based diets and, hence, alternative reasons (i.e., those unrelated to health or ethics) could be more likely to convince them to adopt a plant-based diet. For example, some might find having vegetarian friends to be a more powerful motivator than the potential health and environmental benefits of plant-based diets (112). Because our analyzed samples were largely women, our evidence map likely did not reflect possible trends in motivations that were neither health nor ethical.

Given that only a few studies reported education level and income, we could not determine the socioeconomic profiles. People with higher levels of education likely have elevated awareness of the potential health and sustainability benefits of plant-based diets. Further, higher quality dietary patterns are shown to be more expensive (113). Interestingly, however, we found 1 study that reported finances/cost as a significant motivator to reduce meat consumption (59). The affordability of plant-based diets and consumer behavior are complex research topics that are beyond the scope of this article, and we could not summarize their possible effects on dietary motivations based on the limited data.

In regard to the third limitation, there is no consensus in the literature with respect to consistently categorizing motivations, and some researchers might disagree with the broad ethical and health motivation categories that we created. For example, some studies have classified ethical motivations as only concern for animal welfare (22, 23, 36, 42, 62, 65, 77, 92) and others have classified both animal welfare and environmental protection as ethical motivations (24, 31, 32, 38, 45, 52, 54, 59, 93). Many studies have considered health and weight concerns as separate motivations, especially those that investigated dietary restraint

among plant-based diet followers (24, 26, 27, 30–32, 34–37). Overall, studies investigated different combinations of motivations (Figure 3), and many studies reported data on broad health and ethical (or ideological) motivations without providing the breakdown of specific motivations (24, 26–29, 37, 45–48, 51, 53, 57, 64, 65, 77, 84). Accordingly, we found that broad ethical and health motivation categories were the most effective way to synthesize results for the purpose of this review. Researchers conducting future studies should consider either investigating a wide variety of specific motivations (as opposed to broad health and ethical motivations) or using questionnaires such as the FCQ, which would result in better synthesis of study results.

Finally, although our evidence map shows research interest in motivations to adopt plant-based diets since the 1980s (Figure 2), this is still an emerging field of study and there are only a few studies with large sample sizes. Notably, the Adventist Health Studies recruited thousands of vegetarians and studied their health outcomes but did not investigate their dietary motivations (114, 115). We expect this limitation of few studies with large sample sizes to be overcome in the coming years, especially with the emergence of online surveys that can facilitate large-scale recruitment of participants (39, 104).

Conclusions

We created 2 evidence maps summarizing the literature on motivations to adopt plant-based diets, which is growing and becoming more complex. Because increasing use of online recruitment results in larger samples, the rate items method could be effective for obtaining quantitative data. To facilitate comparisons in epidemiological studies, we recommend using a structured questionnaire such as the FCQ. Followers of more stringent diets, such as vegans and vegetarians, tended to endorse ethical motivations, whereas those seeking to simply reduce meat consumption (semivegetarians) tended to endorse health motivations. Given these distinct motivations, distinguishing among self-identified vegans, vegetarians, and semivegetarians will likely result in meaningful and interpretable data. Evidence on the association between age and motivations to adopt a plant-based diet remains inconclusive due to few studies, small sample sizes, and underrepresentation of certain demographic groups. Many studies of adolescents and young adults had small sample sizes and combined different types of plant-based diets. Those of middle-aged adults often had medium- to large-scale samples that were predominantly vegetarians and vegans. Studies that recruited older adults had large samples of mostly semivegetarians. For future investigations, larger sample sizes that isolate specific types of plant-based diets will be conducive to obtaining robust evidence on dietary motivations as predictors of eating pathology and on incentives to reduce meat consumption and integrate more plant foods in the diet.

