



Flexitarianism in the Netherlands in the 2010 decade: Shifts, consumer segments and motives

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ABSTRACT

The consumption of large amounts of meat is associated with a high environmental burden and a negative impact on human health. A reduction in meat consumption in Western diets is needed. Consumers differ in their attitudes, norms and behaviours related to meat. The aim of the current study is to improve our understanding of meat consumption and reduction. Segments of meat consumers are identified and shifts in these segments, their attitudes and norms in the 2010 decade are examined. Two online surveys have been conducted among Dutch adults, one in 2011 (N = 1253) and one in 2019 (N = 1979). In both years, similar consumer segments were identified: two meat-oriented segments (compulsive meat eaters and meat lovers) and three segments of meat reducers (unconscious, potential and conscious flexitarians). The segments differed in their attitudes, norms and motives towards meat reduction, their meat consumption and intentions and in their socio-demographic and psychological profile. A comparison over the years showed minor, though positive changes. We conclude that meat consumers can be classified into several groups that form a continuum from strong meat attachment to significant meat moderation. Targeted approaches should be developed to stimulate these groups towards shifting their diet into more flexitarian directions. The development of flexitarianism in the Netherlands during the 2010 s suggests that there is still a long way to go to a predominantly plant-based flexitarian diet.

1. Introduction

Improving our understanding of meat reduction by consumers has become increasingly important since scientific evidence has mounted about the pressing need for a dietary shift from meat-rich diets to more plant-based food consumption patterns. Such a dietary shift is mostly advocated for environmental sustainability and human health reasons (Derbyshire, 2017; Godfray et al., 2018; González, Marquès, Nadal & Domingo, 2020; Poore & Nemecek, 2018; Richi et al., 2015; Springmann et al., 2018; Tilman & Clark, 2014; Willett et al., 2019). Besides, curbing the overconsumption of meat and animal-based foods generally is also beneficial to animal welfare (Mathur et al, 2021).

First and foremost with respect to high-income countries, scholarly hope is placed on flexitarian diets – a diet in which meat intake is curtailed by occasionally abstaining from eating meat without fully abandoning meat (Dagevos, 2021; Springmann et al., 2018; Willett et al., 2019) – to move to food consumption patterns that are less unsustainable and unhealthy than the current ones. Comparable to many other European countries, also in the Netherlands the consumption of (red)

meat exceeds dietary guidelines (van Dooren, Man, Seves & Biesbroek, 2021) and overall meat consumption has remained high in the past decades at such a level that approximately one third of the amount of the meat consumed may be considered as overconsumption (Dagevos, Verhoog, van Horne & Hoste, 2020).

Despite the fact that earlier studies have been conducted on what was called then demi-vegetarianism (e.g. Richardson, MacFie & Shepherd, 1994) and the recent increase in research on flexitarianism (Dagevos, 2021), our understanding of flexitarianism is relatively limited as yet. A few years ago Hartmann and Siegrist (2017) noted that ways to motivate consumers to decrease their meat consumption have been underexplored, and they then called for more studies investigating factors influencing people's willingness to reduce meat. More recently, Malek and Umberger (2021a, p. 1) appropriately stated that “there is limited information available about the characteristics of this subgroup of consumers who are reducing their consumption of meat (...) – also referred to in the literature as ‘flexitarians’”. Rosenfeld and colleagues add to this by rightly stating that “we have little knowledge about how flexitarians construe their food choices” (Rosenfeld, & Tomiyama, 2020,

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p. 1).

The present study tries to fill this research gap by researching to what extent and why meat eaters are transitioning towards flexitarian diets. We aim to provide further insight into flexitarianism by investigating (i) consumers' attitudes, norms and motives on meat reduction, (ii) different forms or levels of flexitarianism, and (iii) shifts towards more flexitarian diets in the 2010 decade.

Regarding the first aim, a lot has yet to be explored when it entails motives for meat reduction. Although multiple motives pro and con meat reduction have been identified in the literature – ranging from health, taste, weight control to price and ethical reasons – (see Graça, Godinho & Truninger, 2019 for an overview; see also Dagevos, 2021; Lentz, Connelly, Miroso, & Jowett, 2018; Malek & Umberger, 2021; Rosenfeld, Rothgerber, & Janet Tomiyama, 2020) this does not imply that there is convincing evidence about consumer meat moderation motivations – on the contrary (Kemper, 2020; Malek & Umberger, 2021). In addition, meat consumption is rooted in a cultural, social and personal context with norms and habits that can enhance or restrain meat reduction (de Boer, Schöslér & Aiking, 2017; Lentz et al., 2018; Milford, le Mouël, Bodirsky & Rolinsky, 2019). Consuming meat is by many still perceived as the normal thing to do (Piazza et al., 2015), and is associated with status, welfare, and masculinity (Lentz et al., 2018; Rosenfeld, 2018, 2020; Rothgerber, 2013; Rozin, Hormes, Faith & Wansink, 2012; Ruby & Heine 2011; Schöslér, de Boer & Boersema, 2015). Thus, it is relevant to explore this complex set of aspects to better understand what (de)motivates consumers to moderate meat consumption.

With respect to our second aim, levels of meat consumption of flexitarians can vary, just as the underlying psychographics including attitudes, norms and motives to limit meat consumption (Miki, Livingston, Karlsen, Folta & McKeown, 2020; Rosenfeld, 2018). Such differences are important to consider to better understand meat reduction. From this perspective, it is interesting to see that distinguishing different groups of flexitarians is an emerging approach followed in recent studies (for an overview, see Dagevos, 2021). After our earlier study (Verain, Dagevos & Antonides, 2015a) in which in-group differences among flexitarians were made, this is repeated in the present work. We feel motivated to do so by Kemper's comment that "future research could benefit from delineating between low, medium and high meat reducers" (Kemper, 2020, p. 8), and by Rosenfeld's suggestion that future research could "benefit from distinguishing between variants of flexitarianism" (Rosenfeld, 2018, p. 9).

Finally, with regard to our third aim, we are able to compare the results of our previous survey conducted in 2011 with new consumer data from 2019. Such a comparison over the years adds to the existing literature on consumer segments and dietary categories, that are mostly conducted in a single year. Investigating whether and how attitudes, norms and motives are changing over time, and whether similar segments of meat eaters and flexitarians could be identified in both years gives insights into the direction of meat consumption and can provide leads to stimulate or facilitate a shift towards more plant-based diets.

2. Methods

2.1. Procedure and respondents

Two online surveys were conducted to collect the data; the first in 2011 and the second in 2019. In both years, participants were recruited by MSI-ACI Europe BV., a professional market research agency. Participants were approached by email to take an online self-administered survey. Both surveys were completed by a national representative sample of the Dutch adult population. Quota were set to get a balanced sample on gender, age and level of education. Informed consent was organised at the level of the market research agency. The authors only had access to an anonymised data set.

Part of the survey conducted in 2011 has been repeated in 2019.

Using similar questions in both years provides the possibility to analyse changes over time. The present work focusses on the survey conducted in 2019, and the comparison between 2011 and 2019. The results of the survey conducted in 2011 have been reported elsewhere (Dagevos, 2014; Dagevos & Voordouw, 2013; Verain et al., 2015a). The sample characteristics of both surveys are presented in Table 1. The sample of 2019 consisted of 2,383 participants. After removing 201 participants who indicated to be a vegan or vegetarian (since they do not consume meat at all) and 203 participants who showed no dispersion in their answers (flatliners, suggesting that they did not take the survey seriously), 1,979 respondents remained eligible for analysis.

2.2. Measures

2.2.1. Segmentation variables

Several meat-related psychographics were used as segmentation variables. These items were exactly the same as in the study conducted in 2011, in order to be able to make a good comparison between the years (Verain et al., 2015a). In 2011, (validated) scales on this topic were rather limited. Therefore, the items were a combination of items adopted from literature, items that were based on literature and adapted to fit the meat context and self-developed items. In recent years, the field of meat consumption has been booming and many new scales have been developed. Several relevant new scales have therefore been added to the 2019 survey and were used as profiling variables (see Section 2.2.2.).

