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Reducing meat consumption: The influence of life course transitions, barriers and enablers, and effective strategies according to young Dutch adults

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ABSTRACT

High consumption of animal-source foods, specifically meat, adversely affects human health and the environment. Dietary habits are shaped at younger ages and a reduction in meat consumption may be facilitated by the life course transitions in early adulthood, but studies are limited. This study among young Dutch adults aimed to describe their perceptions on the influence of life course transitions on meat consumption, barriers and enablers to reduce meat consumption, and strategies for reducing meat consumption. Barriers and enablers were grouped applying the COM-B model that includes capability, opportunity, and motivation. This quantitative cross-sectional study included a representative sample of 1806 young adults from two Dutch consumer panels who completed an online survey. Young adults frequently reported life course transitions, especially those related to moving house, to have decreased their meat consumption. Barriers and enablers to reduce meat consumption were identified for all three factors of the COM-B model. Important barriers included taste, perceived high prices of meat alternatives, and habits. In contrast, important enablers included care for the environment and animal welfare, enjoyment of smaller portions of meat and saving money. However, barriers and enablers largely differed by groups of meat consumption frequency. Self-perceived effective strategies for reducing meat consumption were price reduction of meat alternatives, recipes for vegetarian meals, and more attractive meat alternatives. The findings of this study are relevant for the development of targeted behaviour-change programmes including interventions in the physical and the social environment (like lowering prices and improving the offer of meat alternatives).

1. Introduction

Since the nineteenth century, global consumption of animal-source foods has been rapidly increasing as a result of industrialisation, an increase in welfare, and a growing world population (FAO, 2006, 2018; Grigg, 1995). The consumption of animal-source foods, including meat, dairy, fish and shellfish, eggs, and butter (RIVM, 2016a), is especially high in western countries, including the Netherlands (FAO, 2018; RIVM, 2016b). Animal-source foods contribute to human nutritional needs by providing energy, high-quality proteins, and essential micro-nutrients (FAO., 2011; Larsen, 2003). However, high consumption of animal-source foods, specifically of red and processed meat, has been associated with an increased risk of amongst others mortality, colorectal cancer, stroke, and type 2 diabetes (Abete et al., 2014; Willett et al., 2019). This current dietary pattern, rich in animal source foods, also has negative consequences for the environment. Food production is the largest contributor to environmental change and production of animal-source foods significantly adds to amongst others emission of greenhouse gasses, water depletion, and loss of biodiversity (FAO, 2006; Willett et al., 2019).

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In order to create a more healthy and environmentally sustainable dietary pattern[1], a shift is recommended towards a dietary pattern low in animal-source foods and high in plant-based foods, including legumes, whole grains, nuts, fruits, and vegetables (FAO., 2010; Pimentel & Pimentel, 2003; Willett et al., 2019). An important aspect of this dietary shift is a decrease in meat consumption (FAO., 2010; Pimentel & Pimentel, 2003; Willett et al., 2019), which can be achieved by a reduction in portion sizes of meat or by substitution of meat with, preferably plant-based, alternatives (De Boer et al., 2014).

Evidence on effective strategies to reduce meat consumption is still limited (Bianchi et al., 2018; Garnett et al., 2015). In order to be able to develop effective strategies that facilitate a decrease in meat consumption, research is required on factors that influence meat consumption (Graça et al., 2019; RIVM, 2020b). Various studies have identified barriers and enablers for a decrease in meat consumption, such as awareness of the health aspects of meat and its climate impact, habitual behaviour, cooking skills, social norms, fear of stigmatization, and availability and price of meat and meat alternatives (Hielkema & Lund, 2021; Hoek et al., 2017; Mullee et al., 2017; Natuur & Milieu, 2019; Markowski & Roxburgh, 2019; Collier et al., 2021). However, without an overarching rationale or theoretical framework this evidence remains fragmented and provides few options to design and deliver effective strategies to reduce meat consumption (Graça et al., 2019). Hielkema & Lund (2021) recently used the stages of changes model to explore willingness, behaviour, barriers, and drivers of meat consumption in the Danish population. However, this model focuses on intentional behavior and does not address the important role of automatized, impulsive, or 'heuristic' behavior (Kahnermann, 2012).

A framework that does take into account these automatized aspects of behaviour is the COM-B model. COM-B is a method for characterising and designing behaviour change interventions and conceptualizes how behaviour is shaped by the interaction between three broad behavioural determinants, namely capability, opportunity, and motivation (Michie et al., 2011). Capability is defined as the individual's psychological and physical capacity to engage in the activity concerned and includes having the necessary knowledge and skills. Opportunity includes all the factors that lie outside the individual that make the behaviour possible or prompt it. Motivation is defined as all brain processes that energise and direct behaviour, not just goals and decision making (Michie et al., 2011).

The COM-B model has been used in a review of 110 studies on barriers and enablers to reduce meat consumption by Graça et al. (2019). They showed that motivational barriers and enablers for a reduction in meat consumption have been studied, but that research on opportunity and capability is scarce. In addition, they concluded that there is a need for studies in this field including all three behavioural determinants of the COM-B model (Graça et al., 2019).

Most existing studies on barriers and enablers for reducing meat consumption have focused on the general population (Graça et al., 2019; RIVM, 2020b; Hielkema & Lund, 2021). However, there is evidence that barriers and enablers can differ between subgroups within the population based on age, gender, and meat consumption (De Boer et al., 2017; Graça et al., 2019; Mullee et al., 2017; Lacroix & Gifford, 2019). Young adults are a group which is not frequently researched in the meat consumption literature (Kemper & White, 2021). Kemper (2020) investigated motivation to reduce meat consumption in different family lifecycle stages in a qualitative study using focus groups. This study showed significant differences in motivations for meat reduction and consumption between young adults, families, and retirees, as well as differences in barriers and strategies for substitution. However, quantitative studies are lacking so far. The results support the importance of tailor-made behaviour-change strategies to reduce meat consumption (Lacroix & Gifford, 2019; Kemper, 2020). So far a limited number of studies applied the COM-B model to design theory-based dietary interventions. For example, McEvoy et al. (2018) used the COM-B model to develop an intervention to encourage dietary behavior change towards a Mediterranean diet. In 2020, Lacroix and Gifford (2020) applied the COM-B model to develop group-targeted interventions to reduce consumption of green house gas-intensive meats and animal products. In this intervention, the presence or absence of the three necessary conditions (capability, opportunity and motivation) was assessed using previously recognized inhibitors for three groups of meat -eaters (reducers, moderate hindrance and strong hindrance).

Research also suggests that a reduction in meat consumption may be facilitated by life course transitions, including changes in employment, housing, relationship status, and functional status (Elder et al., 2003; Mortimer & Shanahan, 2007). Life course transitions change people's living situation and circumstances and could thereby lead to disruption in habits (Elder et al., 2003; Verplanken & Roy, 2016). Especially young adults experience many life course transitions (Cooksey & Rindfuss, 2001). However, as far as known, only one qualitative study from Scotland has explored the role of life course transitions in relation to meat consumption (McBey et al., 2019). In this small focus study, no clear effect of life course transitions on meat consumption was found, although it was stated that life course transitions could enhance the potential of a dietary change. Quantitative studies allows for a higher sample size and therefore give more credibility to the results and more insight into this topic.

Therefore, this quantitative research aimed to investigate the influence of life course transitions and experienced barriers, enablers, and potential strategies for reducing meat consumption among young adults.

To address the aim, three research questions were formulated:

What is the self-perceived influence of life course transitions on meat consumption among young Dutch adults?
What are barriers and enablers experienced by young Dutch adults to reduce their meat consumption and do these differ by gender and between groups with different meat consumption frequency?
What are self-perceived effective strategies for reducing meat consumption among young Dutch adults and do they differ by gender and groups of meat consumption frequency?

2. Methods

2.1. Participants and procedure

A cross-sectional, online survey was distributed by the Motivaction research agency in March 2020 among 15,864 young Dutch adults from two online Dutch consumer panels. Panel members were invited to participate in the survey via email. The topic of the survey was not mentioned in the email in order to minimize response bias. Informed consent was provided by the panel members upon registration. As a reward, panel members who answered the survey received points with which they could buy products in an online gift shop. Power analysis revealed that a sample size of 1,800 would yield sufficient power (0.80) for detecting small to medium differences (Cohen's $w = 0.11$) in Pearson's chi square analysis with $df = 12$ and $P < 0.01$ and small to medium differences (Cohen's $F = 0.13$) between four groups in analysis of covariance. Subgroups of young adults known for their relatively low response rate were oversampled in order to obtain a representative sample. Due to the applied sampling procedure, response rates could not be calculated. Weighting of the data ensured that the sample was representative of the target population for six sociodemographic characteristics namely age, gender, education level, work status, urban density, and region. Figures on actual socio-demographic characteristics of young Dutch adults came from Statistics Netherlands, which is

[1] "Sustainable Healthy Diets are dietary patterns that promote all dimensions of individuals' health and wellbeing; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable."(FAO & WHO, 2019, p. 9).

regarded as the gold standard.

2.2. Research instrument.

2.2.1. Survey development

The survey was developed based on research on life course transitions (Elder et al., 2003; Mortimer & Shanahan, 2007), on the COM-B model (Michie et al., 2011), and on reviews on barriers and enablers for reducing meat consumption (Graça et al., 2019; RIVM, 2020b). After initial development, the survey was checked and commented on by twelve other researchers with expertise on meat consumption behaviour, behaviour change, and/or survey development. The survey was pilot-tested on comprehensibility and completeness via think-aloud interviews (Willis & Artino, 2013) among three young Dutch adults. Based on the pilot tests, a question on knowledge about plant-based alternatives of meat and two statements on health and taste were added to the survey, three statements on knowledge were removed, and the order and language level of the survey were improved. The final survey can be found in Appendix A and is described in the next sections.

