

# **Cutting down or eating up: Examining meat consumption, reduction, and sustainable food beliefs, attitudes, and behaviors**

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## **Abstract**

In response to health, environmental, ethical, and cost concerns, growing numbers of individuals are reducing their meat consumption. However, while people are now subscribing to “flexitarian” or reduced-meat diets, these flexitarian and more “traditional” omnivore diets are usually not well defined. Using an online survey, this research examined the attitudinal and behavioral differences between meat eaters, meat reducers, and occasional meat eaters in terms of their meat consumption (consumption frequency of red and white meat, fish, and meat substitutes) and their reasons for and against meat reduction. We also investigated respondents’ attachment to eating red and chicken meat and their healthy and sustainable food beliefs, attitudes, and behaviors as well as attitudes towards future foods. Our findings suggest lamb and pork consumption was the only factor that differed significantly between meat eaters, meat reducers, and occasional meat eaters, while beef and chicken was consumed similarly by meat eaters and reducers, suggesting this may be more difficult to reduce. There were differences in motivations to eat meat between the dietary groups, but little difference between these groups regarding their reasons for meat reduction. We also found significant differences in attitudes toward future foods such as plant-based substitutes, fortified foods, and cultured meat with meat reducers compared to meat eaters finding these options more appealing. A comprehensive and specific understanding of meat consumption and reduction preferences, attitudes, and beliefs is important for providing segmented marketing and social marketing strategies aimed at encouraging more sustainable and healthy food behaviors.

# 1. Introduction

Every human on Earth relies upon the global food production system. With a rising world population that is increasingly urbanized, food security is one of the major issues of our time, especially considering our changing global climate. Of particular concern is that meat consumption is high in most countries and exceeds the recommended intake. For example, the average consumption of ruminant animal protein (mostly beef and lamb) is three times the recommended level (McKinsey, 2020). In the UK, 57 % of men and 31 % of women eat more than the recommended maximum daily intake of red and processed meat (Hobbs-Grimmer et al., 2021). Political and economic institutions also favor animal agriculture (Gunderson, 2011) but fail to take into account the impact of agriculture on the environment. Agriculture alone is estimated to account for 30 % of global greenhouse gas emissions (GHG) (Bellarby et al., 2008). Meat consumption is also associated with coronary heart disease (Micha et al., 2010) and obesity (Wang & Beydoun, 2009). Thus, there have been calls by scientists and scholars to reduce meat consumption by around 40 % to transition toward a sustainable and healthy diet (Carlsson-Kanyama and González, 2009, Macdiarmid et al., 2012, Willett et al., 2019).

In response to health, environmental, ethical, and cost concerns, growing numbers of omnivores are reducing their meat consumption (Apostolidis and McLeay, 2019, Cheah et al., 2020). While consumers are increasingly adopting meat-elimination diets, such as veganism (1.9 %) or vegetarianism (3.1 %), many more are identifying as flexitarian (22.9 %) (Vegan, 2020). This shift towards meat reduction has seen substantial growth in the last decade with research showing the number of participants in the Netherlands, who were self-declared flexitarians, increasing from 13 % in 2011, to 43 % in 2019 (Verain, Dagevos & Jaspers, 2022). Yet, the term “flexitarian” is defined in various ways in the literature (Dagevos, 2021b), from those who consume meat once a week (i.e., low meat eaters) to those who identify as “semi-vegetarian” (i.e., social meat eaters) or those who are reducing their meat consumption (Kemper, 2020, Malek and Umberger, 2021a). These widely differing definitions suggest that a more nuanced understanding of different types of omnivores (meat eaters and reducers) is needed (Dagevos, 2021b). For example, in a study on flexitarians, Malek and Umberger (2021b) identify-five flexitarian segments, each differing in the amount of meat consumed and in the types of meats consumed.