Appreciation of meatless meals was measured with three items ($\alpha = 0.711$), with higher scores indicating a higher appreciation: 'The day after a barbeque with meat, I eat less meat', 'I like a meal without meat' and 'It is easy to prepare a tasty meal without meat'. The items were inspired by self-licensing literature, adapted from Lea and Worsley (2001) and Steptoe, Pollard and Wardle (1995). *Need for meat* was operationalised with two self-developed items ($\alpha = 0.785$), inspired by Roos, Prättälä and Koski (2001): 'After a day without meat I feel extra need for meat' and 'If I do not eat meat for a whole day, I feel weaker'. *Ethical considerations* were operationalised through three items ($\alpha = 0.842$), adopted from de Boer, Hoogland and Boersema (2007) and Vanhonacker and Verbeke (2009): 'If I buy meat I want to know it has been produced in an animal-friendly way', 'If I buy meat I want to know it has been produced in an environmentally friendly way' and 'Animal wellbeing is important to me'. *Dislike of animals as a source of meat* was measured with two items ($\alpha = 0.681$), adopted from de Boer and colleagues (2007): 'The idea that meat comes from animals gives me an unhappy feeling' and 'I can accept that meat comes from animals'. *Perceived positive health effects of reduced meat consumption* were measured with four items ($\alpha = 0.899$), based on Lea and Worsley (2001): 'Eating meat is unhealthy', 'Meat causes heart diseases', 'Meat causes cancer' and 'Meat fattens'. *Personal norm to consume less meat* was operationalised with two items ($\alpha = 0.866$), based on Bamberg, Hunecke and Blöbaum (2007) and Gärling, Fujii, Gärling and Jakobsson (2003) and adapted to the meat context: 'Because of my own values and norms, I feel morally obliged to eat less meat' and 'It is important that people in general eat less meat'. *Perceived status of meat consumption*, was

Table 1
Sample characteristics of both surveys.

Year	2011	2019
N	1253	1979
Construct		
Age (mean)	45,9 (range 18–75)	49,6 (range 18–84)
Sex (% mentioned)		
Male	49,6	50,5
Female	50,4	49,5
Education (% mentioned)		
low	28,7	18,1
Middle	37,4	44,2
High	33,9	37,4

operationalised through four self-developed items ($\alpha = 0.898$), inspired by Roos and colleagues (2001) and Twigg (1983): 'Eating meat is "cool"', 'By eating meat, I feel I am on top of the food chain', 'Eating meat gives one status' and 'By eating less meat I feel myself as being unworthy'. Finally, two items dealt with the *price* of meat, based on Steptoe and colleagues (1995) and adapted to the meat context: 'Meat is not expensive' and 'Meat is worth its money'. They did not form a reliable construct and were therefore kept as single items. All answers were given on a seven-point Likert scale (1 = 'Totally disagree' to 7 = 'Totally agree').

2.2.2. Descriptor variables

In addition to the segmentation variables, a range of questions has been asked to describe the segments. These descriptor variables partly overlap with those included in 2011, but new relevant scales were added. First of all, questions on *current meat consumption* (number of days per week), *meat consumption increase* in the past year, *intended change in meat consumption* in the next year (both measured on seven-point scale running from 1 'much less meat' to 7 'much more meat', and 4 indicating no change), and *strategies to reduce meat consumption* (e.g., smaller portions, based on de Bakker & Dagevos, 2012; Neff et al., 2018; Schösler, de Boer & Boersema, 2012; Verain, Dagevos & Antonides, 2015b) were asked. Second, socio-psychological concepts were included: *identity* (one multiple-choice item: meat eater, flexitarian, vegetarian or vegan), *food neophobia* (five items; $\alpha = 0.843$; based on Pliner & Hobden, 1992), *social injunctive norms* (four items; $\alpha = 0.936$; based on Ajzen, 1991; Minton & Rose, 1997) and *food choice motives* (13 single items; based on Onwezen, Reinders, Verain & Snoek, 2019). In addition, two recently developed scales have been included that identify elements that consumers use as reasons to hold on to their meat consumption. The Meat Attachment Questionnaire (MAQ), developed by Graça, Calheiros and Oliveira (2015) is an instrument to better understand barriers to meat reduction. The four dimensions of the MAQ-scale were computed (averages of four items per dimension): Hedonism ($\alpha = 0.885$), affinity ($\alpha = 0.872$), entitlement ($\alpha = 0.761$) and dependence ($\alpha = 0.891$). A similar instrument has been developed by Piazza and colleagues (2015), who identified 4 N's as justifications for consuming meat. The four dimensions of the 4 N's scale were computed (averages of four items per dimension): natural ($\alpha = 0.772$), necessary ($\alpha = 0.863$), normal ($\alpha = 0.605$) and nice ($\alpha = 0.887$). All answers to the socio-psychological items, except for identity, were given on a seven-point Likert scale (1 = 'Totally disagree' to 7 = 'Totally agree'). Finally, several *demographics* were included.

2.3. Data analysis

First, exploratory factor analyses were conducted to construct factors of the segmentation variables and the descriptor variables. Reliability was checked with Cronbach's Alpha (reported in Section 2.2.). Second, independent samples T-tests have been performed to compare data on meat consumption, intentions and a range of psychographic variables between 2011 and 2019 in order to gain insights in significant changes between those years. Third, a cluster analysis was performed on the segmentation variables to identify distinct consumer segments based on their meat-related psychographic characteristics. The scales were centred before clustering to reduce the influence of answering tendencies. For each respondent, the individual's average scale score has been subtracted from the individual's raw scale scores. Hierarchical agglomerative cluster analysis with Ward's method was used. The final number of clusters was based on inspection of the dendrogram and judgement of the interpretation of the clusters. Finally, after the segments were identified, they were characterised based on the descriptor variables. Univariate analyses of variance (ANOVAs), with post hoc Tukey comparisons of mean scores were performed to test for significant differences across the identified segments on the psychographic segmentation variables, meat consumption and meat reduction intentions.

Cross tabulation with *post hoc* comparisons (Z-test with Bonferroni correction) were used to check differences across the segments in their use of several meat reduction strategies as well as categorical demographics. Since the cluster analysis was a repetition of the cluster analysis conducted in 2011, it allowed us to investigate whether similar segments could be identified in both years.

3. Results

3.1. Shifts in the 2010 s: A comparison between 2011 and 2019

3.1.1. Shifts in meat identity, intentions and consumption

Whereas in 2011 only 13.0% of Dutch meat consumers identified oneself as a flexitarian or meat reducer (Dagevos & Voordouw, 2013; Verain et al., 2015a), this percentage drastically increased to 42.9% in 2019. This increase was in line with the self-reported decrease in meat consumption in the past year ($M = 3.51$, $SD = 1.03$) and the reported intentions to further decrease meat consumption in the coming year ($M = 3.56$, $SD = 1.00$). Interestingly, these findings seemed contradictory to the significant increase in meat consumption frequency (see Fig. 1). The average number of days of meat consumption frequency at dinner significantly increased from 4.61 days a week in 2011 (Verain et al., 2015a) to 4.79 days a week in 2019. More specific, the number of so-called "light" flexitarians (5 or 6 days a week) significantly increased, whereas the number of "heavy" flexitarians (a maximum of 2 days a week) significantly decreased between 2011 and 2019.

3.1.2. Changing attitudes and norms on meat consumption

To better understand the shifts in self-identity and meat consumption between 2011 and 2019, changes in a range of psychographic factors related to meat consumption were studied. Table 2 shows mean scores on attitudes, opinions and norms related to meat consumption. Most of the variables remained stable between 2011 and 2019, but some shifts were found. First, the personal norm became slightly more positive towards meat reduction ($t(3230) = 5.47$, $p < .001$). Additionally, the appreciation of meatless meals somewhat increased ($t(3230) = 6.47$, $p < .001$). Finally, respondents indicated to attach more importance to the environment and animal friendliness in 2019 as compared to 2011 ($t(3230) = 8.11$, $p < .001$). In contrast, respondents became less convinced of the positive health effects of lowering one's meat consumption ($t(3230) = -2.20$, $p = .028$).