2.2.2. Meat consumption

Current meat consumption of the respondents was measured by three questions. First, frequency of meat consumption was measured by two multiple choice questions, in which respondents were asked to select their frequency of meat consumption in days per week 1) during the hot meal, and 2) outside the hot meal. Second, respondents were asked to indicate their self-assigned meat consumption identity (meat eater, flexitarian, vegetarian, pescatarian, or vegan).

2.2.3. Life course transitions

Respondents were asked to select all life course transitions they had experienced during the past five years. Answer categories were based on literature on life course transitions (Elder et al., 2003; Mortimer & Shanahan, 2007) and included life course transitions related to employment, housing, relationship status, and functional status. For a maximum of three of the selected life course transitions, respondents were asked to indicate whether they believed that their meat consumption was decreased, increased, or not influenced by this life course transition and to subsequently explain their answer. Answers provided to the open-ended question, in which respondents were asked to explain the self-perceived influence of a life course transition on their meat consumption, were grouped into categories were possible.

2.2.4. Barriers and enablers and self-perceived effective strategies

In order to identify barriers and enablers for reducing meat consumption, respondents first received the multiple-choice question: *'What are plant-based alternatives of meat according to you?'*. Answer categories included five types of plant-based alternatives of meat, for example *'legumes'*. The aim of this question was not only to measure knowledge about plant-based alternatives of meat, but also to ensure that all respondents had a proper understanding of the definition of plant-based alternatives of meat. Therefore, all respondents received a definition of plant-based alternatives of meat after answering this question. This definition was formulated as: '*Plant-based alternatives of meat are all food products that are not derived from animals but do have a high protein-content. These include nuts and peanuts, legumes, ready-to-eat meat replacers, traditional meat replacers, and seeds'*.

Next, respondents received 45 statements on psychological and physical capability, physical and social opportunity, and reflective and automatic motivation for reducing meat consumption (e.g. '*Consuming meat is part of my culture'*), based on the COM-B model and literature (Graça et al., 2019; Michie et al., 2011; RIVM, 2020b). Statements could be answered on five-point Likert scales ranging from '*completely disagree'* to '*completely agree'*.

Respondents who reported to consume meat were asked to indicate whether they had the intention to reduce their meat consumption during the next five years. In addition, these respondents were asked to select a maximum of three self-perceived barriers and enablers for reducing meat consumption, which were formulated based on the COM-B model and literature (Graça et al., 2019; RIVM, 2020b). Finally, these respondents received a multiple-choice question on self-perceived effective strategies to reduce their own meat consumption. This question included five answer categories, for example *'price differences'*.

Respondents who reported to *not* consume any meat, only received the survey questions on meat consumption, life course transitions, and knowledge about plant-based alternatives of meat and the statements on capability, opportunity, and motivation.

2.3. Sociodemographic characteristics and meat consumption subgroups

Data on sociodemographic characteristics (e.g. age and gender) was obtained through the research agency and was defined according to the Golden Standard of Statistics Netherlands (MOA, 2018). Socioeconomic status was based on household income and education level. Education level was measured as the highest level of education achieved or attending. More detailed information about the definition and categorisation of the sociodemographic characteristics is provided in Table 1.

Self-reported meat consumption identity was grouped into three categories, namely meat eater, flexitarian, and vegetarian (vegetarian, pescatarian, and vegan). However, correlations of this categorised meat consumption identity variable with meat consumption frequencies were low, specifically for males ($r_s = -0.26$ to -0.50), which indicates that respondents with a similar meat consumption frequency assigned themselves a different meat consumption identity. Therefore, classification of respondents into meat consumption subgroups for investigating differences in barriers, enablers, and self-perceived effective strategies was based on self-reported meat consumption frequencies in days per week. Respondents who reported that they never consumed meat during and outside the hot meal were classified as vegetarians. The remaining respondents were grouped into three approximately equally sized groups based on their reported meat consumption frequency during the hot meal, because young Dutch adults consume on average 73% of their total meat consumption during the hot meal (RIVM, 2020a). These groups represented low (<3 days/week), middle (4–5 days/week) and high (6–7 days/week) tertile of meat consumption.

The influence of life course transitions on meat consumption was *not* based on meat consumption frequencies. Instead, as described in section 2.2.2., this was investigated by asking respondents whether their meat consumption in general had increased, decreased, or remained stable after a life course transition.

2.4. Statistical analysis

Data was screened for insufficient effort responding by investigating answers provided to the statements (Curran, 2016; DeSimone et al., 2014; Huang et al., 2012). Screening was conducted using long-string analysis with the cut-offs recommended by Costa and McCrae (Huang et al., 2012). However, for the answer options '*strongly disagree'* and *'strongly agree',* cut-offs of 9 and 10 invariant responses in a row were used respectively, because the recommended cut-offs of Costa and McCrae appeared to be too strict for the current survey. Furthermore, respondents who answered *'don't know/no opinion'* more than 10 times in a row or who answered *'not applicable'* more than 10 times in a row were removed. In total, data of 136 respondents was removed from the dataset, leaving 1,670 eligible responses for analysis.

Sociodemographic characteristics were calculated for the total population and by gender and meat consumption category. Differences between groups were investigated using Pearson's chi square analysis for categorical variables and Kruskal Wallis tests for continuous variables (because data was not normally distributed).

Answers provided to the survey questions were presented for the total population using descriptive statistics. Answers to the statements

Table 1
Sociodemographic characteristics of the total sample and split by meat consumption groups and gender (n = 1670) 1.

	Total population	Gender			Meat consumption group[7]				
		Males (n=822)	Females (n=848)	P-value[2]	Vegetarian (n=123)	Low meat (n=489)	Middle meat (n=602)	High meat (n=455)	P-value[3]
Age (years), median (IQR)	27 (21-31)	27 (22-31)	26 (21-30)	$H = 6.08$ P=0.014	26 (21-30)	27 (23-31)	27 (21-31)	26 (21-31)	$H = 9.25$ P = 0.026
Gender, (%)									
Male	49.2	-	-	-	15.3	47.4	51.4	57.4	$\chi^2 = 70.85$
Female	50.8	-	-		84.7	52.6	48.6	42.6	P<0.001
Socioeconomic status[4], (%)									
Low	25.7	29.1	22.4	$\chi^2 = 9.82$	27.6	30.8	21.2	25.6	$\chi^2 = 15.56$
Middle	29.8	28.2	31.4	P=0.007	30.1	25.4	33.3	29.8	P=0.016
High	44.5	42.7	46.3		42.3	43.8	45.5	44.5	
Education level[5], (%)									
Low	3.8	5.1	2.5	$\chi^2 = 25.38$	1.6	4.1	4.3	2.8	$\chi^2 = 13.31$
Middle	43.3	47.7	39	P<0.001	35	41.3	42.3	48.9	P=0.038
High	52.9	47.1	58.6		63.4	54.6	53.4	47.8	
Work status, (%)									
Employed	57.1	60.5	53.9	$\chi^2 = 17.30$	41.9	57.6	61.5	55	$\chi^2 = 30.96$
Entrepreneur	4.7	5.5	3.9	P=0.002	4.8	6.1	3.2	5.3	P=0.002
Unemployed	6.1	5.5	6.7		10.5	7.6	4.8	4.8	
Student	24.9	20.9	28.8		33.9	21.2	24.6	26.8	
Other	7.2	7.7	6.7		8.9	7.6	6	8.1	
Migration background, (%)									
None	83.6	82.3	84.9	$\chi^2 = 2.21$	78.5	78.1	85.9	88	$\chi^2 = 22.30$
Western	7.6	8.4	6.7	P=0.332	11.6	9.7	6.6	5.4	P = 0.001
Non-western	8.8	9.2	8.4		9.9	12.2	7.5	6.6	
Urban density[6], (%)									
Very high	29.2	29.5	28.9	$\chi^2 = 7.64$	37.7	37.9	28.4	18.6	$\chi^2 = 62.20$
High	30.7	32.2	29.3	P=0.106	32	31.1	30.4	30.6	P < 0.001
Medium	15.2	12.8	17.4		11.5	13	16	17.1	
Low	17.7	18.4	17		13.9	12.8	18	23.5	
Non-urban	7.2	7.1	7.4		4.9	5.2	7.2	10.2	
Household composition, (%)									
Single/ single parent	20.2	19.2	21.1	$\chi^2 = 2.46$	22.9	26.5	18.1	15.4	$\chi^2 = 40.11$
Living with partner	44.1	45.9	42.5	P=0.483	34.7	44.1	44.4	46.4	P < 0.001
Living with parents	30	29.7	30.3		33.1	23.2	30.8	35.3	
Residential group/ student house	5.7	5.1	6.1		9.3	6.2	6.6	2.9	
Residing children, (%)									
Yes	23.1	24.5	21.8	$\chi^2 = 1.67$	11.4	23.7	22.4	26.8	$\chi^2 = 13.26$
No	76.9	75.5	78.2	P=0.197	88.6	76.3	77.6	73.2	P = 0.004
Meat consumption identity, (%)									
Meat consumer									
Flexitarian	52.3	68.8	45.3	$\chi^2 = 86.91$	0	29.4	62.7	93.7	$\chi^2 = 1232.93$
Vegetarian	27.5	21.6	37.8	P<0.001	0.8	59.5	31.8	5.1	P < 0.001
Unknown	12.38	9.5	17		99.2	11.2	5.5	1.2	
Meat consumption outside the hot meal (days/week), median (IQR)	3 (0-4)	3 (2-5)	2 (0-4)	$H = 84.22$ P<0.001	0	2 (0-3)	3 (2-5)	4 (3-6)	$H = 480.84$ P < 0.001

[1] Data was weighted on the variables age, gender, education level, work status, urban density, and region.
[2] Chi-square analysis (categorical variables) or Kruskal-Wallis test (continuous variables) for comparison between males and females.
[3] Chi-square analysis (categorical variables) or Kruskal-Wallis test (continuous variables) for comparison between meat consumption groups.
[4] Categorisation of respondents by socioeconomic status was based on combination of income and education level ().
[5] Measured as the highest level of education achieved or attending. Low education level: primary education, preparatory vocational education, first three years of higher general secondary education or pre-university education, or intermediate vocational education level 1; Middle education level: senior classes higher general secondary education, senior classes pre-university education, or intermediate vocational education level 2, 3, or 4; High education level: applied university or university.