Some recent research sheds initial light on the variations in beliefs among different types of omnivores (i.e., flexitarians, restricted-meat eaters) (Dagevos, 2021b). Malek and Umberger (2021a) found that self-identified meat reducers differed from unrestricted omnivores and meat avoiders in their meat-consumption behaviors, beliefs surrounding the nutritional and food-choice adequacy of meat-free diets, and the relative importance they placed on egoistic factors (i.e., taste, health, price, convenience). Specifically, self-identified meat reducers had stronger beliefs regarding meat-free diet adequacy and placed lower importance on egoistic food (e.g., price) choice factors, while meat avoiders had weaker beliefs regarding meat-free diet adequacy and placed higher importance on egoistic food (e.g., price) choice factors (Malek & Umberger, 2021a). Similarly, committed meat eaters believed that meat-free diets featured inadequate food choices, and they were less likely to believe that livestock farming contributes to climate change (Malek et al., 2019b). Further, Verain, Dagevos and Jaspers (2022) found that the most important differences between meat consumers and three flexitarian segments was a higher personal norm towards meat reduction and a higher appreciation of meatless meals for flexitarian segments. Research has also found different motivations for meat reduction depending on current meat-consumption habits (Lentz et al.,

2018); for example, Malek and Umberger (2021b) found that all five segments of flexitarians indicated health as a top motivator.

However, limited research has investigated the different food-consumption habits of omnivores, and, as a result, their meat-reduction or substitute strategies. For example, Verain et al. (2016) found that, when compared with other flexitarian types, conscious flexitarians (with the lowest frequency of weekly meat consumption) and potential flexitarians (with average meat consumption) used meat substitutes and left meat out of their meals most often and were also most open to consuming smaller meat portions. Malek and Umberger (2021b) found three different 'light' flexitarian segments which focused mainly on certain types of meat (i.e., chicken, pork). While Verain, Dagevos and Jaspers (2022) segment meat consumers into 2 groups (meat lovers and compulsive meat eaters) and flexitarians into heavy, medium and light, regardless of segment, all indicated replacing meat by another product was the most common meat reduction strategy. Moreover, Neff et al. (2018) points out we lack knowledge about what and how flexitarians consume to replace meat.

Moreover, very little research has examined the attitudes to "future foods," such as cultured meat and fish, and plant-based meat and chicken substitutes, held by different types of omnivores (i.e., low, medium, high meat consumption) (Kerslake et al., 2021). In their review of the literature, Onwezen et al. (2021) determined that research in general has found that those with higher meat consumption and high meat attachment are more receptive to cultured meat and meat substitutes (i.e., products that look similar to meat) and less open to plant-based proteins. However, Circus and Robinson (2019) found that both low and high meat-attachment consumers did not like edible insects but that low meat-attachment groups (mostly vegan and vegetarian) favored plant-based substitutes the most. Therefore, the research is not clear regarding whether meat reducers or eliminators are more or less receptive to future foods as findings may differ on the type of meat alternative.

Overall, a comprehensive understanding of meat (non) consumption and attitudes toward distinct meat-consumption preferences is important for providing segmented marketing and social marketing strategies aimed at encouraging sustainable and healthy food consumption (Malek & Umberger, 2021a). This is especially important in meat-reduction campaigns and for marketing a variety of meat substitutes.

## **2. Research objectives**

While previous studies have investigated the reasons for meat reduction and flexitarianism, research thus far has made little effort to distinguish different types of meat eaters and reducers. This is surprising considering how individuals' reasons for reducing meat consumption might differ depending on their degree of meat restriction (De Backer and Hudders, 2014, Miki et al., 2020, Mullee et al., 2017, Rosenfeld and Tomiyama, 2019). Dagevos (2021b) suggests that future research should investigate further the motivational, psychological and demographical differences between flexitarians, meat 'lovers', vegetarians and vegans as well as the differences within the consumer group of flexitarians. Our study bridges those two proposals.

In this research, we examine the behavioral, attitudinal, psychosocial, and sociodemographic characteristics of meat eaters, meat reducers, and occasional meat eaters. In particular, we examine meat type consumption (red, white, fish, meat substitutes), which most previous

research has failed to delineate, and the reasons for meat reduction and against meat elimination. We investigate attachment to red and chicken meat and healthy and sustainable food beliefs, attitudes, and behaviors. In addition, we investigate the appeal of future foods, such as insects and plant-based chicken. To achieve our objective, we adopted a quantitative approach to data collection and implemented an online survey of New Zealanders.