3.2. Identifying segments of meat consumers

3.2.1. Five consumer segments

The previous section discussed changes in meat consumption, intentions, and psychographics for the whole sample. To better understand consumers standpoints and shifts in meat consumption, it is important to consider differences across consumers. Therefore, a cluster analysis was performed on the 2019 dataset to identify distinct segments of meat consumers. The final cluster solution included five clusters, with a total of 1935 respondent. 44 respondents have not been included in the final solution due to missing data on one of the segmentation variables (they could indicate that certain statements were not relevant, which has been recoded into missing data). The cluster analysis was based on the centred scale values, but for reasons of interpretability, the uncentred mean scores are presented in Table 3.

3.2.2. Two meat-oriented segments: Compulsive meat consumers and meat lovers

Two of the segments contained respondents who were meat-oriented. These segments have been labelled 'compulsive meat consumers' and 'meat lovers'. The *compulsive meat consumers* (15.6%) scored least in favour of meat reduction on all segmentation variables (Table 3) and had the highest meat consumption frequency with almost six days a week (Table 4). They were particularly characterised by a low

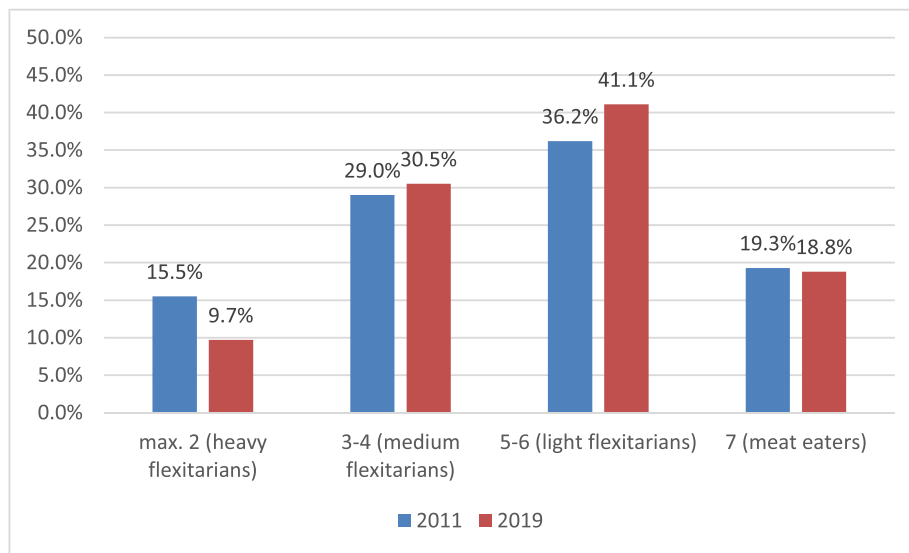


Fig. 1. Frequency of meat consumption at dinner per week.

Table 2

Means and standard deviations of meat-related psychographics, consumption and intentions in 2011 and 2019.

Year	2011		2019	
	M	SD	M	SD
N	1253		1979	
Construct	M	SD	M	SD
Personal norm to consume less meat***	3.30	1.72	3.64	1.75
Perceived positive health effects of less meat*	2.92	1.33	2.82	1.28
Status of meat consumption	2.33	1.26	2.31	1.40
Appreciation of meatless meal***	4.10	1.54	4.46	1.56
Need for meat consumption	2.77	1.52	2.84	1.65
Importance of environment/animal friendliness***	4.36	1.42	4.78	1.44
Dislike of animals as source of meat	2.60	1.33	2.66	1.37
Meat is not expensive	3.48	1.52	3.53	1.60
Meat is worth its money	4.67	1.39	4.70	1.36
Days of meat consumption per week**	4.61	1.82	4.79	1.65
Increase of meat consumption last year	3.55	1.03	3.51	1.03
Intention of meat consumption increase next year	3.62	0.96	3.56	1.00

Note. Asterisks indicate that means differed significantly between 2011 and 2019: * $p < .05$, ** $p < .01$, *** $p < .001$.

personal norm towards consuming less meat, a low appreciation of meatless meals and a rather high need for meat. Interestingly, like all other segments, they did not derive status from meat consumption.

Meat lovers (13.3%) also score unfavourable towards meat reduction with a particular low personal norm. Compared to compulsive meat consumers Meat lovers scored lower on attachment to meat, their meat consumption was slightly less, with a frequency of about 5.5 days a week, and they derived less status from meat consumption. They appreciated meatless meals slightly more and reported a lower need for meat. In addition, they attached more importance to environmental and animal friendliness than compulsive meat consumers. Finally, they agreed more that meat is not expensive and worth its money.

Based on changes in meat consumption in the past, and intention for the future, compulsive meat eaters had a rather stable (high) level of meat consumption, whereas meat lovers indicated a slight decrease in their meat consumption in the past year and intended to continue with slowly reducing in the next year (Table 4). Replacing meat by another product was the most popular meat reduction strategy in both segments, followed by consuming smaller portions of meat and leaving out meat without replacing it (Table 5). Please note that the small percentages result from the fact that most of the meat-oriented consumers did not use any meat reduction strategy.

Table 3

Means of the psychographic segmentation variables per segment.

	CM	ML	UF	PF	CF
N	301	258	768	339	269
Cluster size (%)	15.6	13.3	39.7	17.5	13.9
Personal norm to consume less meat	1.76 ^a	1.95 ^a	4.06 ^b	4.31 ^b	5.55 ^c
Perceived positive health effects of less meat	2.05 ^a	1.87 ^a	3.29 ^c	2.52 ^b	3.70 ^d
Status of meat consumption	2.95 ^a	1.69 ^{b,c}	2.79 ^a	1.77 ^b	1.45 ^c
Appreciation of meatless meal	2.84 ^a	3.33 ^b	4.57 ^c	5.56 ^d	6.00 ^e
Need for meat consumption	4.23 ^a	2.69 ^c	3.21 ^b	1.97 ^d	1.47 ^e
Importance of environment/animal friendliness	3.48 ^a	4.63 ^b	4.53 ^b	5.81 ^c	6.01 ^c
Dislike of animals as source of meat	1.65 ^a	1.67 ^a	3.09 ^c	2.26 ^b	4.11 ^d
Meat is not expensive	2.86 ^a	4.24 ^d	3.30 ^b	4.25 ^d	3.36 ^c
Meat is worth its money	5.20 ^b	5.54 ^a	4.38 ^c	5.31 ^{a,b}	3.41 ^d

^{a-e} Different superscripts across rows indicate significant different means.

Note. CM = compulsive meat eater, ML = meat lovers, UF = unconscious flexitarians, PF = potential flexitarians and CF = conscious flexitarians.

Table 4

Means of meat consumption frequency and intention per segment.

	CM	ML	UF	PF	CF
Days of meat consumption per week	5.90 ^a	5.54 ^b	4.77 ^c	4.32 ^d	3.23 ^e
Increase of meat consumption last year	4.01 ^a	3.87 ^a	3.61 ^b	3.21 ^c	2.64 ^d
Intention of meat consumption increase next year	4.08 ^a	3.89 ^a	3.64 ^b	3.26 ^{bc}	2.76 ^d

^{a-e} Different superscripts across rows indicate significant different means.

Note. CM = compulsive meat eater, ML = meat lovers, UF = unconscious flexitarians, PF = potential flexitarians and CF = conscious flexitarians.

Both segments had a majority of males (65%). Compulsive meat eaters were slightly younger ($M = 49.2$, $SD = 16.2$) than meat lovers ($M = 54.6$, $SD = 17.0$). The distribution across levels of education and household composition was comparable (see Appendix I). Whereas 91%

Table 5
Strategies to reduce meat consumption per segment.

	CM	ML	UF	PF	CF
Meat reduction strategy (% mentioned)					
Lower frequency of meat consumption	7.6 ^a	11.2 ^a	32.7 ^b	40.1 ^{b,c}	50.6 ^c
Lower frequency of meat purchase	5.0 ^a	6.2 ^a	23.2 ^b	23.0 ^b	35.3 ^c
Smaller portions	12.6 ^a	17.4 ^a	29.0 ^b	38.1 ^c	30.9 ^{b,c}
Leaving out meat of the meal, without replacement	11.0 ^a	13.6 ^a	26.3 ^b	38.3 ^c	49.1 ^c
Replacing meat by another product	15.6 ^a	24.8 ^{a,b}	34.0 ^b	46.0 ^c	61.0 ^d
Irrelevant, I do not want to reduce my meat consumption	61.8 ^a	45.7 ^b	14.6 ^c	6.8 ^d	1.1 ^e

^{a-e} Different superscripts across rows indicate significant different percentages. Note. CM = compulsive meat eater, ML = meat lovers, UF = unconscious flexitarians, PF = potential flexitarians and CF = conscious flexitarians.

of compulsive meat eaters was born in the Netherlands, this percentage was higher (98%) for meat lovers (Appendix I).