[6] Very high urban density: at least 2500 addresses per km^2; High urban density: 1500 to 2500 addresses per km^2; Medium urban density: 1000 to 1500 addresses per km^2; Low urban density: 500 to 1000 addresses per km^2; Very low urban density: <500 addresses per km^2.

[7] Meat consumption was categorized as low (<3 days/week), middle (4–5 days/week) and high (6–7 days/week) based on the tertiles of meat consumption among meat consumers (vegetarians excluded)..

on capability, opportunity, and motivation were analysed continuous as well as categorical, because of the ongoing debate on whether Likert scale results can be treated as continuous variables (Sullivan & Artino, 2013). For the categorical approach, five-point Likert scale answers were categorised into three groups (agree, neutral, disagree). For readability issues, only results of the categorical approach are reported in the written text of the results section.

Factor analysis was performed to investigate whether the group of statements per subscale reflect the subscale. In addition, Cronbach's alpha were calculated to measure the internal consistency of the statements within each subscale. Values > 0.7 were considered to be sufficient (Tavakol & Dennick, 2011).

Differences between gender and meat consumption subgroups were investigated with ANCOVA models (for the statements), binary logistic regression analyses (for knowledge, self-perceived barriers and enablers, and self-perceived effective strategies), and multinomial logistic regression analysis (for intention to reduce meat consumption). For the latter two types of analyses, the outcome variable was whether a respondent selected a specific answer category (yes or no). Results by gender were adjusted for meat consumption subgroup, meat consumption identity, meat consumption frequency outside the hot meal, and all sociodemographic variables that remained significantly associated with gender after correction for the three meat consumption variables ($P < 0.05$). Results by meat consumption group were adjusted for gender and for all sociodemographic variables that remained significantly associated with meat consumption group after correction for gender ($P < 0.05$).

Data was analysed using IBM SPSS Statistics version 24. Weighted percentages and means are presented. Throughout the analysis, missing data was excluded pairwise. In order to take into account the multiple tests performed, a significance level of $P < 0.01$ was used except for identification of potential confounders.

3. Results

3.1. Socio-demographic characteristics

In total, 1,670 respondents were included for analysis. An overview of the sociodemographic characteristics is presented in Table 1. The proportion of males (49.2%) and females (50.8%) was approximately equal. Compared to females, males were slightly older ($P = 0.014$) and more likely to have a low socioeconomic status ($P = 0.007$) and a low or middle education level ($P < 0.001$). In addition, males were more often employed, whereas females were more often student ($P = 0.002$). Furthermore, males more frequently identified themselves as meat consumers ($P < 0.001$) and reported higher frequency of meat consumption outside the hot meal ($P < 0.001$) compared to females. All above-mentioned variables remained significantly associated with gender after correction for meat consumption subgroup, meat consumption identity, and meat consumption frequency outside the hot meal.

A total of 7.4% of the respondents was classified as vegetarian. Vegetarians differed from respondents with low, middle, and high meat consumption frequency in the sense that they were more likely to be female and student, whereas they were less likely to be living with a partner or having children. In addition, the proportion of men ($P < 0.001$) and the proportion of people without a migration background was higher per tertile of meat consumption ($P = 0.001$). Respondents were less likely to be unemployed, to live in a high urban density area ($P < 0.001$), or to live in a residential group or student house with increasing meat consumption frequency. Differences in age and education level between meat consumption groups disappeared after correction for gender.

3.2. Life course transitions

Almost all respondents (86%) had experienced at least one life course transition during the past five years (Fig. 1 The title of figure 1 lacks the reference to the colors (dark grey 'consumption decreased', light grey 'consumption increased' and grey 'no influence on meat consumption')). For each life course transition, at least some respondents reported that this life course transition had changed their meat consumption in general. The amount of respondents who reported no change in meat consumption ranged from 54% to 87%, depending on the requested transition. The life course transitions related to moving house were most frequently reported to have changed (decreased or increased) meat consumption (range 37% for moving in with partner to 47% for moving in with flatmates). Almost all life course transitions were more often reported by the respondents to have decreased their meat consumption (range 8% to 33%) as compared to have increased their meat consumption (range 4% to 16%).

The most frequently provided reasons for a decrease in meat consumption after life course transitions were *independence* (n = 88), limited meat consumption of people in the *social environment* (n = 85), *saving money* (n = 43), and *environment, animal welfare, and health* (n = 40) (Table 2). Independence, was especially frequently reported after moving away from parents, flatmates, or partner (n = 41). Respondents stated that these life course transitions provided the opportunity to prepare food for themselves.

The *social environment* (n = 41) was the most frequently mentioned reason for an increase in meat consumption after life course transitions, especially after moving in with one's partner (n = 35). Respondents stated that their partner *"loves meat"*, "*eats more meat*", or "*does not like vegetarian"*.

Although many respondents either did not provide an explanation for why meat consumption was not influenced by a specific life course transition or just mentioned that their meat consumption or eating pattern *'remained stable'* (n = 436), several respondents did provide an explanation for this. An explanation that was provided relatively frequently for all life course transitions was that respondents were already *vegetarian* or had already limited their meat consumption before they experienced a specific life course transition (n = 170). A full overview of all provided reasons for a decrease, increase, or no change in meat consumption after life course transitions can be found in Appendix B.

3.3. Barriers and enablers

In the multiple-choice question on knowledge about plant-based alternatives of meat, 19% of the respondents recognised all plant-based alternatives, with *'vegetarian pieces, meat balls, and burgers'* being selected most frequently (66%) and seeds being selected least frequently (36%). Females selected legumes significantly more frequently as compared to males ($P < 0.001$). Knowledge about plant-based alternatives was inversely associated with groups with different meat consumption frequency (Appendix B). For example, '*tofu, tempeh and seitan'* were recognised as plant-based alternatives twice as often by vegetarians in comparison to respondents with a high meat consumption (86% vs 44%). This was the case for around 60% of the respondents with low and middle meat consumption frequency.

Table 3 shows the results of the statements on capability, opportunity, and motivation to reduce meat consumption: for all respondents,

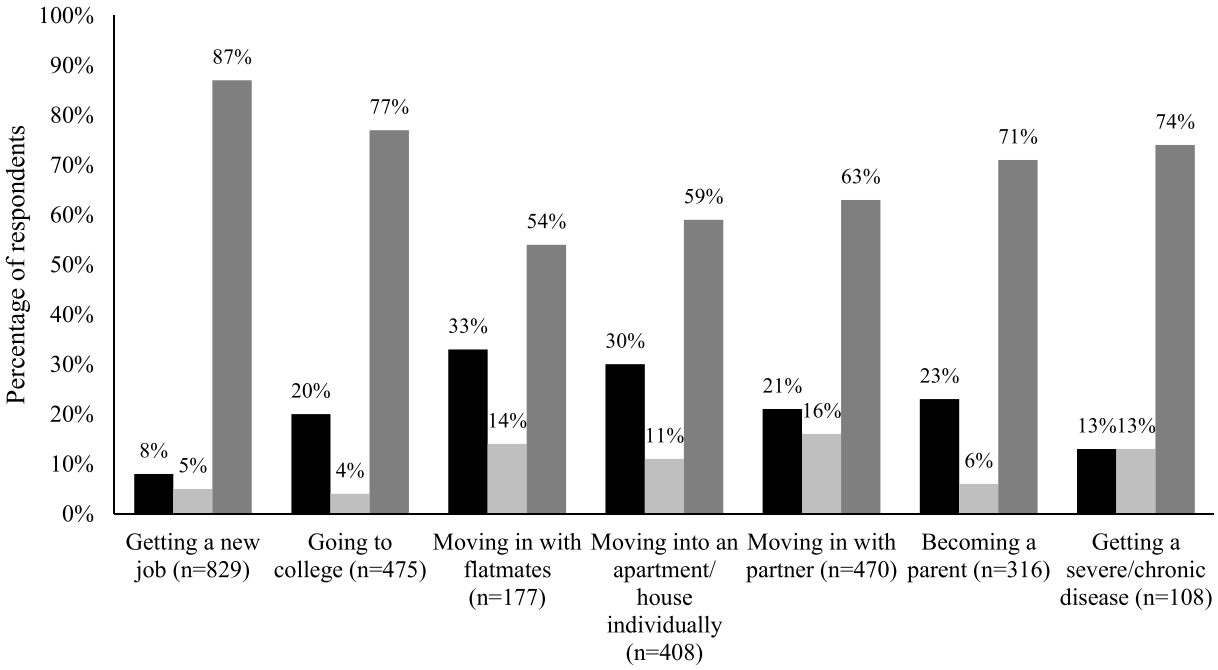

Fig. 1. Self-perceived influence of experienced life course transitions on meat consumption in percentages (, consumption decreased;, consumption increased;, no influence on meat consumption).

Table 2
Overview of the most frequently provided reasons for a decrease, increase, or no change in meat consumption after life course transitions.

Reason	Frequency (n)							
	Total	Getting a new job	Going to college	Moving in with flatmates	Moving into apartment/ house individually	Moving in with partner	Becoming a parent	Getting a severe/ chronic disease
Decrease in meat consumption								
Independence	88	6	22	13	41	6	–	–
Social environment	85	3	21	24	7	25	5	–
Saving money	43	–	16	7	14	4	2	–
Environment, animal welfare, and health	40	–		–	10	17	13	–
Increase in awareness	29	4	12	–	2	6	5	–
Increase in meat consumption								
Social environment	41	–	–	4	–	35	2	–
Taste	10	–	–	–	5	2	3	–
Nutritional needs	10	–	–	–	3		2	5
Independence	8	–	2	–	6	–	–	–
No influence on meat consumption								
Stable (meat) consumption	436	181	69	7	35	68	67	9
Being vegetarian	170	57	32	12	26	21	11	11
Stable living situation	42	12	30	–	–	–	–	–
Social environment	34	–	–	4	–	30	–	–
Independence	28	–		9	6	13	–	–
Taste	18	–	5	–	4	–	9	–

by gender, and by meat consumption frequency. The number of statements differed per sub-component of the COM-B model and Cronbach's alphas ranged from 0.43 to 0.80. After adjustment for meat consumption frequency, some statistically significant differences in agreement to the statements by gender were found, but effect sizes were small (mean difference ≤ 0.35). In contrast, large and statistically significant differences were identified between the four meat consumption subgroups for nearly all statements. In general, a trend was observed with higher frequency of meat consumption towards lower agreement to the statements in favour of reducing meat consumption and higher agreement to statements in favour of meat. Statements to which relatively many respondents agreed or disagreed or with large difference by meat consumption group are described below.