Most research on meat reduction and restriction is based in the United States and Europe, and wider perspectives outside these regions are needed (Onwezen et al., 2021). New Zealand is an especially important context in which to examine this phenomenon, as it is a major exporter of agricultural products: dairy, its largest goods export sector, is valued at approximately \$NZ13.6 billion annually (Ballingall & Pambudi, 2017), and New Zealand has the sixth highest per capita meat-consumption rate in the world (Food and Agriculture Organization of the United Nations, 2013). As a result, nearly 50 % of New Zealand's GHG emissions are from agriculture (Ministry for the Environment, 2019).

### **3. Material and methods**

#### **3.1. Respondents**

This research uses data from an online survey of New Zealand food shoppers. A reputable online panel provider (Dynata™) administered the survey to 1,004 respondents. Quotas were set for gender, age, and location to ensure that the sample was nationally representative of New Zealand adults in terms of these characteristics. There were 913 eligible survey respondents of 18 years or older. Ethics approval was provided by the University of Auckland (Ref 017323).

#### **3.2. Questionnaire**

The questionnaire assessed (non) meat-consumption frequency, self-identified dietary preferences, and reasons for meat preference and meat reduction. It also contained items to measure respondents' beliefs and attitudes toward various food-related issues, including sustainability, health, and future food concepts. Only the variables used in the present analysis are described below.

##### **3.2.1. Personal (non) meat-consumption frequency and self-identified dietary preferences**

Respondents indicated how frequently they had consumed seven different protein foods (listed in Table 1 below) during the preceding 12 months. They were then asked to select one of six options that best described their way of eating: (1) vegan (I do NOT consume any animal products of any type), (2) vegetarian (I do NOT eat any type of meat), (3) pescatarian (I do NOT eat red meat or chicken, but do eat fish), (4) an occasional meat eater (I generally do NOT eat meat), (5) meat reducer (I have already and/or am currently attempting to reduce my meat consumption), or (6) meat eater (I eat meat at least once or twice per week). These categories were adapted from existing research (Graça et al., 2015, Lentz et al., 2018). The categories are also similar to those of de Gavelle et al. (2019), which distinguished between flexitarians and pro-flexitarians, the former of which moderated their red and processed meat more substantially, while the latter seriously considered reducing meat consumption. To test

that there was a correlation between their identified diet and their stated consumption, analyses were run and are shown below (see Results 4.1 and Appendix 1).

Table 1. **Frequency of meat and substitutes consumption** (1 = never, 2 = Occasionally, 3 = once per week, 4 = several times a week, 5 = most days, 6 = every day, 7 = several times a day).

	<b>Meat Eater</b>	<b>Reducer</b>	<b>Occasional</b>	<b>X<sup>2</sup></b>	<b>P</b>
	<b>Mean</b>	<b>Mean</b>	<b>Mean</b>		
<b>Beef</b>	5.09 <sup>a</sup>	4.64 <sup>a</sup>	2.88 <sup>b</sup>	73.45	0.00
<b>Lamb</b>	3.70 <sup>a</sup>	3.01 <sup>b</sup>	2.26 <sup>c</sup>	55.54	0.00
<b>Pork</b>	4.49 <sup>a</sup>	3.64 <sup>b</sup>	2.59 <sup>c</sup>	57.08	0.00
<b>Chicken</b>	5.21 <sup>a</sup>	5.23 <sup>a</sup>	3.96 <sup>b</sup>	26.64	0.00
<b>Fish</b>	4.29 <sup>a</sup>	4.23 <sup>a</sup>	3.06 <sup>b</sup>	21.86	0.00
<b>Meat substitute</b>	3.02 <sup>a</sup>	2.00 <sup>b</sup>	2.22 <sup>b</sup>	73.09	0.00
<b>Bean/pulses/legumes</b>	3.02 <sup>a</sup>	3.65 <sup>b</sup>	3.12 <sup>a,b</sup>	18.48	0.00

Mean values followed by different letters are significantly different ( $p < 0.05$ ).