3.2.3. Three segments of flexitarians: unconscious, potential and conscious flexitarians

In addition to the two meat-oriented segments, we identified three segments of flexitarians labelled 'unconscious flexitarians', 'potential flexitarians' and 'conscious flexitarians'. The most important differences between the meat-oriented segments and the flexitarian segments were the much higher personal norm towards meat reduction of flexitarians and a higher appreciation of meatless meals.

Unconscious flexitarians (39.7%) formed the largest segment in the sample. They consumed meat a little less than five times a week and can be perceived as light flexitarians. This segment was difficult to characterise because the segment members were not very outspoken in any of the variables and showed a neutral attitude and norm towards meat reduction.

Potential flexitarians (17.5%) consumed significantly less meat than unconscious flexitarians, with a frequency of just over four days a week and can be perceived as "medium" flexitarians. Compared to unconscious flexitarians, potential flexitarians derived less status from meat, appreciated meatless meals more, showed a lower need for meat and attached more importance to the environment and animal welfare. In contrast, unconscious flexitarians perceived more positive health effects of meat reduction (although still little) and although potential flexitarians disliked animals as source of meat, unconscious flexitarians disliked it more.

Finally, conscious flexitarians (13.9%) were the most heavy flexitarians being most distinct from the meat-oriented segments. They scored most favourable towards meat reduction on all segmentation variables, except for the statement 'meat is not expensive' (Table 3). This segment had the lowest frequency of meat consumption of just over three days a week. They were particularly characterised by a high personal norm towards meat reduction. For this group, environmental and animal welfare were very important and they did not like the fact that meat originates from animals. Interestingly, even this segment did not seem to be convinced of the positive health effect of meat reduction.

All three flexitarian segments indicated a reduction in their meat consumption in the past year and intention to continue with this decrease, although in different degrees. Conscious flexitarians showed the strongest decrease in meat consumption, whereas for unconscious flexitarians this shift was rather small (Table 4). Replacing meat by another product was the most applied strategy for all flexitarian segments, followed by lowering the frequency of meat consumption. The third most applied strategy by conscious and potential flexitarians was leaving out meat without replacing it, whereas unconscious flexitarians preferred to reduce portion sizes (Table 5).

Unconscious and potential flexitarians were rather equally distributed in terms of gender (52.6% and 45.1% males respectively), whereas the large majority of conscious flexitarians was female (87.3%) (Appendix I). The age of the flexitarian segments differed significantly, with the highest mean age for potential flexitarians ($M = 54.3$, $SD = 17.3$) and the lowest mean age for unconscious flexitarians ($M = 45.7$, $SD = 17.1$). The distribution in education level and country of birth did not differ across the flexitarian segments. While most conscious flexitarians lived alone, most potential and unconscious flexitarians lived with a partner (Appendix I).

3.3. Description of the consumer segments

3.3.1. Segments differ in their socio-psychological characteristics

The self-identification of the segment members as a flexitarian confirmed the continuum from great meat attachment to significant meat moderation of the five consumer segments. Whereas only a small percentage of compulsive meat eaters (7.6%) and meat lovers (17.8%) identified themselves as flexitarians, the percentages were much higher for the flexitarian segments with 44.8% among unconscious flexitarians, 56.6% among potential flexitarians and 88.8% among conscious flexitarians. The scores on the MAQ and the 4Ns confirmed this: most of the scores changed by degrees along the segments (Table 6). Compulsive meat eaters felt most hedonic about eating meat, showed most affinity with eating meat, agreed most that humans are entitled to eat meat and felt most dependent of meat. In addition, compulsive meat eaters agreed the most that meat consumption is natural, necessary, normal and nice. The mean scores gradually declined for meat lovers, unconscious flexitarians and potential flexitarians with the lowest mean scores for conscious flexitarians. Food neophobia showed less differences across segments, with compulsive meat eaters and unconscious flexitarians showing slightly more food neophobia compared to the other segments, but food neophobia does not seem a barrier in any of the segments. Finally, although social norms were low in all segments, unconscious flexitarians perceived their social environment as most supportive towards meat reduction. Social norms were least favourable among the two meat-oriented segments.

3.3.2. Segments differ in their motives to reduce meat consumption

Respondents were asked whether they reduced their meat consumption in the past, and if so, for what reasons. The five identified segments all had a different top 3 of most important motives to reduce eating meat (Table 7). The small number of answers in Table 7 (particularly for the meat segments) indicate that many respondents reported that they did not (consciously) reduce their meat consumption. But those who did, showed interesting differences in their motivations. The top 3 motives for both meat segments and unconscious flexitarians showed large overlap. Affordability was a top 3 motive for all three segments. In addition, food safety was a top 3 reason for both meat

Table 6
Means of the socio-psychological descriptor variables per segment.

	CM	ML	UF	PF	CF
MAQ_Hedonism	5.88 ^a	5.55 ^b	4.52 ^c	4.34 ^c	2.84 ^d
MAQ_Affinity	6.34 ^a	6.43 ^a	5.08 ^b	5.65 ^c	4.31 ^d
MAQ_Entitlement	5.24 ^a	4.93 ^b	4.20 ^c	4.13 ^c	2.89 ^d
MAQ_Dependence	4.97 ^a	4.25 ^b	3.67 ^c	2.93 ^d	2.02 ^e
4N_Natural	5.39 ^a	4.97 ^b	4.32 ^c	4.07 ^d	3.08 ^e
4N_Necessary	5.20 ^a	4.58 ^b	4.09 ^c	3.64 ^d	2.69 ^e
4N_Normal	4.91 ^a	4.43 ^b	4.13 ^c	3.76 ^d	3.18 ^e
4N_Nice	5.72 ^a	5.20 ^b	4.28 ^c	3.76 ^d	2.46 ^e
Food Neophobia	3.68 ^a	3.21 ^b	3.70 ^a	3.22 ^b	3.24 ^b
Social norms	1.59 ^a	1.45 ^a	2.99 ^b	2.13 ^c	2.48 ^d

^{a-e} Different superscripts across rows indicate significant different means.

Note. CM = compulsive meat eater, ML = meat lovers, UF = unconscious flexitarians, PF = potential flexitarians and CF = conscious flexitarians.

Table 7

Means of the motives to reduce/stop eating meat per segment.

	CM	ML	UF	PF	CF
<i>N</i>	34	42	315	178	205
Healthy	4.32 ^a	4.60^{a,b}	5.09^{b,c}	5.56 ^{c,d}	5.99^d
Animal friendly	3.41 ^a	3.98 ^a	4.71 ^b	5.59^c	6.11^c
Safe	4.38^a	4.38^a	4.80 ^{a,b}	5.28 ^{b,c}	5.69 ^c
Natural	3.65 ^a	3.76 ^a	4.63 ^b	5.31 ^c	5.66 ^c
Convenience	4.15 ^{a,b}	3.74 ^a	4.43 ^b	4.46 ^b	4.64 ^b
Affordable	4.74^a	4.60^a	4.94^a	4.94 ^a	4.98 ^a
Fairly produced	3.12 ^a	3.74 ^a	4.43 ^b	5.28 ^c	5.58 ^c
Sensory appeal	4.59^{a,b}	4.02 ^a	4.84^b	5.13 ^b	5.21 ^b
Familiar	4.00 ^{a,b}	3.52 ^a	4.29 ^b	4.34 ^b	4.53 ^b
Makes me feel good	3.97 ^a	4.24 ^{a,b}	4.56 ^b	5.67^c	5.67 ^d
Environmental friendly	3.32 ^a	3.83 ^a	4.70 ^b	5.57^c	5.88^c
Regional	3.56 ^{a,b}	3.17 ^a	3.91 ^{b,c}	4.38 ^c	4.34 ^c
Weight control	3.59 ^a	4.02 ^{a,b}	4.44 ^b	4.46 ^b	4.74 ^b

^{a-d} Different superscripts across rows indicate significant different means.