The findings regarding the sub-component *psychological capability* showed that 54% (mean 3.4) of the respondents reported to know how to replace meat in a dish with plant-based alternatives which was much more the case among vegetarians compared to those with a high meat consumption (adjusted mean = 4.6 vs 2.8). In addition, 32% (mean 2.7) of the respondents find it hard to come up with a dish without meat. Agreement on this statement was more as twice at high among those with a high meat consumption compared to vegetarians (adjusted means 3.6 vs 1.4). Furthermore 69% (mean 3.7) of the respondents reported to have knowledge about the consequences of meat on the environment (4.4 among vegetarians and 3.3 among high meat consumers).

Regarding *physical capability,* 39% (mean 3.0) of the respondents find it difficult to replace meat in a dish with plants based alternatives, which was especially reported by respondents with a high meat consumption compared to vegetarians (adjusted mean 3.6 vs 1.6). In addition, 66% (mean 3.6) of the respondents found it easy to prepare a meal with a smaller portion of meat than they were used to (3.9 among vegetarians

Table 3
(Adjusted) means for the statements on capability, opportunity, and motivation to reduce meat consumption for the total population and split by meat consumption groups and gender (n = 1670).[1,2]

	Total population *mean(sd)*	Vegetarian	Meat consumption groups *mean (se)*[3]			
			Low	Middle	High	*P-value*[5]
Psychological capability (Cronbach's Alpha[4] = 0.52)						
1. I know how to replace meat in a dish with plant-based alternatives	3.43 (1.06)	4.57 (0.10)	3.62 (0.07)	3.19 (0.07)	2.83 (0.07)	***
2. I find it hard to come up with a dish without meat	2.72 (1.19)	1.39 (0.11)	2.47 (0.07)	3.01 (0.07)	3.63 (0.08)	***
3. I know which consequences meat consumption has on the environment	3.73 (0.92)	4.42 (0.09)	3.72 (0.06)	3.59 (0.06)	3.30 (0.07)	***
4. I know how much meat I am allowed to eat according to the Wheel of Five	2.88 (1.06)	2.66 (0.11)	3.08 (0.08)	2.94 (0.08)	2.84 (0.08)	***
Physical capability (Cronbach's Alpha = 0.58)						
5. I find it difficult to replace meat in a dish with plant-based alternatives	2.97(1.21)	1.57 (0.12)	2.76 (0.08)	3.10 (0.08)	3.61 (0.09)	***
6. I find it easy to locate plant-based alternatives for meat in the (online) stores	3.54(1.04)	4.31 (0.11)	3.59 (0.08)	3.29 (0.08)	3.17 (0.08)	***
7. I find it easy to locate plant-based alternatives for meat in restaurants	3.15(1.09)	3.50 (0.12)	3.24 (0.09)	3.07 (0.09)	2.83 (0.09)	***
8. I find it easy to locate plant-based alternatives for meat at takeaways and delivery restaurants	2.93(1.07)	3.29 (0.12)	2.97 (0.09)	2.80 (0.09)	2.76 (0.09)	***
9. I find it easy to prepare a meal with a smaller portion of meat than I am used to	3.58 (0.98)	3.93 (0.16)	3.74 (0.07)	3.65 (0.07)	3.17 (0.08)	***
Physical opportunity (Cronbach's Alpha = 0.43)						
10. It takes less time to prepare a meal without meat than to prepare a meal with meat	2.95 (1.00)	3.60 (0.11)	3.35 (0.07)	2.90 (0.07)	2.84 (0.08)	***
11. It takes too much time to prepare a meal with a plant-based alternative of meat	2.52 (1.07)	1.73 (0.11)	2.62 (0.08)	2.85 (0.08)	2.86 (0.08)	***
12. The (online) stores offer satisfying plant-based alternatives for meat	3.71 (0.88)	3.91 (0.10)	3.58 (0.07)	3.50 (0.07)	3.38 (0.07)	***
13. Restaurants offer satisfying plant-based alternatives for meat	3.27 (0.99)	3.26 (0.11)	3.21 (0.08)	3.21 (0.08)	2.99 (0.08)	**
14. Takeaways and delivery restaurants offer satisfying plant-based alternatives for meat	3.05 (0.98)	3.11 (0.11)	3.00 (0.08)	2.92 (0.08)	2.78 (0.09)	**
15. The canteen at work or school offers satisfying plant-based alternatives for meat	2.93 (1.14)	2.75 (0.15)	2.84 (0.10)	2.91 (0.10)	2.80 (0.11)	N.S.
16. Plant-based alternatives of meat are more expensive than meat	3.61 (0.98)	3.32 (0.11)	3.62 (0.08)	3.87 (0.08)	3.85 (0.08)	***
Social opportunity (Cronbach's Alpha = 0.76)						
17. My friends find it important to eat meat	3.32 (1.01)	3.03 (0.11)	3.24 (0.07)	3.56 (0.07)	3.90 (0.08)	***
18. My household finds it important to eat meat	3.39 (1.07)	2.80 (0.13)	3.15 (0.08)	3.61 (0.08)	3.90 (0.09)	***
19. My family finds it important to eat meat	3.46 (1.00)	2.85 (0.11)	3.30 (0.07)	3.57 (0.07)	4.03 (0.08)	***
20. My colleagues/ fellow students find it important to eat meat	3.24 (0.97)	3.25 (0.11)	3.33 (0.08)	3.40 (0.08)	3.71 (0.08)	***
21. Eating meat is part of my culture	3.31 (1.18)	1.98 (0.11)	3.15 (0.08)	3.62 (0.08)	4.06 (0.08)	***
22. My friends accept people who want to eat less meat	3.87 (0.86)	3.97 (0.09)	3.81 (0.06)	3.63 (0.06)	3.50 (0.07)	***
23. My household takes people who want to eat less meat into account	3.65 (1.02)	4.54 (0.13)	3.92 (0.08)	3.63 (0.08)	3.29 (0.09)	***
24. My colleagues/ fellow students accept people who want to eat less meat	3.86 (0.82)	3.74 (0.09)	3.70 (0.07)	3.66 (0.07)	3.60 (0.07)	N.S.
25. My family takes people who want to eat less meat into account	3.67 (0.96)	4.33 (0.10)	3.85 (0.07)	3.53 (0.07)	3.36 (0.08)	***
26. I can decide for myself whether I eat meat or not	4.31 (0.74)	4.71 (0.08)	4.27 (0.05)	4.20 (0.05)	4.31 (0.06)	***
27. People in my environment eat less and less meat	3.38 (1.02)	3.72 (0.11)	3.55 (0.07)	3.22 (0.07)	2.85 (0.08)	***
Reflective motivation (Cronbach's Alpha = 0.80)						
28. The environment plays an important role in my decision whether to eat meat	3.18 (1.19)	4.35 (0.12)	3.62 (0.08)	3.10 (0.08)	2.51 (0.08)	***
29. Animal welfare plays an important role in my decision whether to eat meat	3.25 (1.18)	4.59 (0.12)	3.67 (0.08)	3.15 (0.08)	2.65 (0.08)	***
30. My health plays an important role in my decision whether to eat meat	3.29 (1.07)	3.71 (0.12)	3.58 (0.08)	3.28 (0.08)	3.30 (0.08)	***
31. My decision whether to eat meat is mainly based on price	2.55 (1.08)	1.48 (0.11)	2.66 (0.08)	2.81 (0.08)	2.61 (0.08)	***
32. My decision whether to eat meat mainly depends on what I enjoy eating	3.71 (1.02)	1.95 (0.10)	3.66 (0.06)	3.98 (0.06)	4.11 (0.07)	***
33. A dish without meat lacks flavour	2.59 (1.22)	1.53 (0.11)	2.48 (0.08)	2.85 (0.08)	3.41 (0.08)	***

(*continued on next page*)

Table 3 (*continued*)

	Total population *mean(sd)*	Vegetarian	Meat consumption groups *mean (se)*[3]			
			Low	Middle	High	*P-value* [5]
34. Eating meat is important to stay healthy	3.25 (1.11)	1.54 (0.10)	3.20 (0.07)	3.52 (0.07)	3.92 (0.07)	***
35. A plant-based alternative of meat is healthier than meat	3.03 (1.03)	4.20 (0.10)	3.34 (0.07)	2.92 (0.07)	2.60 (0.08)	***
36. I like trying vegetarian dishes	3.46 (1.18)	4.63 (0.11)	3.86 (0.07)	3.42 (0.07)	2.62 (0.08)	***
37. A meal without meat is not satisfying [filling]	2.64 (1.23)	1.64 (0.12)	2.59 (0.08)	3.00 (0.08)	3.45 (0.09)	***
38. It is natural to eat meat	3.57 (1.01)	2.05 (0.09)	3.42 (0.06)	3.79 (0.06)	4.23 (0.07)	***
Automatic motivation (Cronbach's Alpha = 0.79)						
39. I enjoy eating meat	4.00 (1.03)	1.69 (0.08)	3.75 (0.06)	4.11 (0.06)	4.44 (0.06)	***
40. I enjoy a meal with meat more than a meal with a plant-based alternative of meat	3.31 (1.26)	1.76 (0.11)	3.08 (0.08)	3.75 (0.07)	4.26 (0.08)	***
41. I enjoy a meal with a small portion of meat as much as a meal with a normal portion of meat	3.50 (1.03)	2.50 (0.13)	3.72 (0.07)	3.62 (0.07)	3.17 (0.08)	***
42. Eating meat is my habit	3.31 (1.19)	1.39 (0.10)	3.12 (0.07)	3.70 (0.07)	4.02 (0.07)	***
43. I thoughtlessly add meat to my meals	3.00 (1.26)	1.41 (0.11)	2.76 (0.08)	3.48 (0.08)	3.91 (0.08)	***
44. When meat is offered to me, I accept it	3.77 (1.09)	1.18 (0.08)	3.53 (0.06)	3.97 (0.06)	4.30 (0.06)	***
45. I feel guilty when eating meat	2.40 (1.21)	4.34 (0.12)	2.72 (0.07)	2.25 (0.07)	1.77 (0.08)	***