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References

1. Lea EJ, Crawford D, Worsley A. Public views of the benefits and barriers to the consumption of a plant-based diet. Eur J Clin Nutr 2006;60:828.
2. Tuso PJ, Ismail MH, Ha BP, Bartolotto C. Nutritional update for physicians: plant-based diets. Perm J 2013;17:61–6.
3. Turner-McGrievy GM, Davidson CR, Wingard EE, Wilcox S, Frongillo EA. Comparative effectiveness of plant-based diets for weight loss: a randomized controlled trial of five different diets. Nutrition 2015;31:350–8.
4. Hyseni L, Atkinson M, Bromley H, Orton L, Lloyd-Williams F, McGill R, Capewell S. The effects of policy actions to improve population dietary patterns and prevent diet-related non-communicable diseases: scoping review. Eur J Clin Nutr 2017;71:694–711.
5. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of obesity among adults and youth: United States, 2015–2016. National Center for Health Statistics, Centers for Disease Control and Prevention [Internet]. 2017 [cited 2019 Aug 5]. Available from: https://www.cdc.gov/nchs/products/databriefs/db288.htm.
6. Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. National diabetes statistics report; 2017 [Internet]. Centers for Disease Control and Prevention; 2017 [cited 2019 Aug 5]. Available from: https://www.cdc.gov/diabetes/data/statistics-report/index.html.
7. National Center for Health Statistics, Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services. Heart disease. Centers for Disease Control and Prevention [Internet]. 2017 [cited 2019 Aug 5]. Available from: https://www.cdc.gov/nchs/fastats/heart-disease.htm.
8. Bodai BI, Nakata TE, Wong WT, Clark DR, Lawenda S, Tsou C, Liu R, Shiue L, Cooper N, Rehbein M, et al. Lifestyle medicine: a brief review of its dramatic impact on health and survival. Perm J 2017;22:17–25.
9. Derbyshire EJ. Flexitarian diets and health: a review of the evidence-based literature. Front Nutr 2017;3:55.
10. Lacour C, Seconda L, Allès B, Hercberg S, Langevin B, Pointereau P, Lairon D, Baudry J, Kesse-Guyot E. Environmental impacts of plant-based diets: how does organic food consumption contribute to environmental sustainability? Front Nutr 2018;5:8.
11. Perignon M, Vieux F, Soler L-G, Masset G, Darmon N. Improving diet sustainability through evolution of food choices: review of epidemiological studies on the environmental impact of diets. Nutr Rev 2017;75:2–17.
12. Springmann M, Godfray HCJ, Rayner M, Scarborough P. Analysis and valuation of the health and climate change cobenefits of dietary change. Proc Natl Acad Sci U S A 2016;113:4146–51.
13. Carrera-Bastos P, Fontes-Villalba M, O'Keefe JH, Lindeberg S, Cordain L. The Western diet and lifestyle and diseases of civilization. Res Rep Clin Cardiol 2011;2:15–35.
14. Cordain L, Eaton SB, Sebastian A, Mann N, Lindeberg S, Watkins BA, O'Keefe JH, Brand-Miller J. Origins and evolution of the Western diet: health implications for the 21st century. Am J Clin Nutr 2005;81:341–54.
15. Vega Mejía N, Ponce Reyes R, Martinez Y, Carrasco O, Cerritos R. Implications of the Western diet for agricultural production, health and climate change. Front Sustain Food Syst 2018;2:88.
16. Dinu M, Abbate R, Gensini GF, Casini A, Sofi F. Vegetarian, vegan diets and multiple health outcomes: a systematic review with meta-analysis of observational studies. Crit Rev Food Sci Nutr 2017;57:3640–9.
17. Qian F, Liu G, Hu FB, Bhupathiraju SN, Sun Q. Association between plant-based dietary patterns and risk of type 2 diabetes: a systematic review and meta-analysis. JAMA Intern Med [Internet] 2019. doi:10.1001/jamainternmed.2019.2195.
18. Nielsen. Plant-based food options are sprouting growth for retailers [Internet]. Nielsen; 2018 [cited 2019 Aug 5]. Available from: https://www.nielsen.com/us/en/insights/article/2018/plant-based-food-options-are-sprouting-growth-for-retailers.