Note. CM = compulsive meat eater, ML = meat lovers, UF = unconscious flexitarians, PF = potential flexitarians and CF = conscious flexitarians.

Note. Top 3 highest means in bold.

segments and health is a top 3 motive for meat lovers and unconscious flexitarians. Sensory appeal completed the top 3 for compulsive meat eaters and unconscious flexitarians. In contrast, the top 3 of the potential and conscious flexitarians is very different from the other three segments. Animal and environmental welfare are important reasons to reduce meat consumption for both segments, with 'makes me feel good', completing the top 3 of potential flexitarians and 'health' completing the top 3 of conscious flexitarians.

4. General discussion

The present study has aimed to add to the field of understanding meat reduction by identifying shifts in consumers' consumption, intentions, attitudes and norms in relation to meat, by identifying and describing consumer segments who differ in attitudes and norms related to meat reduction, and by gaining insights in meat reduction motives in distinct consumer segments of meat consumers. The repetition of a data collection from 2011 in 2019 provided an unique opportunity to identify shifts, both in meat consumption and underlying psychographics, as well as in consumer segments regarding meat moderation and meat attachment.

Despite a broad consensus in the scientific community that dietary change towards a more plant-based – more flexitarian – diet is urgently needed for planetary and public health reasons, our findings showed that actual progress into more flexitarian directions is slow. Some minor positive shifts have been observed in consumer attitudes and norms regarding meat reduction, but simultaneously self-reported meat consumption frequencies have slightly increased between 2011 and 2019. This accords with the fact that the total amount of meat eaten in the Netherlands in the 2010 s had barely changed instead of following a declining trend (Dagevos et al., 2020). But our findings appeared to be more surprising in the light of the striking upward shift in the 2010 decade in the percentage of consumers that identified themselves as flexitarian. This contradicts an expectation by Rosenfeld and colleagues (2020, p. 2) about flexitarians who are not believed to identify themselves as such. In the Dutch case they do, and this indicates that the term flexitarianism has become more mainstream. Dutch consumers' self-reported decline in meat consumption in the past year, and the expressed intention to further decrease in the coming year corresponded with this finding. The small though positive shifts in personal norms towards meat reduction, appreciation of meatless meals and the importance of environmental concerns and animal welfare pointed into a similar direction of slow progress into more flexitarian diets.

In contrast, the low social norm towards meat reduction that we found across all segments showed that diets low in meat are still far from

being the norm. High meat consumption is still normative in Dutch society. Given that social norms are important drivers of the transition to more sustainable diets (Eker, Reese & Obersteiner, 2019) and an enabling social environment for meat reduction is vital (Lacroix & Gifford, 2019) such a result underpins the conclusion that a decisive shift towards more low-meat diets will be a long-term process. Such a conclusion is further supported by the finding that perceived positive health effects of lowering meat consumption were not convincing to many respondents. This is not to say that health was unimportant to meat reduction. Similar to multiple other studies in the field (e.g. De Backer & Hudders, 2014; Lacroix & Gifford, 2019; Lentz et al., 2018; Malek & Umberger, 2021) also the present study revealed that health is a main motive for meat reduction across different consumer segments – particularly for the three flexitarian segments.

The overall picture of a slow diffusion of flexitarianism was also represented by the five consumer segments identified on the basis of attitudes and norms regarding meat reduction. During the 2010 s not much has changed in the size of consumer segments. Hence, a comparison between the Dutch consumer segments of 2011 and 2019 showed no trend towards more "heavy" flexitarian diets and less meat-heavy dietary habits. The stability during the 2010 decade is represented by two meat-oriented segments that remained large and by the "most flexitarian" segment of conscious flexitarians that turned out to be the smallest segment in 2019. Such ratios are in line with other studies discovering large segments of meat-attached food consumers (e.g. Hielkema & Lund, 2021; Lacroix & Gifford, 2019; Marinova & Bogueva, 2019; see Dagevos, 2021 for an overview) or a relatively small segment of dedicated meat reducers (e.g. Funk, Sütterlin & Siegrist, 2021; Sarti, Darnall & Testa, 2018).

When looking at the characteristics of the flexitarian segments, some modest differences across the segments identified in 2011 and 2019 could be observed. Unconscious and potential flexitarians became more distinct in their need for meat, status derived from meat consumption, intentions to reduce and self-reported meat consumption. Potential and conscious flexitarians in turn became more alike on some aspects, such as the importance they attach to environmental and animal welfare and their personal norm, and became more distinct with respect to their appreciation of meatless meals and status derived from meat. The similarity with the 2011 results justified the reuse of the same segment labels. The adjectives conscious and unconscious in this study indicate the difference between these two segments at both sides of the flexitarian spectrum. Although we are fully aware that we did not measure consciousness as such, we gave priority to keep these labels instead of finding a substitute, e.g. (un)perceived.

With respect to motives to reduce meat consumption also differences and similarities between the five segments could be detected. As these segments represent a continuum from strong meat attachment to substantial meat moderation, it is more surprising that segments have motives for meat reduction in common – the health motive in particular (which is consistent with Malek & Umberger, 2021) – than that prominent motives differ. For both meat segments and the segment of unconscious flexitarians the main motives to reduce meat consumption consisted of "egoistic" motivations (affordability, sensory appeal and food safety). For potential and conscious flexitarians, however, "prosocial" motivations (animal and environmental welfare) are important for meat reduction. In contrast, environmental and animal welfare concerns are not expressed as important motives for meat reduction in the two meat-oriented segments. Such findings in which personal benefits dominate the ranking of motives of more meat-attached consumers while prosocial food choice motives are more prominent to those consumers who are more seriously engaged to flexitarianism, largely overlap with results obtained in other recent research (e.g. Funk, Sütterlin, & Siegrist, 2021; Lentz, Connelly, Miroso, & Jowett, 2018; Malek & Umberger, 2021; Malek & Umberger, 2021).

4.1. Practical implications

The differences that we identified across the consumer segments lead to several practical implications in targeting different consumer segments. Compulsive meat eaters seem difficult to encourage to reduce their meat consumption, as they express a high need for meat and no intentions to reduce. All other segments, however, express a certain intention to reduce their meat consumption. Consumers in all other segments refer to the importance of environmental and animal welfare. This could be used as an argument in favour of meat reduction in behavioural interventions. Meat lovers seem somewhat open to reduce their meat consumption, but the low appreciation of meatless meals is a potential barrier to them. This segment could therefore be encouraged to reduce portion sizes of meat, or chefs and food service companies can seduce them with appetizing efforts of alternative no or low-meat dishes containing plant-based proteins such as legumes, fruits and seeds for example. Food manufacturers can contribute here, by developing tasty meat alternatives. Tempting meals and recipes may also help to increase this segment's (perceived) lack of ability to lower meat consumption. The hedonic aspect of meat consumption is another potential barrier for meat reduction, specifically for the meat segments and the unconscious and potential flexitarians. This barrier may be overcome by providing tasty alternative products, meals and recipes to these segments by food manufacturers or supermarkets. Possibly another (marketing) strategy to overcome this barrier is by positioning meat as something exceptional to enjoy at special occasions ('meat as a treat') rather than a 'normal' everyday product.

Second, the rather high scores on meat as 'necessary' for most of the segments, in combination with the low perception of meat reduction as being healthy implies that there is still much room for improvement in terms of how flexitarian diets are perceived. Better informing consumers on the potential health benefits of meat reduction, and taking away their feeling that they need (a lot of) meat remains helpful. This warrants information campaigns by national nutrition centers, other government-related agencies or non-governmental organisations.

Third, the insights in motives to reduce or stop eating meat imply that different consumer groups can be triggered by different motives. Whereas health, safety, affordability and sensory appeal can be used as arguments for meat reduction to all segments, sustainability motives such as animal welfare and environmental friendliness only seems to be appealing to the flexitarian segments. The decline that we found in the perceived positive health effects of reducing meat consumption, in combination with the increasing importance of environmental and animal welfare, suggest, however, that we should increasingly focus on sustainability gains of meat reduction instead of the health benefits.