[1]Data was weighted on the variables age, gender, education level, work status, urban density, and region.
[2]Statements could be answered on five-point Likert scales ranging from 'completely disagree' to 'completely agree'.
[3] Low, middle an d high meat consumption groups were based on the tertiles of meat consumption among meat consumers (vegetarians excluded).
[4] Cronbach's Alpha reflect the internal consistency of the statements within each subscale. Values > 0.7 were considered to be sufficient (Tavakol & Dennick, 2011).
[5] Adjusted means, standard errors and P-values from ANCOVA analysis corrected for gender, urban density, household composition, ethnicity, residing children, socioeconomic status, and work status. **P < 0.01; ***P < 0.001.

and 3.2 among high meat consumers). Furthermore, 61% of the respondents found it easy to locate plant-based alternatives in the stores, although fewer respondents agreed that it was easy to locate such foods in restaurants or takeaways and delivery restaurants (43% and 35%). This trend was also visible by group of meat consumption frequency.

Results regarding *physical opportunity* showed that 19% (mean 2.5) of the respondents agreed that it takes too much time to prepare a meal with a plant-based alternative, which was more often agreed by those with a high meat consumption compared to vegetarians (adjusted mean 2.9 vs 1.7). Furthermore, 69% agreed that online stores offered satisfying plant-based alternatives for meat although fewer respondents agreed this was the case in restaurants (45%), takeaways and delivery restaurants (37%), and canteens at work or school (37%). Differences between meat consumption groups were relatively small (adjusted mean < 0.6).

Results related to the sub-component *social opportunity* showed that more than 60% of the respondents found that friends, the household, family members, and colleagues or fellow students accepted or took into account people who wanted to eat less meat (range 64% to 76%). The largest difference between meat consumption groups was found for the statement that their household takes people who want to eat less meat into account (adjusted mean 4.5 among vegetarians and 3.3 among high meat consumers). Nearly all respondents (91%; mean 4.3) reported to be able to decide for themselves whether they consumed meat or not.

Concerning *reflective motivation*, nearly half of the respondents agreed that the environment, animal welfare and health plays a role in their decision whether to eat meat. Almost 75% answered that their decision whether to consume meat was mainly based on what they enjoyed eating and almost 25% answered that this decision was mainly based on price. Those results largely differed by meat consumption groups. Adjusted means for the statements regarding enjoyment and price were approximately as twice as high among all meat consumption groups compared to vegetarians. This was the other way around for the statements regarding environment and animal welfare which were highly agreed by vegetarians. In addition, 65% (mean 3.6) of the respondents agreed that it is natural to eat meat. Nevertheless, only 27% (mean 2.6) of the respondents found that a dish without meat lacked flavour and 29% (mean 2.6) reported that a meal without meat was not satisfying. Agreement on those statements was twice as high among respondents with a high meat consumption compared to vegetarians.

Results for *automatic motivation* were that most of the respondents (80%; mean 4.0) enjoyed eating meat, 60% (mean 3.5) reported to enjoy a meal with a small portion of meat as much as a meal with a normal portion of meat, and 75% (adjusted mean 3.8) reported to accept meat when it was offered to them. Agreement on those statements was much higher among those with a high meat consumption compared to vegetarians. In addition, 20% (adjusted mean 2.4) felt guilty when consuming meat, which was more agreed on by vegetarians compared to meat consumers (adjusted mean 4.3 vs 1.8). Compared to the other subcomponents the largest differences between groups of meat consumption were found among statements regarding automatic motivation.

Half of the respondents who consumed meat at least sometimes had the intention to reduce their meat consumption during the next five years, whereas 34% of the respondents did not intend to do so. The intention to reduce meat consumption was comparable between males and females, but differed statistically significant between groups of meat consumption frequency (Appendix B). One third of the respondents with a high meat consumption reported to have the intention to reduce meat consumption compared to just over half of those with middle and low meat consumption.

Among meat consumers, the most frequently selected reasons for reducing meat consumption in the future were the environment (53%) and animal welfare (49%) (Table 4). Health (39%) and saving money (26%) were also frequently selected reasons. The most frequently selected self-perceived barrier for reducing meat consumption was taste (57%) (Table 4). In addition, the price of alternatives for meat (33%)

Table 4
Self-perceived enablers and barriers for reducing meat consumption for the total population and split by meat consumption groups and gender (n = 1546)[1].

	Total population (%)	Gender (%)			Meat consumption tertiles (%)			
		Male	Female	P-value	Low	Middle	High	P-value[2]
Reasons for reducing meat consumption								
Environment	53	46	60	N.S.	59	60	35	***
Animal welfare	49	43	57	N.S.	59	53	35	***
Health	39	36	42	N.S.	45	38	34	**
Save money	26	25	27	N.S.	25	24	29	N.S.
People in the social environment	7	9	5	**	9	6	6	N.S.
Taste	6	4	8	**	9	4	3	***
Save time during cooking	6	6	6	N.S.	7	5	7	N.S.
Other[3]	2	2	2	N.S.	2	2	2	N.S.
None, I would never reduce my meat consumption	12	16	8	N.S.	5	10	23	***
% With more than one reason	60	55	64	***	73	68	49	***
Barriers for reducing meat consumption								
Taste	57	57	58	N.S.	46	59	69	***
Price of alternatives of meat	33	34	33	N.S.	28	36	36	**
Habit	26	26	25	N.S.	20	27	30	N.S.
Limited offer of plant-based alternatives of meat with good quality	17	18	17		19	16	16	N.S.
Convenience	15	13	16	N.S.	12	18	13	N.S.
Lack of knowledge about alternatives of meat	15	15	15	N.S.	10	17	18	***
Health	14	14	13	N.S.	15	12	15	N.S.
People in the social environment	13	10	17	**	14	13	12	N.S.
Lack of skills for preparing a meal without meat	10	9	11	N.S.	7	12	11	**
Satiety	9	11	6	N.S.	8	8	12	N.S.
More time is required for preparing a meal without meat	4	4	3	N.S.	2	4	4	N.S.
None	6	6	5	N.S.	11	4	2	***
Other[3]	1	0	1	N.S.	1	0	0	N.S.
% With more than one barrier	59	58	60	**	57	69	64	**

[1] Data was weighted on the variables age, gender, education level, work status, urban density and region.
[2] Among respondents who consumed meat at least sometimes and who did not report that they would never reduce their meat consumption.
[2] Logistic regression analysis for comparison between meat consumption subgroups corrected for gender, urban density, household composition, ethnicity, residing children, socioeconomic status, and work status. **P < 0.01; ***P < 0.001.
[3] Answers provided by respondents who selected the 'other, namely…' category were classified in one of the predefined answer categories whenever possible.

and habits (28%) were frequently selected barriers. Analysis by gender and groups of meat consumption frequency showed the same ranking of self-perceived barriers and enablers. However, some large differences between level of meat consumption was were observed. Environment and animal welfare were selected nearly as twice often as reason to reduce meat consumption by respondents with a low meat consumption compared to those with higher meat consumption. Regarding barriers to reduce meat consumption, taste was more often selected by respondents with a high meat consumption compared to those with a lower meat consumption frequency (69% vs 46%).

An overview of all barriers and enablers to reduce meat consumption identified in this study are presented in Table 6.

3.4. Self-perceived effective strategies to reduce meat consumption

Among meat consumers, the most often selected self-perceived effective strategy for reducing meat consumption was price reduction of plant-based alternatives of meat (58%). This reason was more selected by female than male (63% vs 52%) and by respondents in the middle meat consumption category compared to those with a low meat consumption (62% vs 53). The second most often selected effective strategy to reduce meat consumption was recipes for vegetarian meals (40%) which was more often selected by female than male (47% vs 33%). The third most often selected strategy was more attractive plant-based alternatives of meat, which did not differ by subgroups (33%; Table 5). The ranking of the three most frequently reported strategies was similar by gender and meat consumption groups.

4. Discussion

This study among 1806 young Dutch adults aimed to describe the self-perceived influence of life course transitions on meat consumption, the experienced barriers and enablers (using the COM-B model), and self-perceived effective strategies for reducing meat consumption.

This study showed that all inquired life course transitions were more frequently reported by the respondents to have decreased than to have increased their meat consumption. Especially the life course transitions related to moving house have decreased respondents' meat consumption, with a change in the social environment and an increase in independence being frequently mentioned reasons for this change. In addition, barriers and enablers to reduce meat consumption were identified for all three aspects of the COM-B model (capability, opportunity, and motivation). The most important self-perceived reasons for reducing meat consumption in the future were the environment, animal welfare, health and saving money. The most frequently selected self-perceived barriers were taste, the price of alternatives of meat and habits. Self-perceived most effective strategies for reducing meat consumption were a price reduction of plant-based alternatives of meat, recipes for vegetarian meals and more attractive plant-based alternatives. Results were more or less comparable between males and females. In contrast, large differences were identified between meat consumption subgroups.