19. Reinhart RJ. Snapshot: few Americans vegetarian or vegan [Internet]. Gallup; 2018 [cited 2019 Aug 5]. Available from: https://news.gallup.com/poll/238328/snapshot-few-americans-vegetarian-vegan.aspx.
20. Conrad Z, Karlsen M, Chui K, Jahns L. Diet quality on meatless days: National Health and Nutrition Examination Survey (NHANES), 2007–2012. Public Health Nutr 2017;20:1564–73.
21. Ruby MB. Vegetarianism. A blossoming field of study. Appetite 2012;58:141–50.
22. Baş M, Karabudak E, Kiziltan G. Vegetarianism and eating disorders: association between eating attitudes and other psychological factors among Turkish adolescents. Appetite 2005;44:309–15.
23. Çiçekoğlu P, Tunçay GY. A comparison of eating attitudes between vegans/vegetarians and nonvegans/nonvegetarians in terms of orthorexia nervosa. Arch Psychiatr Nurs 2018;32:200–5.
24. Curtis MJ, Comer LK. Vegetarianism, dietary restraint and feminist identity. Eat Behav 2006;7:91–104.
25. Fisak B, Peterson RD, Tantleff-Dunn S, Molnar JM. Challenging previous conceptions of vegetarianism and eating disorders. Eat Weight Disord 2006;11:195–200.
26. Forestell CA, Spaeth AM, Kane SA. To eat or not to eat red meat. A closer look at the relationship between restrained eating and vegetarianism in college females. Appetite 2012;58:319–25.
27. Gilbody SM, Kirk SFL, Hill AJ. Vegetarianism in young women: another means of weight control? Int J Eat Disord 1999;26:87–90.
28. Heiss S, Boswell JF, Hormes JM. Confirmatory factor analysis of the Eating Disorder Examination-Questionnaire: a comparison of five factor solutions across vegan and omnivore participants. Int J Eat Disord 2018;51:418–28.
29. Heiss S, Coffino JA, Hormes JM. Eating and health behaviors in vegans compared to omnivores: dispelling common myths. Appetite 2017;118:129–35.
30. Klopp SA, Heiss CJ, Smith HS. Self-reported vegetarianism may be a marker for college women at risk for disordered eating. J Am Diet Assoc 2003;103:745–7.
31. Lindeman M, Stark K, Latvala K. Vegetarianism and eating-disordered thinking. Eat Disord 2000;8:157–65.
32. Mooney KM, Walbourn L. When college students reject food: not just a matter of taste. Appetite 2001;36:41–50.
33. Perry CL, McGuire MT, Neumark-Sztainer D, Story M. Characteristics of vegetarian adolescents in a multiethnic urban population. J Adolesc Health 2001;29:406–16.
34. Robinson-O'Brien R, Perry CL, Wall MM, Story M, Neumark-Sztainer D. Adolescent and young adult vegetarianism: better dietary intake and weight outcomes but increased risk of disordered eating behaviors. J Am Diet Assoc 2009;109:648–55.
35. Trautmann J, Rau SI, Wilson MA, Walters C. Vegetarian students in their first year of college: are they at risk for restrictive or disordered eating behaviors? Coll Stud J 2008;42:340–7.
36. Worsley A, Skrzypiec G. Teenage vegetarianism: beauty or the beast? Nutr Res 1997;17:391–404.
37. Timko CA, Hormes JM, Chubski J. Will the real vegetarian please stand up? An investigation of dietary restraint and eating disorder symptoms in vegetarians versus non-vegetarians. Appetite 2012;58:982–90.
38. Bobić J, Cvijetić S, Barić IC, Šatalić Z. Personality traits, motivation and bone health in vegetarians. Coll Antropol 2012;36:795–800.
39. Kessler CS, Holler S, Joy S, Dhruva A, Michalsen A, Dobos G, Cramer H. Personality profiles, values and empathy: differences between lacto-ovo-vegetarians and vegans. Forsch Komplemed 2016;23:95–102.
40. Fessler DMT, Arguello AP, Mekdara JM, Macias R. Disgust sensitivity and meat consumption: a test of an emotivist account of moral vegetarianism. Appetite 2003;41:31–41.
41. Rothgerber H. Can you have your meat and eat it too? Conscientious omnivores, vegetarians, and adherence to diet. Appetite 2015;84:196–203.