Finally, the findings on norms imply that currently consumers do not experience much pressure from their social context to lower their meat consumption. But, in contrast to the two meat segments, the three flexitarian segments express a positive personal norm towards meat reduction and could be triggered towards meat reduction by emphasizing this personal norm and enabling them to follow their norm. Politicians and policymakers could support this normalization process by taking measures that are exemplifying and engaging as well as encouraging and enabling with respect to a socio-cultural and physical environment for meat moderation (Defra, 2008).

4.2. Future research

Although the current study adds to our understanding of meat reduction, much work remains to be done in the field of flexitarianism. First, to further improve our understanding of meat reduction, future research should include meat abstainers (vegetarians and vegans) and compare the segments of meat consumers and flexitarians with consumer segments that fully eliminated meat. Already a few years ago De Backer and Hudders (2015, p. 72) call "for further investigation into whether and how flexitarians differ from vegetarians and full-time meat

eaters." More recently, Dagevos (2021, p. 536) pointed out that recent studies have started to explore this new avenue of research.

A second suggestion for future research is to develop more focus and efforts on studies that take multiple years into account in order to obtain and compare results over the years. It is fortunate to see that recently in the field of meat eating and plant-based diets consumer-oriented studies appear in which several years are covered (Bryant & Sanctorem, 2021; Lehto, Kaartinen, Sääksjärvi, Männistö & Jallinoja, 2021; Milfont, Satherley, Osborne, Wilson & Sibley, 2021; Onwezen, Verain & Dagevos, forthcoming).

Third, and related to the second suggestion, future research is needed to improve our understanding of transitioning to and from one segment to another. The (stability of the) consumer segments detected in this study give no reason to assume that flexitarianism evolves gradually from (excessive) meat eating and strong meat attachment to incremental changes in meat frequency and intake to significant meat curtailment and dedicated flexitarianism – the latter possibly considered as a stepping stone to vegetarianism and eventually veganism. Such a straightforward process is hardly supported by empirical evidence so far. Transitions between the segments may be expected to be more complex and capricious. However, further investigations could provide valuable insights to ways contemporary food consumer make dietary shifts to and from more meat-based, flexitarian, and plant-based diets (see Milfont et al., 2021 for a pioneering example of this type of research).

A fourth line of future research follows a suggestion made by Graça and colleagues (2019). They advocate to devote more attention to variables in the domains of capabilities and opportunities, i.e. to concentrate not merely on motivations – an important part of the current study too – but also on people's (perceived) abilities to shift to lower-level meat consumption patterns, and on practical and contextual factors. This implies stepping up research efforts into lifestyles, socio-cultural impacts, food practices and eating routines, among other topics (see e.g. Sijtsema, Dagevos, Nassar, van Haaster-de Winter, & Snoek, 2021 for a recent example looking into this direction).

Fifth, future research could include objective meat consumption data, to try to explain the seemingly contradictory finding that on the one hand, respondents indicated to have lowered their meat consumption in the past year and the percentage of self-identified flexitarians increased between 2011 and 2019, and at the other hand, self-reported meat consumption frequency also increased between 2011 and 2019. A possible explanation could be that societal attention to overconsumption of meat and related sustainability issues has increased awareness of meat consumption, and as a result, consumers may now report certain dishes that include meat, but are not meat-dominant, as 'a dinner with meat' (e.g. vegetable soup with meat balls or a vegetable quiche containing ham). Alternatively, the increased self-reported meat consumption frequency does not necessarily mean an increase in meat consumption, as portion sizes might have reduced. Other types of data, such as production data or purchase data may add important insights on this topic.

Finally, whether the insights in the identified segments can actually lead to more effective interventions to reduce meat consumption, remains a question for future research. A next step would therefore be to actually design pathways and interventions targeted at different groups of meat consumers, and test the effectiveness in terms of meat reduction. An interesting focus here, could be to consider – next to differences across groups of meat consumers – within-person differences across different points of the day, both in the amount of meat consumption as in the underlying motives, as different contexts may ask for different approaches to effectively stimulate meat reduction. Recent research focusing on situational circumstances of eating (less) meat are Bierman and Rau (2020) or Elzerman, Keulemans, Sap and Luning (2021).

5. Conclusion

The present study showed only minor shifts in the direction of a more

flexitarian diet during the 2010 s. Although several signals of emergent flexitarianism were found, it appeared anything but self-evident that contemporary consumers are or are going to decrease their meat consumption. We showed that in understanding meat consumption it is important to consider heterogeneity across consumers. Five distinct segments of meat-oriented consumers and flexitarians have been identified based on attitudes and norms on meat reduction that form a continuum from strong meat attachment to significant meat moderation. The revealed differences in attitudes, norms and meat-reduction motives of these groups can be valuable for developing pathways towards meat reduction, as they provide starting points for optimal framing and targeting of campaigns, interventions and/or products to diverse consumer groups.

The next decades seem crucial in the transition towards more sustainable, flexitarian, plant-based dietary patterns. As per today, flexitarianism remains promising and crucial in switching to more sustainable diets. The results obtained in the present study, however, highlighted that flexitarianism is progressing slowly. The developments in the Netherlands in the 2010 decade did not show a convincing shift from light and medium flexitarians becoming heavy flexitarians. The sizes of the consumer segments in 2019 were very similar to the ones in 2011. From the perspective of the pressing need to make a dietary shift to less meat-heavy and more plant-rich eating patterns, the research

presented in this article gives reason to assert that the process of shifting away from meat-rich diets has not kept up with its urgency in the 2010 decade.

CRediT authorship contribution statement

Muriel C.D. Verain: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Hans Dagevos:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Patricia Jaspers:** Formal analysis, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix I

Segment description on socio-demographic characteristics

	CM	ML	UF	PF	CF
Male (%)	64.8 ^a	64.7 ^a	52.6 ^b	45.1 ^b	22.7 ^c
Age (mean)	49.2 ^{a,b}	54.6 ^c	45.7 ^a	54.3 ^c	50.1 ^b
Age category					
Age 18–29 years (%)	13.6 ^a	11.6 ^a	23.4 ^b	11.5 ^a	16.7 ^{a,b}
Age 30–45 years (%)	28.9 ^a	15.1 ^b	28.9 ^a	17.1 ^b	21.6 ^{a,b}
Age 46–65 years (%)	39.5 ^{a,b}	40.7 ^a	31.0 ^b	41.0 ^a	39.4 ^{a,b}
Age 65 + years (%)	17.9 ^a	32.6 ^b	16.7 ^a	30.4 ^b	22.3 ^{a,b}
Education level					
Low	20.6 ^a	20.2 ^a	16.8 ^a	19.8 ^a	15.2 ^a
Medium	46.8 ^a	47.3 ^a	42.7 ^a	44.0 ^a	42.0 ^a
High	32.2 ^a	32.6 ^a	40.0 ^a	36.3 ^a	42.8 ^a
Household type					
Single	25.6 ^{a,b}	26.4 ^{a,b}	23.7 ^a	31.9 ^b	32.3 ^{a,b}
Single with kids	3.0 ^a	4.7 ^a	6.4 ^a	3.8 ^a	7.8 ^a
Partner	37.5 ^{a,b}	43.0 ^b	32.9 ^a	40.4 ^{a,b}	30.5 ^a
Partner and kids	27.2 ^{a,b}	17.8 ^{b,c}	27.1 ^a	17.1 ^c	23.0 ^{a,b,c}
Living with parents	5.0 ^a	7.0 ^a	8.6 ^a	4.7 ^a	5.6 ^a
Household size	2.3 ^{a,b}	2.2 ^{a,b}	2.5 ^a	2.1 ^b	2.3 ^{a,b}
Born in NL (%)	90.9 ^a	97.7 ^b	92.6 ^a	93.5 ^{a,b}	95.3 ^{a,b}