As far as known, this was the first quantitative study providing insights into the self-perceived influence of life course transitions on meat consumption. Interestingly, results indicated that life course transitions in general are more likely to decrease than to increase meat consumption. This finding might have been prone to recall bias or social desirability bias (Bound et al., 2001), so more research is required to confirm this finding. Looking at different types of life course transitions, especially moving house which often coincided with leaving the parental home in the current study was frequently reported by young adults to decrease their meat consumption. This finding is in line with a recent published qualitative study (Kemper & White, 2021) that reported that young adults are encouraged to reduce meat consumption due to a transition away from home which is enabled amongst others through increased control in food purchasing and cooking, and encouragement

Table 5
Self-perceived effective strategies to reduce meat consumption for respondents who consumed meat at least sometimes and who did not report that they would never reduce their meat consumption (n = 1361) [1].

Strategy	Total population (%)	Gender (%)			Meat consumption tertile (%)			
		Males	Females	P-	Low	Middle	High	P-
A reduction of the price of plant-based alternatives of meat	58	52	63	**	53	62	57	**
Recipes for vegetarian meals	40	33	47	***	38	44	37	N. S.
More attractive plant-based alternatives of meat	33	30	37	N. S.	32	37	31	N. S.
Lower meat consumption of people in the social environment	26	21	31	**	24	27	28	N. S.
More plant-based alternatives of meat	24	23	25	N. S.	26	24	21	N. S.
Information about how to replace meat with plant-based alternatives	23	19	27	**	21	26	21	N. S.
An increase in the price of meat	20	22	18	**	25	19	14	**
If vegetarian dishes were easier to find in restaurants, for takeaways, and for delivery meals	18	14	21	N. S.	23	17	12	**
Information about the effect of meat on the environment	18	17	18	N. S.	18	19	15	N. S.
Information about the effect of meat on animal welfare	16	16	15	N. S.	19	17	8	***
Information about the effect of meat on health	16	16	17	N. S.	16	17	17	N. S.
Labels on products and at dishes that show whether the product is good for the environment	16	14	19	N. S.	21	15	12	**
More advertisements of plant-based alternatives of meat	16	15	17	N. S.	21	17	10	***
Smaller portions of meat in restaurants, for takeaways, and for delivery meals	15	12	18	N. S.	13	20	12	**
Labels on products and at dishes that show how healthy the product is	14	12	16	N. S.	15	14	13	N. S.
Cooking lessons to learn how to cook vegetarian meals	12	12	11	N. S.	12	9	15	N. S.
If plant-based alternatives of meat were easier to find in the (online) stores	11	10	12	N. S.	11	12	9	N. S.
Less advertisements of meat	9	10	7	N. S.	12	8	5	***
None	9	11	6	**	8	6	14	**
Other[2]	0	0	1	N. S.	0	1	1	N. S.
% With more than one strategy	62	59	65	N. S.	71	73	55	***

[1] Data was weighted on the variables age, gender, education level, work status, urban density, and region.
[2] Answers provided by respondents who selected the 'other, namely…' category were classified in one of the predefined answer categories whenever possible.

from others. This highlights the moment of leaving the parental home as an important window of opportunity to reduce meat consumption among young adults.

This study was among one of the first quantitative studies investigating barriers and enablers among young adults specifically. Although barriers and enablers were observed among all three aspects of the COM-B model, most important barriers and enablers were related to motivation and opportunity. Combining this with the results on the self-reported barriers and enablers, knowledge about plant-based alternatives of meat, and intention to reduce meat consumption, revealed that most important barriers for reducing meat consumption were taste, perceived high prices of plant-based alternatives of meat and habits (Table 6). The most important identified enablers were care for the environment and animal welfare, high enjoyment of smaller portions of meat and the possibility of saving money.

We observed only small differences between males and females in barriers and enablers to reduce meat consumption. This in line with other research in this area (Hayley et al., 2015; Lea et al., 2006). Although, a review of Graça et al. (2019) stated that relevant gender differences were identified in many studies. These differences were mainly related to the amount of meat consumption and willingness to reduce meat consumption. This was also found in our study. For example female more often agreed to like trying vegetarian dishes and reported a lower meat consumption than male.

On the other hand, large differences in barriers and enablers to reduce meat consumption were identified between meat consumption groups, which is in line with literature (Lacroix & Gifford, 2019; Hielkema & Lund, 2021; Verain et al., 2022). All identified barriers were stronger barriers among higher meat consumption groups and most enablers were weaker enablers among higher meat consumption groups. Indeed, the absence of some enablers among the highest meat consumption group (for example the willingness to reduce meat consumption) can be understood as a barrier to reduce meat consumption in this group. An interesting finding was that 78% of the vegetarians reported to not like eating meat, whereas enjoyment of meat was reported to be high among the other meat consumption groups. This could be due to the fact that moral vegetarians often develop disgust for meat (Fessler, Arguello, Mekdara, & Macias, 2003).

An important finding of this study is that meat consumption was shown to be strongly habitual behaviour. As a consequence, intentions or ideals are weak predictors of meat consumption (Van't Riet et al., 2011; Rothgerber, 2020). Thus, it is questionable to which extent the observed high intention to reduce meat consumption in this study could be considered an enabler. However, according to Van't Riet et al. (2011), a high intention to reduce meat consumption could become an enabler of a change in meat consumption during moments of disruption in habits.

Instead of being influenced by intentions, habitual behaviour is

Table 6
Overview of identified barriers and enablers for a shift from a meat-based diet towards a more plant-based diet.

Factor	Based on:	Determinant
Barriers		
Taste (high enjoyment of meat)	MCQ barriers, Statement 32, 39, 40	Motivation
High perceived prices of plant-based alternatives of meat	MCQ barriers, Statement 16	Opportunity
Habits (meat consumption is habitual behaviour)	MCQ barriers, Statement 42–44	Motivation
Cultural/ social norms	Statement 17–21	Opportunity
Limited knowledge about plant-based alternatives of meat	MCQ knowledge	Capability
Belief that meat consumption is natural	Statement 38	Motivation
Limited knowledge about recommendations for meat by the Wheel of Five	Statement 4	Capability
Enablers		
High interest in the environment and animal welfare[a]	MCQ enablers, Statement 28, 29	Motivation
Enjoyment of smaller portions of meat	Statement 41	Motivation
Saving money (saving money was considered a reason for reducing meat consumption)	MCQ enablers	Opportunity
Intention to reduce meat consumption	MCQ intention	Motivation
Dynamic norms/ social acceptance of people with limited meat consumption	Statement 22–27	Opportunity
High knowledge about the consequences of meat on the environment	Statement 3	Capability
High knowledge on how to replace meat in a dish[a]	Statement 1, 2	Capability
Skills for preparing smaller portions of meat	Statement 9	Capability
Willingness to try vegetarian dishes[a]	Statement 36	Motivation
Belief that meals without meat offer satiety[a]	Statement 37	Motivation
Other/ unknown[b]		
Offer of plant-based alternatives of meat	MCQ barriers, Statement 12–15	Opportunity
Skills to locate plant-based alternatives of meat	Statement 6–8	Capability
Beliefs about health	MCQ barriers, MCQ enablers, Statement 20, 34, 35	Motivation

[a] Factors that were enablers for young adults in general but barriers for respondents from the highest tertile of meat consumption specifically.
[b] Factors that could not be classified as a barrier or an enabler due to contradictory or neutral findings.

mainly driven by cues from the environment, including the physical and social environment (Van't Riet et al., 2011). Therefore, the finding that about half of the respondents considered meat consumption the social or cultural norm was considered an important barrier for reducing meat consumption. Nevertheless, results also revealed that norms regarding meat consumption were dynamic, as more than half of the respondents reported that people in their environment were reducing their meat consumption. This latter finding is consistent with previous research showing that the majority of the Dutch adults believed that eating less meat would become the norm (Natuur & Milieu, 2019). The social environment was not frequently selected as a self-perceived barrier or enabler, but a possible explanation for this is that the description of 'people in my environment' may have been somewhat vague. Other studies report the important role of social barriers such as fear of stigmatization and lack of social support from family and friends among people who want to reduce their meat consumption (Markowski & Roxburgh, 2019; Graça et al., 2019).

Another striking finding of this study was that price could both hinder and facilitate a decrease in meat consumption. On the one hand, high perceived prices of plant-based alternatives of meat were shown to be a barrier for replacing meat with plant-based alternatives of meat. On the other hand, saving money was considered a reason for reducing meat consumption. That plant-based alternatives of meat were considered more expensive than meat is an interesting finding, because all plant-based alternatives of meat, except for ready-to-eat meat replacers, are in fact less expensive than meat in the Netherlands (Albert Heijn, n.d.; Voedingscentrum, n.d.). However, a possible explanation for this finding is lower willingness to pay for plant-based alternatives of meat than for meat as observed by Vanhonacker et al. (2013).

Four of the five most important identified barriers were previously identified as barriers among adults in general, namely taste, habits, cultural and social norms, and high prices of plant-based alternatives of meat (Hoek et al., 2017; Mullee et al., 2017; Hielkema & Lund, 2021). Additionally, the enablers care for the environment and animal welfare, high enjoyment of smaller portions of meat, and dynamic norms were previously identified among Dutch adults (Natuur & Milieu, 2019). This indicates that young adults experience similar types of barriers and enablers as adults in general, which is supported by the qualitative study about meat reduction among family life cycle groups (Kemper, 2020). Kemper (2020) found that health, the environment and costs are as important motivating factors for meat reduction among young adults, families, and retirees but to different degrees per group. In addition, the barriers to meat reduction were similar among the family life cycle groups. On the other hand, we observed differences among young adults in the motivations to reduce their meat consumption by group of meat consumption frequency. Although taste and price were more important among higher meat consumption groups, whereas the environment, animal welfare, and health were less important among higher meat consumption groups. This is in with the results of a recent research among Dutch adults (Verain et al., 2022).