Previous studies have tended not to distinguish between different types of meat eaters, such as pescatarian and occasional meat eaters, and these classifications may also apply to vegetarians who occasionally violate their diet. Therefore, respondents' answers were used to allocate them into three self-identified meat-diet groups for the purposes of this study: meat eaters, meat reducers, and occasional meat eaters. Respondents were also asked to indicate their consumption frequency and reduced consumption of beef, lamb, pork, ham and/or bacon, chicken, fish, meat-substitute products, and beans, pulses, and/or legumes. We specified that each meat category meant any type or form of meat, including sausages, burgers, and mince.

### 3.2.2. Reasons for changes in consumption

Respondents were asked to indicate their reasons for continuing to eat meat and why they were reducing their meat consumption (where applicable). Reasons were preformulated to cover specified topics: health, concern for animal welfare, concern for the environment, habit, and (social) appropriateness (Schösler et al., 2015).

### 3.2.3. Attitudes and beliefs about sustainability, health, and future food

Drawing on previous research (Graça et al., 2015, Lacroix and Gifford, 2019), various survey items were created around beliefs in the following: (a) sustainable and healthy eating behaviors (12 items, Lacroix and Gifford, 2019, Lea et al., 2006, Piazza et al., 2015, Schösler et al., 2015) (b) sustainable food production beliefs (12 items, Lea et al., 2006, Schösler et al., 2015), and (c) red meat and chicken attachment (4 items, Graça et al., 2015). All items were measured on a 7-point Likert scale.

To measure red meat and chicken attachment, four items (one from examining each original factor: pleasurable, disrespectful, right, irreplaceable) were selected from the meat-attachment scale (Graça et al., 2015), and the same four were used to measure chicken

attachment and red meat attachment. We used exploratory factor analysis (EFA) and found that four items explained 48.4 % of the variance for chicken attachment with a Cronbach's alpha of 0.626, and red meat attachment explained 58.348 % of the variance with a Cronbach's alpha of 0.758.

We asked respondents to read a concept statement and rate their perceptions of the appeal (attractiveness) of different "future foods" on a 7-point Likert scale comprising cultured meat, plant-based red meat, plant-based chicken, foods fortified with added plant proteins, non-dairy cheeses, and cultured fish. As a result of the large number of items in the survey, each participant rated three of the foods concepts, which were randomly rotated.

### **3.3. Statistical analyses**

Univariate analyses comparing the characteristics of consumers from self-identified diet groups were conducted in SPSS (version 26.0) using one-way analysis of variance and chi-square tests. Non-parametric ANOVA test (Kruskal-Wallis test with Dunn's post hoc) were appropriate for categorical variables (type of (non)meat consumption and reduction). For nominal variables (Likert scale attitudes), Scheffé's method (equal variances assumed) and Tamhane T2 (equal variances not assumed) tests were used to compare means between each pair of diet groups because of uneven sample sizes. A 5 % significance level was used for all analyses.

## **4. Results**

### **4.1. Sample and diet group classifications**

A total of 1,004 respondents completed the survey, with 913 falling into the three meat-consumption categories and thus providing usable responses. In total, 93 (10.2 %) identified as occasional meat eaters, 149 (16.3 %) as meat reducers, and 671 (73.5 %) as meat eaters. To check that there was a correlation between respondents' identified diet and their stated consumption, a chi-square analysis was conducted. The results can be found in Appendix 1. Overall, the results show that occasional meat eaters and meat reducers were more likely to reduce their intake of meat, but the latter were more likely to eat meat on a regular basis. Meat eaters were more likely to eat more meat on a regular basis and less likely to have reduced their consumption of meats. Occasional meat eaters were more likely to eat more meat substitutes and beans/pulses/legumes.

The sample was mostly representative of the New Zealand population. It comprised 48.4 % male, 51.3 % female, and 0.3 % gender diverse; 62 % identified as European, 11.1 % as Maori, 3.5 % as Pacific Islander, and 9.9 % as Asian; 12.3 % were aged 18–24, 15.3 % were aged 25–34, 18.2 % were aged 35–44, 18.6 % were aged 45–54, 14.9 % were aged 55–64, and 20.7 % were aged 65 and over. In the last national census, of those aged 18 and over, males represented 48.8 % and females 51.2 %; 66.1 % were European, 13.4 % Maori, 6.4 % Pacific, 15.0 % Asian; 12.2 % were aged 18–24, 18.4 % were aged 25–34, 16.3 % were aged 35–44, 17.5 % were aged 45–54, 15.7 % were aged 55–64, and 20 % were aged 65 and over (Statistics New Zealand, 2018).