Note. CM = compulsive meat eater, ML = meat lovers, UF = unconscious flexitarians, PF = potential flexitarians and CF = conscious flexitarians.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Bamberg, S., Hunecke, M., & Blöbaum, A. (2007). Social context, personal norms and the use of public transportation: Two field studies. *Journal of Environmental Psychology*, 27(3), 190–203. <https://doi.org/10.1016/j.jenvp.2007.04.001>
- Biermann, G., & Rau, H. (2020). The meaning of meat: (Un)sustainable eating practices at home and out of home. *Appetite*, 153, 104730. <https://doi.org/10.1016/j.appet.2020.104730>
- Bryant, C., & Sanctorem, H. (2021). Alternative proteins, evolving attitudes: Comparing consumer attitudes to plant-based and cultured meat in Belgium in two consecutive years. *Appetite*, 161, 105161. <https://doi.org/10.1016/j.appet.2021.105161>
- Dagevos, H. (2014). Flexibility in the frequency of meat consumption: Empirical evidence from the Netherlands. *EuroChoices*, 13(2), 40–45. <https://doi.org/10.1111/1746-692X.12062>
- Dagevos, H. (2021). Finding flexitarians: Current studies on meat eaters and meat reducers. *Trends in Food Science and Technology*, 114, 530–539. <https://doi.org/10.1016/j.tifs.2021.06.021>
- Dagevos, H., Verhoog, D., van Horne, P., & Hoste, R. (2020). *Vleesconsumptie per hoofd van de bevolking in Nederland, 2005-2019* [Meat consumption per capita in the Netherlands, 2005-2019], Wageningen: Wageningen Economic Research. <https://edepot.wur.nl/531409>
- Dagevos, H., & Voordouw, J. (2013). Sustainability and meat consumption: Is reduction realistic? *Sustainability: Science, Practice, and Policy*, 9(2), 60–69. <https://doi.org/10.1080/15487733.2013.11908115>
- De Backer, C. J. S., & Hudders, L. (2014). From Meatless Mondays to Meatless Sundays: Motivations for Meat Reduction among Vegetarians and Semi-vegetarians Who Mildly or Significantly Reduce Their Meat Intake. *Ecology of Food and Nutrition*, 53(6), 639–657. <https://doi.org/10.1080/03670244.2014.896797>
- De Backer, C. J. S., & Hudders, L. (2015). Meat morals: Relationship between meat consumption consumer attitudes towards human and animal welfare and moral behavior. *Meat Science*, 99, 68–74. <https://doi.org/10.1016/j.meatsci.2014.08.011>
- de Bakker, E., & Dagevos, H. (2012). Reducing meat consumption in today's consumer society: Questioning the citizen-consumer gap. *Journal of Agricultural and Environmental Ethics*, 25(6), 877–894. <https://doi.org/10.1007/s10806-011-9345-z>
- de Boer, J., Hoogland, C. T., & Boersema, J. J. (2007). Towards more sustainable food choices: Value priorities and motivational orientations. *Food Quality and Preference*, 18(7), 985–996. <https://doi.org/10.1016/j.foodqual.2007.04.002>