The self-perceived most effective strategies for reducing meat consumption that were identified in this study were broadly in line with the most important identified barriers and enablers. The most frequently selected strategy was price reduction of plant-based alternatives of meat, which targets the barrier of price and the enabler of saving money. In addition, strategies related to a change in the offer of plant-based alternatives of meat and a change in the social environment were frequently selected. These strategies could address the barriers of habits, taste, and social and cultural norms and target the enabler of dynamic norms and high social acceptance. This is supported by findings of a recent experiment among consumers to assess their sensory acceptance of different plant protein meat substitutes beside meat (Cordelle et al., 2022). The results showed that, although the meat was generally preferred, one of the plant-based protein product was highly appreciated for the taste and structure, even more than the meat. Finally, recipes for vegetarian meals was considered an effective strategy, which could address the barrier of limited knowledge about plant-based alternatives of meat and is related to the enabler of high intention to reduce meat consumption. Remarkably, labels on products and at dishes that show whether the product is good for the environment or healthy were not considered helpful to reduce meat consumption. This corresponds with the results of an experimental study in which information about the negative effects of meat consumption on health and environmental was provide among visitors of an university canteen. The results showed no direct effect of health or environmental information on attitude, intention, or meat consumption behaviour compared to the control group (Weingarten et al., 2022).

4.1. Practical implications

Findings of this study have important practical implications for the development of behaviour change strategies aiming to reduce meat consumption under young adults. The first implication is that strategies should utilize the windows of opportunity provided by live course transitions. In particular, programs or interventions specifically aimed at young adults who are leaving the parental home.

In addition, multiple barriers and enablers for reducing meat consumption were identified in this study, which indicates that a

combination of multiple strategies is required in order to effectively stimulate this dietary change. This was also suggested by two recent reviews (RIVM, 2020b; Veul, 2018). Moreover, knowledge about the effectiveness of such combination of interventions is needed (Kwasny et al., 2022). The identified barriers and enablers in this study were similar to those previously identified among adults in general, which could indicate that similar types of strategies can be used for reducing meat consumption among younger adults as compared to older adults. However, barriers and enablers largely differed by groups of meat consumption frequency which implicate that targeted approaches are needed to stimulate different groups towards lower meat consumption (Hielkema & Lund, 2021; Verain et al., 2022).

In line with Hoek et al. (2017) and Vanhonacker et al. (2013), findings of this study suggest that strategies stimulating a reduction in portion sizes of meat may be more easily accepted than strategies stimulating replacement of meat with plant-based alternatives of meat. Nevertheless, increasing and improving the offer of plant-based alternatives of meat was considered one of the most effective strategies by the young adults themselves. Related to this, the results indicate that strategies aiming to reduce meat consumption are most likely to be effective if they focus on changing the physical and the social environment, because meat consumption was shown to be habitual behaviour. Furthermore, results of this study suggest that increasing the prices of meat or decreasing the prices of plant-based alternatives could stimulate a reduction in meat consumption. This is supported by the results of a modelling studies which showed that applying a meat tax leads to less meat consumption (Springmann et al., 2018; Broeks et al., 2019). For example, a 15% or 30% meat tax could result in on average an 8% or 16% lower meat consumption in the Netherlands (Broeks et al., 2019).

Finally, strategies could focus on education and distributing recipes in order to improve knowledge about plant-based alternatives of meat. Bianchi, Dorsel et al. (2018) found that education is unlikely to change meat consumption, but could change intentions to reduce meat consumption and might therefore be important to increase acceptance of more structural strategies aiming to reduce meat consumption. Thus, education may be especially important for young adults who consume meat (almost) daily, because this study showed that they had limited willingness to reduce meat consumption and little knowledge and skills. However, the most suitable design for strategies aiming to reduce meat consumption and the most effective combination of strategies remains to be investigated in practice.

5. Limitations

This research has several limitations that need to be acknowledged. A first limitation of the current study is that it was cross-sectional in nature and therefore does not allow to draw any conclusions on causal relationships due to the risk of reverse causation and confounding (Psaty et al., 1999; Webb and Bain, 2011). However, the likelihood of confounding was reduced by means of multivariate adjustments for known potential confounders.

A second limitation is that internal consistency of several subscales of the statements was rather low (Cronbach's alpha < 0.60), which indicates limited reliability and hampered the possibility of drawing conclusions at subscale level. However, the low internal consistency of the subscales could be at least partially explained by the limited number of statements included and the diverse set of topics covered (Field, 2018). That a diverse set of topics is covered in this research is a consequence of the use of the COM-B model (Michie et al., 2011). This provided very interesting insights at statement level especially for groups of meat consumption frequency. The COM-B model allowed for investigation of a wide range of potential barriers and enablers and is therefore also recommended for future research, but with an extended number of statements for some of the subscales.

Furthermore, classification of respondents into meat consumption groups was a somewhat arbitrary decision, which could have influenced the results. For example, classification was only based on frequency of meat consumption and not on portion sizes. However, portion size is difficult to estimate, and literature shows that measuring frequency of consumption is appropriate for ranking and grouping individuals by consumption level (Biro et al., 2002). Therefore, the results of this study are considered reliable.

Finally, limitations of survey research in general should be acknowledged. Survey research relies on self-report and is therefore prone to social desirability bias and recall bias (Bound et al., 2001). This may also be the case here because of the emotive connotations of meat consumption. In addition, surveys are prone to order bias, which was reduced by randomisation of the order of the survey questions (Kraan et al., 2010).

6. Conclusion

Results of this cross-sectional study among 1806 young Dutch adults suggest that life course transitions, especially those related to moving house, provide a window of opportunity for reducing meat consumption, with a change in the social environment and an increase in independence being important underlying reasons. In this study barriers and enablers were observed among all three aspects of the COM-B model. However, most important barriers and enablers for reducing meat consumption among young adults were related to the model components motivation (for example taste and habits) and opportunity (for example price and saving money).

The findings of this study are relevant for the development of behaviour-change strategies aiming to reduce young adult's meat consumption. Furthermore, the results indicates that a combination of multiple strategies in an integrated approach is necessary in order to address all identified barriers and enablers. Strategies using of the window of opportunity provided by live course transitions and aiming to change the physical and the social environment (such as reducing the portion size of meat, lower price, and improved offer of meat alternatives) are likely to be effective. The most suitable design of strategies aiming for a reduction in meat consumption remains to be investigated in practice.

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Ethical statement

The study protocol was reviewed by the Clinical Expertise Centre of the National Institute for Public Health in the Netherlands. Based on this review, exemption from requiring ethics approval was provided. Written informed consent was provided by the participants before taking part in the study.

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 A. Supplementary data

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References

Abete, I., Romaguera, D., Vieira, A. R., de Munain, A. L., & Norat, T. (2014). Association between total, processed, red and white meat consumption and all-cause, CVD and IHD mortality: A meta-analysis of cohort studies. *British Journal of Nutrition, 112*, 762–775. https://doi.org/10.1017/S000711451400124X

Albert Heijn. (n.d.). https://www.ah.nl/ Accessed 15 May 2020.

Bianchi, F., Dorsel, C., Garnett, E., Aveyard, P., & Jebb, S. A. (2018). Interventions targeting conscious determinants of human behaviour to reduce the demand for meat: A systematic review with qualitative comparative analysis. *International Journal of Behavioral Nutrition and Physical Activity, 15*, 1–25. https://doi.org/10.1186/s12966-018-0729-6

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

Biro, G., Hulshof, K., Ovesen, L., & Cruz, J. A. (2002). Selection of methodology to assess food intake. *European Journal of Clinical Nutrition, 56*(2), S25–S32. https://doi.org/10.1038/sj/ejcn/1601426

Broeks, M., et al., A Social Cost-Benefit Analysis of policies for a healthier and more sustainable food consumption in the Netherlands: meat taxation and a fruit & vegetables subsidy. 2019.

Bound, J., Brown, C., & Mathiowetz, N. (2001). Measurement error in survey data. In J. J. Heckman, & E. Leamer (Eds.), *Handbook of econometrics* (Vol. 5, pp. 3705–3843). Elsevier.

Collier, E. S., Oberrauter, L. M., Normann, A., Norman, C., Svensson, M., Niimi, J., et al. (2021). Identifying barriers to decreasing meat consumption and increasing acceptance of meat substitutes among Swedish consumers. *Appetite, 167*, Article 105643.

Cordelle, S., Redl, A., & Schlich, P. (2022). Sensory acceptability of new plant protein meat substitutes. *Food Quality and Preference, 98*, Article 104508.

Cooksey, E. C., & Rindfuss, R. R. (2001). Patterns of work and schooling in young adulthood. *Sociological Forum, 16*, 731–755. https://doi.org/10.1023/A:1012842230505

Curran, P. G. (2016). Methods for the detection of carelessly invalid responses in survey data. *Journal of Experimental Social Psychology, 66*, 4–19. https://doi.org/10.1016/j.jesp.2015.07.006

De Boer, J., Schösler, H., & Aiking, H. (2014). "Meatless days" or "less but better"? Exploring strategies to adapt Western meat consumption to health and sustainability challenges. *Appetite, 76*, 120–128. https://doi.org/10.1016/j.appet.2014.02.002

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

DeSimone, J. A., Harms, P. D., & DeSimone, A. J. (2014). Best practice recommendations for data screening. *Journal of Organizational Behavior, 36*(2), 171–181. https://doi.org/10.1002/job.1962

Elder, G. H., & Johnson, M. K. (2003). The life course and aging: Challenges, lessons, and new directions. In R. A. Settersten (Ed.), *Invitation to the life course: Toward new understanding of later life* (pp. 49–81). Routledge.

FAO. (2006). *Livestock's long shadow: environmental issues and options*. http://www.fao.org/3/a0701e/a0701e00.htm.

FAO. (2010). *Sustainable diets and biodiversity - Directions and solutions for policy, research and action*. http://www.fao.org/3/a-i3004e.pdf.

FAO. (2011). *World livestock 2011 - Livestock in food security*. http://www.fao.org/3/i2373e/i2373e.pdf.

FAO. (2018). *Food supply - Livestock and fish primary equivalent*. http://www.fao.org/faostat/en/#data/CL.