42. Rozin P, Markwith M, Stoess C. Moralization and becoming a vegetarian: the transformation of preferences into values and the recruitment of disgust. Psychol Sci 1997;8:67–73.
43. Izmirli S, Phillips CJC. The relationship between student consumption of animal products and attitudes to animals in Europe and Asia. Br Food J 2011;113:436–50.
44. Janssen M, Busch C, Rödiger M, Hamm U. Motives of consumers following a vegan diet and their attitudes towards animal agriculture. Appetite 2016;105:643–51.
45. Rothgerber H. A comparison of attitudes toward meat and animals among strict and semi-vegetarians. Appetite 2014;72:98–105.
46. Rothgerber H. A meaty matter. Pet diet and the vegetarian's dilemma. Appetite 2013;68:76–82.
47. Rothgerber H. Carnivorous cats, vegetarian dogs, and the resolution of the vegetarian's dilemma. Anthrozoös 2014;27:485–98.
48. Larsson CL, Johansson GK. Dietary intake and nutritional status of young vegans and omnivores in Sweden. Am J Clin Nutr 2002;76:100–6.
49. White RF, Seymour J, Frank E. Vegetarianism among US women physicians. J Am Diet Assoc 1999;99:595–8.
50. Dyett PA, Sabaté J, Haddad E, Rajaram S, Shavlik D. Vegan lifestyle behaviors. An exploration of congruence with health-related beliefs and assessed health indices. Appetite 2013;67:119–24.
51. Radnitz C, Beezhold B, DiMatteo J. Investigation of lifestyle choices of individuals following a vegan diet for health and ethical reasons. Appetite 2015;90:31–6.
52. Hoffman SR, Stallings SF, Bessinger RC, Brooks GT. Differences between health and ethical vegetarians. Strength of conviction, nutrition knowledge, dietary restriction, and duration of adherence. Appetite 2013;65:139–44.
53. Ogden J, Karim L, Choudry A, Brown K. Understanding successful behaviour change: the role of intentions, attitudes to the target and motivations and the example of diet. Health Educ Res 2007;22:397–405.
54. Haverstock K, Forgays DK. To eat or not to eat. A comparison of current and former animal product limiters. Appetite 2012;58:1030–6.
55. Lindeman M, Sirelius M. Food choice ideologies: the modern manifestations of normative and humanist views of the world. Appetite 2001;37:175–84.
56. Lindeman M, Väänänen M. Measurement of ethical food choice motives. Appetite 2000;34:55–9.
57. Pollard TM, Steptoe A, Wardle J. Motives underlying healthy eating: using the Food Choice Questionnaire to explain variation in dietary intake. J Biosoc Sci 1998;30:165–79.
58. Steptoe A, Pollard TM, Wardle J. Development of a measure of the motives underlying the selection of food: the food choice questionnaire. Appetite 1995;25:267–84.
59. de Boer J, Schösler H, Aiking H. Towards a reduced meat diet: mindset and motivation of young vegetarians, low, medium and high meat-eaters. Appetite 2017;113:387–97.
60. Schösler H, de Boer J, Boersema JJ. Fostering more sustainable food choices: can self-determination theory help? Food Qual Prefer 2014;35:59–69.
61. Rothgerber H. Horizontal hostility among non-meat eaters. PLoS One 2014;9:e96457.
62. Santos MLS, Booth DA. Influences on meat avoidance among British students. Appetite 1996;27:197–205.
63. Cooper K, Wise N, Mann LS. Psychological and cognitive characteristics of vegetarians. Psychosomatics 1985;26:521–7.
64. Parviainen H, Elorinne A-L, Väisänen P, Rimpelä A. Consumption of special diets among adolescents from 1999 to 2013: a population-based study in Finland. Int J Consum Stud 2017;41:216–24.
65. Janelle KC, Barr SI. Nutrient intakes and eating behavior scores of vegetarian and nonvegetarian women. J Am Diet Assoc 1995;95:180–9.
66. Althuis MD, Weed DL. Evidence mapping: methodologic foundations and application to intervention and observational research on sugar-