### **4.2. Comparison of diet groups**

#### 4.2.1. Sociodemographic

The meat eaters differed from meat reducers and occasional meat eaters with respect to gender, age, income, and tertiary education. Both meat reducers (55 %) and occasional meat eaters (63.4 %) were more likely to be female, while meat eaters were more likely to be male (51 %) ( $\chi^2 = 10.510$ ,  $p = 0.03$ ). Occasional meat eaters were more likely to be younger, aged 18–54 (74.2 %,  $\chi^2 = 24.436$ ,  $p = 0.01$ ). Similarly, meat reducers were also more likely to be aged 25–54 years old (63.8 %); however, fewer were likely to be 18–24 years old (12.5 %) ( $\chi^2 = 24.436$ ,  $p = 0.01$ ). Meat eaters had a strong presence of younger and older respondents with them more likely to be 18–24 years old (12.8 %) and 55 + years old (38.9 %).

The findings on income were not as straightforward, yielding mixed results ( $\chi^2 = 121.24$ ,  $p = 0.05$ ). Occasional meat eaters were more likely to earn less than NZD\$20,000 (16.1 %) and to earn between NZD\$100,000 to 149,999 (19.4 %), while meat reducers were more likely to earn NZD\$100,000 or more (30.8 %). Occasional meat eaters (no qualification, 8.6 %; high school, 34.4 %) and meat eaters (no qualification, 9.2 %; high school, 28.6 %) were more likely to be less educated ( $\chi^2 = 22.18$ ,  $p = 0.01$ ). The difference between the two groups was that occasional meat eaters were less likely to have a trade background (18.3 %), while meat eaters were more likely to have a trade background (25.5 %) ( $\chi^2 = 22.18$ ,  $p = 0.01$ ). Meat reducers were more likely to have a bachelor's degree or higher (51.7 %).

#### 4.2.2. Consumption frequency of animal-based and plant-based protein foods

The average consumption frequency of animal-based and plant-based protein foods is provided in Table 1 and reduction of meat is provided in Table 2. An ANOVA analysis was conducted on the value means of the numbers (1,2,3...) given to the consumption categories.

Table 2. **Changes in meat and substitute consumption** (1 = eat a lot less now, 2 = eat less now, 3 = eat the same around, 4 = eat more now, 5 = eat a lot more now).

	<b>Meat Eater Reducer Mean</b>	<b>Occasional Mean</b>	<b>X<sup>2</sup></b>	<b>P</b>
<b>Beef</b>	2.72 <sup>a</sup>	2.08 <sup>b</sup>	1.86 <sup>b</sup>	129.94 0.00
<b>Lamb</b>	2.57 <sup>a</sup>	2.11 <sup>b</sup>	1.67 <sup>b</sup>	71.14 0.00
<b>Pork</b>	2.72 <sup>a</sup>	2.13 <sup>b</sup>	1.95 <sup>b</sup>	79.46 0.00
<b>Chicken</b>	3.22 <sup>a</sup>	2.98 <sup>b</sup>	2.65 <sup>b</sup>	34.98 0.00
<b>Fish</b>	3.04 <sup>a</sup>	2.90 <sup>b</sup>	2.67 <sup>c</sup>	3.57 0.02
<b>Meat substitute</b>	1.17 <sup>a</sup>	1.82 <sup>b</sup>	1.93 <sup>b</sup>	36.29 0.00
<b>Bean/pulses/legumes</b>	2.43 <sup>a</sup>	3.10 <sup>b</sup>	3.05 <sup>b</sup>	41.99 0.00

Mean values followed by different letters are significantly different ( $p < 0.05$ ).