FAO, & WHO. (2019). *Sustainable healthy diets: guiding principles*. http://www.fao.org/3/ca6640en/ca6640en.pdf.

Field, A. (2018). *Discovering statistics using IBM SPSS Statistics* (J. Seaman Ed. 5 ed.). SAGE.

Garnett, T., Matthewson, S., Angelides, P., & Borthwick, F. (2015). Policies and actions to shift eating patterns: What works? - A review of the evidence of the effectiveness of interventions aimed at shifting diets in more sustainable and healthy directions. FCRN. https://www.fcrn.org.uk/sites/default/files/fcrn_chatham_house_0.pdf.

Fessler, D. M., Arguello, A. P., Mekdara, J. M., & Macias, R (2003). Disgust sensitivity and meat consumption: A test of an emotivist account of moral vegetarianism. *Appetite, 41*, 31–41. https://doi.org/10.1016/S0195-6663(03)00037-0

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

Grigg, D. (1995). The nutritional transition in Western Europe. *Journal of Historical Geography, 22*(1), 247–261.

Hayley, A., Zinkiewicz, L., & Hardiman, K. (2015). Values, attitudes, and frequency of meat consumption. *Predicting meat-reduced diet in Australians. Appetite, 84*, 98–106. https://doi.org/10.1016/j.appet.2014.10.002

Hoek, A., Pearson, D., James, S., Lawrence, M., & Friel, S. (2017). Shrinking the food-print: A qualitative study into consumer perceptions, experiences and attitudes towards healthy and environmentally friendly food behaviours. *Appetite, 108*, 117–131. https://doi.org/10.1016/j.appet.2016.09.030

Hielkema, M. H., & Lund, T. B. (2021). Reducing meat consumption in meat-loving Denmark : Exploring willingness, behavior, barriers and drivers. *Food Quality and Preference, 93*, Article 104257. https://doi.org/10.1016/j.foodqual.2021.104257

Huang, J. L., Curran, P. G., Keeney, J., Poposki, E. M., & DeShon, R. P. (2012). Detecting and deterring insufficient effort responding to surveys. *Journal of Business and Psychology, 27*, 99–114. https://doi.org/10.1007/s10869-011-9231-8

Kahnermann, D. (2012). *Thinking, fast and slow*. London: Penguin Books.

Kemper, J.A. & White S.K. (2021). Young adults' experiences with flexitarianism: The 4Cs. *Appetite*. 160:105073.

Kemper, J.A. (2020). Motivations, barriers, and strategies for meat reduction at different family lifecycle stages.

Kraan, T., Van den Brakel, J., Buelens, B., & Huys, H. (2010). *Social desirability bias, response order effects and selection effects in the new Dutch Safety Monitor*. Statistics Netherlands. https://www.cbs.nl/nl-nl/achtergrond/2010/ 11/social-desirability-bias-response-order-effect-and-selection-effects-in-the-new-dutch-safety-monitor.

Kwasny, T., Dobernig, K., & Riefler, P. (2022). Towards reduced meat consumption: A systematic literature review of intervention effectiveness, 2001–2019. *Appetite, 168*, Article 105739.

Lacroix, K., & Gifford, R. (2019). Reducing meat consumption: Identifying group-specific inhibitors using latent profile analysis. *Appetite, 138*, 233–241.

Lacroix, K., & Gifford, R. (2020). Targeting interventions to distinct meat-eating groups reduces meat consumption. *Food Quality and Preference, 86*, Article 103997.

Larsen, C. S. (2003). Animal source foods and human health during evolution. *The Journal of Nutrition, 133*(11), 3893S–3897S. https://doi.org/10.1093/jn/133.11.3893S

Lea, E. J., Crawford, D., & Worsley, A. (2006). Public views of the benefits and barriers to the consumption of a plant-based diet. *European Journal of Clinical Nutrition, 60*(7), 828–837. https://doi.org/10.1038/sj.ejcn.1602387

Markowski, K. L., & Roxburgh, S. (2019). "If I became a vegan, my family and friends would hate me:" Anticipating vegan stigma as a barrier to plant-based diets. *Appetite, 135*, 1–9.

McBey, D., Watts, D., & Johnstone, A. M. (2019). Nudging, formulating new products, and the lifecourse: A qualitative assessment of the viability of three methods for reducing Scottish meat consumption for health, ethical, and environmental reasons. *Appetite, 142*, Article 104349. https://doi.org/10.1016/j.appet.2019.104349

McEvoy, C. T., Moore, S. E., Appleton, K. M., Cupples, M. E., Erwin, C., Kee, F., ... Woodside, J. V. (2018). Development of a peer support intervention to encourage dietary behaviour change towards a Mediterranean diet in adults at high cardiovascular risk. BMC Public Health, 18, 1194. 10.1186/s12889-018-.

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

MOA. (2018). *MOA Normvraagstelling 2018 v1.6*. https://moa04.artoo.nl/clou-moaweb-images/images/bestanden/pdf/GS_Normvraagstelling-2018—v1.6-1.pdf.

Mortimer, J. T., & Shanahan, M. J. (2007). *Handbook of the life course* (Vol. 2). Springer.

Mullee, A., Vermeire, L., Vanaelst, B., Mullie, P., Deriemaeker, P., Leenaert, T., et al. (2017). Vegetarianism and meat consumption: A comparison of attitudes and beliefs between vegetarian, semi-vegetarian, and omnivorous subjects in Belgium. *Appetite, 114*, 299–305. https://doi.org/10.1016/j.appet.2017.03.052

Natuur & Milieu. (2019). *Vegamonitor*. https://www.natuurenmilieu.nl/wp-content/uploads/2019/11/Natuur-Milieu-Vegamonitor-2019-RAPP_e1.pdf.

Pimentel, D., & Pimentel, M. (2003). Sustainability of meat-based and plant-based diets and the environment. *The American Journal of Clinical Nutrition, 78*(3), 660S–663S. https://doi.org/10.1093/ajcn/78.3.660S

Psaty, B. M., Koepsell, T. D., Lin, D., Weiss, N. S., Siscovick, D. S., Rosendaal, F. R., et al. (1999). Assessment and control for confounding by indication in observational studies. *Journal of the American Geriatrics Society, 47*(6), 749–754. https://doi.org/10.1111/j.1532-5415.1999.tb01603.x|

RIVM. (2016a). *The diet of the Dutch: Results of the first two years of the Dutch National Food Consumption Survey 2012-2016*. https://www.rivm.nl/bibliotheek/rapporten/2016-0082.pdf.

RIVM. (2016b). *Food consumption in the Netherlands and its determinants: Background report to "What's on our plate? Safe, healthy and sustainable diets in the Netherlands.'*. https://www.rivm.nl/bibliotheek/rapporten/2016-0195.pdf.

Rivm. (2020a). *Consumptie van vlees in*. Nederland: SHIFT-DIETS-project.

RIVM. (2020b). *Wat Werkt Dossier: Verminderen van vleesconsumptie*. https://www.loketgezondleven.nl/documenten/wat-werkt-dossier-verminderen-van-vleesconsumptie.

Rothgerber, H. (2020). Meat-related cognitive dissonance: A conceptual framework for understanding how meat eaters reduce negative arousal from eating animals. *Appetite, 146*, Article 104511.

Springmann, M., et al., Health-motivated taxes on red and processed meat: A modelling. study on optimal tax levels and associated health impacts. PloS one, 2018. 13(11).

Sullivan, G. M., & Artino, A. R., Jr (2013). Analyzing and interpreting data from Likert-type scales. *Journal of graduate medical education, 5*(4), 541–542. https://doi.org/10.4300/JGME-5-4-18

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 27*(2), 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Van't Riet, J., Sijtsema, S. J., Dagevos, H., & De Bruijn, G.-J. (2011). The importance of habits in eating behaviour. An overview and recommendations for future research. *Appetite, 57*(3), 585–596. https://doi.org/10.1016/j.appet.2011.07.010

Vanhonacker, F., Van Loo, E. J., Gellynck, X., & Verbeke, W. (2013). Flemish consumer attitudes towards more sustainable food choices. *Appetite, 62*, 7–16. https://doi.org/10.1016/j.appet.2012.11.003

Verain, M., Dagevos, H., & Jaspers, P. (2022). Flexitarianism in the Netherlands in the 2010 decade: Shifts, consumer segments and motives. *Food Quality and Preference, 96*, Article 104445. https://doi.org/10.1016/j.foodqual.2021.104445

Verplanken, B., & Roy, D. (2016). Empowering interventions to promote sustainable lifestyles: Testing the habit discontinuity hypothesis in a field experiment. *Journal of Environmental Psychology, 45*, 127–134. https://doi.org/10.1016/j.jenvp.2015.11.008

Veul, J. (2018). *Interventions to reduce meat consumption in OECD countries: A systematic review to understand differences in success.* (MSc). [Master's thesis, Radboud University Nijmegen].

Voedingscentrum. (n.d.). Hoe eet ik minder vlees of vegetarisch? https://www.voedingscentrum.nl/nl/service/vraag-en-antwoord/gezonde-voeding-en-voedingsstoffen/hoe-eet-ik-minder-vlees-of-vegetarisch-.aspx/ Accessed 22 January 2020.

Webb, P., & Bain, C. (2011). *Essential epidemiology: An introduction for students and health professionals* (2 ed.). Cambridge University Press.

Weingarten, N., Meraner, M., Bach, L., & Hartmann, M. (2022). Can information influence meat consumption behaviour? An experimental field study in the university canteen. *Food Quality and Preference, 97*, Article 104498. https://doi.org/10.1016/j.foodqual.2021.104498

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., et al. (2019). Food in the anthropocene: The EAT–lancet commission on healthy diets from sustainable food systems. *Lancet, 393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

Willis, G. B., & Artino, A. R., Jr (2013). What do our respondents think we're asking? Using cognitive interviewing to improve medical education surveys. *Journal of Graduate Medical Education, 5*(3), 353–356. https://doi.org/10.4300/JGME-D-13-00154.1