sweetened beverages and health outcomes. Am J Clin Nutr 2013;98: 755–68.
67. Lakshman R, Mazarello Paes V, Hesketh K, O'Malley C, Moore H, Ong K, Griffin S, van Sluijs E, Summerbell C. Protocol for systematic reviews of determinants/correlates of obesity-related dietary and physical activity behaviors in young children (preschool 0 to 6 years): evidence mapping and syntheses. Syst Rev 2013;2:28.
68. Livingston KA, Chung M, Sawicki CM, Lyle BJ, Wang DD, Roberts SB, McKeown NM. Development of a publicly available, comprehensive database of fiber and health outcomes: rationale and methods. PLoS One 2016;11:e0156961.
69. Sawicki CM, Livingston KA, Obin M, Roberts SB, Chung M, McKeown NM. Dietary fiber and the human gut microbiota: application of evidence mapping methodology. Nutrients 2017;9:125.
70. Sawicki CM, Livingston KA, Ross AB, Jacques PF, Koecher K, McKeown NM. Evaluating whole grain intervention study designs and reporting practices using evidence mapping methodology. Nutrients 2018;10: 1052.
71. Teller IC, Embleton ND, Griffin IJ, van Elburg RM. Post-discharge formula feeding in preterm infants: a systematic review mapping evidence about the role of macronutrient enrichment. Clin Nutr 2016;35:791–801.
72. Wang DD, Shams-White M, Bright OJM, Parrott JS, Chung M. Creating a literature database of low-calorie sweeteners and health studies: evidence mapping. BMC Med Res Methodol 2016;16:1.
73. Hetrick SE, Parker AG, Callahan P, Purcell R. Evidence mapping: illustrating an emerging methodology to improve evidence-based practice in youth mental health. J Eval Clin Pract 2010;16:1025–30.
74. Grant MJ, Booth A. A typology of reviews: an analysis of 14 review types and associated methodologies. Health Info Libr J 2009;26:91–108.
75. Miake-Lye IM, Hempel S, Shanman R, Shekelle PG. What is an evidence map? A systematic review of published evidence maps and their definitions, methods, and products. Syst Rev 2016;5:28.
76. Bragge P, Clavisi O, Turner T, Tavender E, Collie A, Gruen RL. The Global Evidence Mapping Initiative: scoping research in broad topic areas. BMC Med Res Methodol 2011;11:92.
77. Brinkman BG, Khan A, Edner B, Rosén LA. Self-objectification, feminist activism and conformity to feminine norms among female vegetarians, semi-vegetarians, and non-vegetarians. Eat Behav 2014;15: 171–4.
78. Asher K, Green C, Gutbrod H, Jewell M, Hale G, Bastian B. Study of current and former vegetarians and vegans: initial findings [Internet]. Faunalytics; 2014 [cited 2018 Sep 24]. Available from: https://faunalytics.org/a-summary-of-faunalytics-study-of-current-and-former-vegetarians-and-vegans/.
79. Asher K, Green C, Gutbrod H, Jewell M, Hale G, Bastian B. Study of current and former vegetarians and vegans: companion to the initial findings [Internet]. Faunalytics; 2014 [cited 2018 Sep 24]. Available from: https://faunalytics.org/a-summary-of-faunalytics-study-of-current-and-former-vegetarians-and-vegans/.
80. Schösler H, de Boer J, Boersema JJ. Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution. Appetite 2012;58:39–47.
81. Frank E, Galuska DA, Elon LK, Wright EH. Personal and clinical exercise-related attitudes and behaviors of freshmen U.S. medical students. Res Q Exerc Sport 2004;75:112–21.
82. Spencer EH, Elon LK, Frank E. Personal and professional correlates of US medical students' vegetarianism. J Am Diet Assoc 2007;107:72–8.
83. Frank E, Rothenberg R, Brown WV, Maibach H. Basic demographic and professional characteristics of US women physicians. West J Med 1997;166:179–84.
84. Kim EHJ, Schroeder KM, Houser RF, Dwyer JT. Two small surveys, 25 years apart, investigating motivations of dietary choice in 2 groups of vegetarians in the Boston area. J Am Diet Assoc 1999;99:598–601.
85. Ryan YM. Meat avoidance and body weight concerns: nutritional implications for teenage girls. Proc Nutr Soc 1997;56:519–24.
86. Smith CF, Burke LE, Wing RR. Vegetarian and weight-loss diets among young adults. Obes Res 2000;8:123–9.
87. Kalof L, Dietz T, Stern PC, Guagnano GA. Social psychological and structural influences on vegetarian beliefs. Rural Sociol 1999;64: 500–11.
88. Tobler C, Visschers VHM, Siegrist M. Eating green. Consumers' willingness to adopt ecological food consumption behaviors. Appetite 2011;57: 674–82.
89. Kerschke-Risch P. Vegan diet: motives, approach and duration. Initial results of a quantitative sociological study. Ernährungs-Umschau 2015;**62**:98–103.