- de Boer, J., Schösler, H., & Aiking, H. (2017). Towards a reduced meat diet: Mindset and motivation of young vegetarians, low, medium and high meat-eaters. *Appetite*, *113*, 387–397. <https://doi.org/10.1016/j.appet.2017.03.007>
- Defra (2008). *A framework for pro-environmental behaviours*. London: Department for Environment, Food and Rural Affairs. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69277/pb13574-behaviours-report-080110.pdf.
- Derbyshire, E. J. (2017). Flexitarian diets and health: A review of the evidence-based literature. *Frontiers Nutrition*, *3*(55). <https://doi.org/10.3389/fnut.2016.00055>
- Eker, S., Reese, G., & Obersteiner, M. (2019). Modelling the drivers of a widespread shift to sustainable diets. *Nature Sustainability*, *2*(8), 725–735. <https://doi.org/10.1038/s41893-019-0331-1>
- Elzerman, Johanna E., Keulemans, Lenneke, Sap, Rosalie, & Luning, Pieter A. (2021). Situational appropriateness of meat products, meat substitutes and meat alternatives as perceived by Dutch consumers. *Food Quality and Preference*, *88*, 104108. <https://doi.org/10.1016/j.foodqual.2020.104108>
- Funk, A., Sütterlin, B., & Siegrist, M. (2021). Consumer segmentation based on Stated environmentally-friendly behavior in the food domain. *Sustainable Production and Consumption*, *25*, 173–186. <https://doi.org/10.1016/j.spc.2020.08.010>
- Gärbling, T., Fujii, S., Gärbling, A., & Jakobsson, C. (2003). Moderating effects of social value orientation on determinants of proenvironmental behavior intention. *Journal of Environmental Psychology*, *23*(1), 1–9. [https://doi.org/10.1016/S0272-4944\(02\)00081-6](https://doi.org/10.1016/S0272-4944(02)00081-6)
- Godfray, H. Charles J., Aveyard, Paul, Garnett, Tara, Hall, Jim W., Key, Timothy J., Lorimer, Jamie, ... Jebb, Susan A. (2018). Meat consumption, health, and the environment. *Science*, *361*(6399). <https://doi.org/10.1126/science.aam5324>
- González, Neus, Marqués, Montse, Nadal, Martí, & Domingo, José L. (2020). Meat consumption: Which are the current global risks? A review of recent (2010–2020) evidences. *Food Research International*, *137*, 109341. <https://doi.org/10.1016/j.foodres.2020.109341>
- Graça, J., Calheiros, M. M., & Oliveira, A. (2015). Attached to meat?: (Un)Willingness and intentions to adopt a more plant-based diet. *Appetite*, *95*, 113–125. <https://doi.org/10.1016/j.appet.2015.06.024>
- Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science and Technology*, *91*, 380–390. <https://doi.org/10.1016/j.tifs.2019.07.046>
- Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science and Technology*, *61*, 11–25. <https://doi.org/10.1016/j.tifs.2016.12.006>
- Hielkema, Marijke Hiltje, & Lund, Thomas Bøker (2021). Reducing meat consumption in meat-loving Denmark: Exploring willingness, behavior, barriers and drivers. *Food Quality and Preference*, *93*, 104257. <https://doi.org/10.1016/j.foodqual.2021.104257>
- Kemper, Joya A. (2020). Motivations, barriers, and strategies for meat reduction at different family lifecycle stages. *Appetite*, *150*, 104644. <https://doi.org/10.1016/j.appet.2020.104644>
- Lacroix, K., & Gifford, R. (2019). Reducing meat consumption: Identifying group-specific inhibitors using latent profile analysis. *Appetite*, *138*, 233–241. <https://doi.org/10.1016/j.appet.2019.04.002>
- Lea, E., & Worsley, A. (2001). Influences on meat consumption in Australia. *Appetite*, *36* (2), 127–136. <https://doi.org/10.1006/appe.2000.0386>
- Lentz, G., Connelly, S., Miroso, M., & Jowett, T. (2018). Gauging attitudes and behaviours: Meat consumption and potential reduction. *Appetite*, *127*, 230–241. <https://doi.org/10.1016/j.appet.2018.04.015>
- Lehto, E., Kaartinen, N. E., Sääksjärvi, K., Männistö, S., & Jallinoja, P. (2021). Vegetarians and different types of meat eaters among the Finnish adult populations from 2007 to 2017. *British Journal of Nutrition*, *1–13*. <https://doi.org/10.1017/S0007114521001719>
- Malek, L., & Umberger, W. J. (2021). How flexible are flexitarians? Examining diversity in dietary patterns, motivations and future intentions. *Cleaner and Responsible Consumption*, *3*, 100038. <https://doi.org/10.1016/j.clrc.2021.100038>
- Malek, Lenka, & Umberger, Wendy J. (2021). Distinguishing meat reducers from unrestricted omnivores, vegetarians and vegans: A comprehensive comparison of Australian consumers. *Food Quality and Preference*, *88*, 104081. <https://doi.org/10.1016/j.foodqual.2020.104081>
- Mathur, Maya B., Peacock, Jacob, Reichling, David B., Nadler, Janice, Bain, Paul A., Gardner, Christopher D., & Robinson, Thomas N. (2021). Interventions to reduce meat consumption by appealing to animal welfare: Meta-analysis and evidence-based recommendations. *Appetite*, *164*, 105277. <https://doi.org/10.1016/j.appet.2021.105277>
- Marinova, D., & Bogueva, D. (2019). Planetary health and reduction in meat consumption. *Sustainable Earth*, *2*, 3. <https://doi.org/10.1186/s42055-019-0010-0>
- Miki, A. J., Livingston, K. A., Karlsen, M. C., Folta, S. C., & McKeown, N. M. (2020). Using Evidence Mapping to Examine Motivations for Following Plant-Based Diets. *Current Developments. Nutrition*, *4*(3). <https://doi.org/10.1093/cdn/nzaa013>
- Milford, Anna Birgitte, Le Mouél, Chantal, Bodirsky, Benjamin Leon, & Rolinski, Susanne (2019). Drivers of meat consumption. *Appetite*, *141*, 104313. <https://doi.org/10.1016/j.appet.2019.06.005>
- Milfont, Taciano L., Satherley, Nicole, Osborne, Danny, Wilson, Marc S., & Sibley, Chris G. (2021). To meat, or not to meat: A longitudinal investigation of transitioning to and from plant-based diets. *Appetite*, *166*, 105584. <https://doi.org/10.1016/j.appet.2021.105584>
- Minton, A. P., & Rose, R. L. (1997). The effects of environmental concern on environmentally friendly consumer behavior: An exploratory study. *Journal of Business Research*, *40*(1), 37–48. [https://doi.org/10.1016/S0148-2963\(96\)00209-3](https://doi.org/10.1016/S0148-2963(96)00209-3)
- Neff, R. A., Edwards, D., Palmer, A., Ramsing, R., Richter, A., & Wolfson, J. (2018). Reducing meat consumption in the USA: A nationally representative survey of attitudes and behaviours. *Public Health Nutrition*, *21*(10), 1835–1844. <https://doi.org/10.1017/S1368980017004190>
- Onwezen, M. C., Reinders, M. J., Verain, M. C. D., & Snoek, H. M. (2019). The development of a single-item Food Choice Questionnaire. *Food Quality and Preference*, *71*, 34–45. <https://doi.org/10.1016/j.foodqual.2018.05.005>
- Onwezen, M. C., Verain, M. C. D., & Dagevos, H. (forthcoming). Positive emotions explain the increased intention to consume five alternative proteins between 2015 and 2019. *Food Quality and Preference*.
- Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. *The 4Ns. Appetite*, *91*, 114–128. <https://doi.org/10.1016/j.appet.2015.04.011>
- Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, *19*(2), 105–120. [https://doi.org/10.1016/0195-6663\(92\)90014-W](https://doi.org/10.1016/0195-6663(92)90014-W)
- Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. <https://doi.org/10.1126/science.aaq0216>
- Richardson, N. J., MacFie, H. J. H., & Shepherd, R. (1994). Consumer attitudes to meat eating. *Meat Science*, *36*(1–2), 57–65. [https://doi.org/10.1016/0309-1740\(94\)90033-7](https://doi.org/10.1016/0309-1740(94)90033-7)
- Richi, E. B., Baumer, B., Conrad, B., Darioli, R., Schmid, A., & Keller, U. (2015). Health risks associated with meat consumption: A review of epidemiological studies. *International Journal for Vitamin and Nutrition Research*, *85*(1–2), 70–78. <https://doi.org/10.1024/0300-9831/a000224>
- Roos, G., Prättälä, R., & Koski, K. (2001). Men, masculinity and food: Interviews with Finnish carpenters and engineers. *Appetite*, *37*(1), 47–56. <https://doi.org/10.1006/appe.2001.0409>
- Rosenfeld, D. L. (2018). The psychology of vegetarianism: Recent advances and future directions. *Appetite*, *131*, 125–138. <https://doi.org/10.1016/j.appet.2018.09.011>
- Rosenfeld, Daniel L. (2020). Gender differences in vegetarian identity: How men and women construe meatless dieting. *Food Quality and Preference*, *81*, 103859. <https://doi.org/10.1016/j.foodqual.2019.103859>
- Rosenfeld, Daniel L., Rothgerber, Hank, & Janet Tomiyama, A. (2020). From mostly vegetarian to fully vegetarian: Meat avoidance and the expression of social identity. *Food Quality and Preference*, *85*, 103963. <https://doi.org/10.1016/j.foodqual.2020.103963>
- Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: Masculinity and the justification of meat consumption. *Psychology of Men and Masculinity*, *14*(4), 363–375. <https://doi.org/10.1037/a0030379>
- Rozin, P., Hormes, J. M., Faith, M. S., & Wansink, B. (2012). Is Meat Male? A Quantitative Multimethod Framework to Establish Metaphoric Relationships. *Journal of Consumer Research*, *39*(3), 629–643. <https://doi.org/10.1086/664970>
- Ruby, M. B., & Heine, S. J. (2011). Meat, morals, and masculinity. *Appetite*, *56*(2), 447–450. <https://doi.org/10.1016/j.appet.2011.01.018>
- Sarti, S., Darnall, N., & Testa, F. (2018). Market segmentation of consumers based on their actual sustainability and health-related purchases. *Journal of Cleaner Production*, *192*, 270–280. <https://doi.org/10.1016/j.jclepro.2018.04.188>
- Schösler, H., de Boer, J., & Boersema, J. J. (2012). Can we cut out the meat of the dish?: Constructing consumer-oriented pathways towards meat substitution. *Appetite*, *58* (1), 39–47. <https://doi.org/10.1016/j.appet.2011.09.009>
- Schösler, H., de Boer, J., Boersema, J. J., & Aiking, H. (2015). Meat and masculinity among young Chinese, Turkish and Dutch adults in the Netherlands. *Appetite*, *89*, 152–159. <https://doi.org/10.1016/j.appet.2015.02.013>
- Sijtsema, S. J., Dagevos, H., Nassar, G., van Haaster-de Winter, M., & Snoek, H. M. (2021). Capabilities and opportunities of flexitarians to become food innovators for a healthy planet: Two explorative studies. *Sustainability*, *13*(20), 11135. <https://doi.org/10.3390/su132011135>
- Springmann, Marco, Clark, Michael, Mason-D' Croz, Daniel, Wiebe, Keith, Bodirsky, Benjamin Leon, Lassaletta, Luis, ... Willett, Walter (2018). Options for keeping the food system within environmental limits. *Nature*, *562*(7728), 519–525. <https://doi.org/10.1038/s41586-018-0594-0>
- Stephens, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The Food Choice Questionnaire. *Appetite*, *25*(3), 267–284. <https://doi.org/10.1006/appe.1995.0061>
- Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518–522. <https://doi.org/10.1038/nature13959>
- Twigg, J. (1983). Vegetarianism and the meanings of meat. In: A. Murcott (ed.) *The sociology of food and eating*. Aldershot: Gower, pp. 18–30.
- van Dooren, C., Man, L., Seves, M., & Biesbroek, S. (2021). A food system approach for sustainable food-based dietary guidelines: An exploratory scenario study on Dutch animal food products. *Frontiers in Nutrition*, *8*, Article 712970. <https://doi.org/10.3389/fnut.2021.712970>
- Vanhonacker, F., & Verbeke, W. (2009). Buying higher welfare poultry products? Profiling Flemish consumers who do and do not. *Poultry Science*, *88*(12), 2702–2711. <https://doi.org/10.3382/ps.2009-00259>
- Verain, M., Dagevos, H., & Antonides, G. (2015). Flexitarianism: A range of sustainable food styles. In L. A. Reisch, & J. Thøgersen (Eds.), *Handbook of research on sustainable consumption* (pp. 209–223). Cheltenham: Edward Elgar Publishing. <https://doi.org/10.4337/9781783471270>
- Verain, M. C. D., Dagevos, H., & Antonides, G. (2015). Sustainable food consumption: Product choice or curtailment? *Appetite*, *91*, 375–384. <https://doi.org/10.1016/j.appet.2015.04.055>
- Willett, Walter, Rockström, Johan, Loken, Brent, Springmann, Marco, Lang, Tim, Vermeulen, Sonja, ... Murray, Christopher J. L. (2019). Food in the Anthropocene:

The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)