90. Waldmann A, Koschizke JW, Leitzmann C, Hahn A. Dietary intakes and lifestyle factors of a vegan population in Germany: results from the German Vegan Study. Eur J Clin Nutr 2003;57:947–55.
91. Latvala T, Niva M, Mäkelä J, Pouta E, Heikkilä J, Kotro J, Forsman-Hugg S. Diversifying meat consumption patterns: consumers' self-reported past behaviour and intentions for change. Meat Sci 2012;92:71–7.
92. de Backer CJS, Hudders L. From meatless Mondays to meatless Sundays: motivations for meat reduction among vegetarians and semi-vegetarians who mildly or significantly reduce their meat intake. Ecol Food Nutr 2014;53:639–57.
93. Lentz G, Connelly S, Mirosa M, Jowett T. Gauging attitudes and behaviours: meat consumption and potential reduction. Appetite 2018;127: 230–41.
94. Lea EJ, Crawford D, Worsley A. Consumers' readiness to eat a plant-based diet. Eur J Clin Nutr 2006;60:342–51.
95. Glowka W, Melancon M, Danielle W. Among the new words. Am Speech 2004;79:194–200.
96. Rosenfeld DL. The psychology of vegetarianism: recent advances and future directions. Appetite 2018;131:125–38.
97. Beardsworth A, Keil T. The vegetarian option: varieties, conversions, motives and careers. Sociol Rev 1992;40:253–93.
98. Stiles BL. Vegetarianism: identity and experiences as factors in food selection. Free Inq Creat Sociol 1998;26:213–26.
99. Fox N, Ward K. Health, ethics and environment: a qualitative study of vegetarian motivations. Appetite 2008;50:422–9.
100. Rahman SA, Khattak MMAK, Mansor NR. Determinants of food choice among adults in an urban community: a highlight on risk perception. Nutr Food Sci 2013;43:413–21.
101. Ooi SY, Mohd Nasir MT, Barakatun Nisak MY, Chin YS. Validation of a Food Choice Questionnaire among adolescents in Penang, Malaysia. Malays J Nutr 2015;21:23–35.
102. Pula K, Parks CD, Ross CF. Regulatory focus and food choice motives. Prevention orientation associated with mood, convenience, and familiarity. Appetite 2014;78:15–22.
103. Rosenfeld DL, Burrow AL. Vegetarian on purpose: understanding the motivations of plant-based dieters. Appetite 2017;116:456–63.
104. Karlsen MC, Lichtenstein AH, Economos CD, Folta SC, Rogers G, Jacques PF, Livingston KA, Rancaño KM, McKeown NM. Web-based recruitment and survey methodology to maximize response rates from followers of popular diets: the Adhering to Dietary Approaches for Personal Taste (ADAPT) feasibility survey [Internet]. Curr Dev Nutr 2018;2:nzy012. Available from: https://doi.org/10.1093/cdn/nzy012.
105. American Academy of Pediatrics Committee on Nutrition. Nutritional aspects of vegetarian diets. In: Kleinman RE, Greer FR , editors. Pediatric nutrition. 7th ed. Elk Grove Village (IL): American Academy of Pediatrics; 2013. pp. 241–64.
106. Melina V, Craig W, Levin S. Position of the Academy of Nutrition and Dietetics: vegetarian diets. J Acad Nutr Diet 2016;116:1970–80.
107. Millum J. Who are the vegetarians?, Faunalytics [Internet]. 2018 [cited 2019 Nov 25]. Available from: https://faunalytics.org/who-are-the-vegetarians/.
108. Allès B, Baudry J, Méjean C, Touvier M, Péneau S, Hercberg S, Kesse-Guyot E. Comparison of sociodemographic and nutritional characteristics between self-reported vegetarians, vegans, and meat-eaters from the NutriNet-Santé study. Nutrients 2017;9:1023.
109. Mullee A, Vermeire L, Vanaelst B, Mullie P, Deriemaeker P, Leenaert T, De Henauw S, Dunne A, Gunter MJ, Clarys P, et al. Vegetarianism and meat consumption: a comparison of attitudes and beliefs between

vegetarian, semi-vegetarian, and omnivorous subjects in Belgium. Appetite 2017;114:299–305.
110. Beardsworth A, Alan B, Teresa K. Women, men, and food: the significance of gender for nutritional attitudes and choices. Br Food J 2002;104: 470–91.
111. Rothgerber H. Real men don't eat (vegetable) quiche: masculinity and the justification of meat consumption. Psychol Men Masculinity 2013;14: 363–75.
112. Lea E, Worsley A. Influences on meat consumption in Australia. Appetite 2001;36:127–36.
113. Rehm CD, Monsivais P, Drewnowski A. Relation between diet cost and Healthy Eating Index 2010 scores among adults in the United States 2007–2010. Prev Med 2015;73:70–5.
114. Tonstad S, Stewart K, Oda K, Batech M, Herring RP, Fraser GE. Vegetarian diets and incidence of diabetes in the Adventist Health Study-2. Nutr Metab Cardiovasc Dis 2013;23:292–9.
115. Orlich MJ, Singh PN, Sabaté J, Jaceldo-Siegl K, Fan J, Knutsen S, Beeson WL, Fraser GE. Vegetarian dietary patterns and mortality in Adventist Health Study 2. JAMA Intern Med 2013;173: 1230–8.