There were significant differences in red meat, lamb, and pork consumption across the meat diets. Occasional meat eaters ate significantly less beef than meat eaters and reducers, and occasional meat eaters had significantly reduced their consumption of beef compared with meat eaters but not meat reducers. All dietary groups differed in their lamb consumption, meat eaters ate the most, followed by meat reducers and occasional meat eaters. Reduced and occasional meat eaters also had significantly reduced their consumption of lamb compared



with meat eaters. Similarly, all dietary groups differed in their pork consumption with meat eaters eating the most, followed by meat reducers and then occasional meat eaters. Meat eaters did not reduce their pork consumption as much compared with occasional meat eaters and meat reducers.

Slight differences between meat diets were also identified for consumption of chicken and fish. Meat eaters and meat reducers ate significantly more chicken than occasional meat eaters. Meat eaters had increased their consumption of chicken compared with occasional meat eaters and meat reducers. Occasional meat eaters ate significantly less fish than meat eaters and reducers. All dietary groups were significantly different in their reduction of fish, with occasional meat eaters reducing their fish intake the most, followed by meat reducers and then meat eaters.

There were also significant differences identified for meat substitutes. Meat eaters ate significantly less meat substitutes than reduced meat reducers and occasional meat eaters. Reduced and occasional meat eaters had significantly increased consumption of meat substitutes compared with meat eaters. Similarly, meat eaters ate fewer legumes, beans, and pulses than meat reducers, however, this was not the case for occasional meat eaters. Reduced and occasional meat eaters had also significantly increased consumption of legumes, beans, and pulses compared with meat eaters.

There was a significant difference between dietary groups and how often they had meat free meals; meat eaters ate the least, followed by meat reducers and then occasional meat eaters. On average, respondents consumed meat-free meals twice per week (see Table 3 and Appendix 1 for chi-square results). Occasional meat eaters ate meat-free meals most frequently, indicating that they did so at least three times a week; this was twice a week for meat reducers and once a week for meat eaters. Occasional meat eaters were more likely to eat four or more meat-free meals a week, while meat reducers were more likely to eat two or more meat-free meals a week. Conversely, meat eaters were less likely to eat meat-free meals twice or more a week and were more likely to eat meat-free meals never, once a week, or twice a week.

Table 3. Frequency of eating meat-free meals.

Frequency	Meat Eater	Reducer	Occasional
Never	17.9 %	2.7 %	3.2 %
Once	27.3 %	16.8 %	6.5 %
Twice	22.0 %	32.2 %	11.8 %
3 times	14.2 %	20.8 %	24.7 %
4 times	5.7 %	14.1 %	7.5 %
5 times	4.2 %	6.0 %	16.1 %
6 times	1.9 %	2.0 %	10.8 %
Every day	3.1 %	2.0 %	12.9 %

#### 4.2.3. Reasons for and against meat consumption

As illustrated in Table 4, respondent beliefs about why they still ate (some) meat differed according to their meat diets. For meat eaters, the main reason was that they enjoyed the taste

of meat (79.1 %); for meat reducers, it was because they believed meat was a good source of iron (57.7 %). Conversely, occasional meat eaters mainly consumed meat because of social situations (21.5 %) and because they cooked meat for others in their household (33.3 %).

Table 4. Reasons for meat consumption.

<b>Reason for meat consumption</b>	<b>Meat Eater</b>	<b>Reducer</b>	<b>Occasional</b>
I like the taste of meat	79.1 %	52.3 %	20.4 %
Meat is a good source of iron	66.8 %	57.7 %	34.4 %
I need some meat in my diet to stay healthy	50.5 %	43.0 %	20.4 %
It is a habit	31.3 %	26.2 %	10.8 %
I eat meat in social situations	14.5 %	16.1 %	21.5 %
Someone else usually prepares my food	11.5 %	9.4 %	14.0 %
People important to me think I should eat meat	6.4 %	5.4 %	11.8 %
I have to cook meat for others in the household	21.0 %	24.2 %	33.3 %

Meat eaters were more likely to select that they liked the taste of meat ( $\chi^2 = 153.50$ ,  $p = 0.00$ ), that meat was a good source of iron ( $\chi^2 = 37.68$ ,  $p = 0.00$ ), that eating meat was a habit ( $\chi^2 = 17.39$ ,  $p = 0.00$ ), that they were eating meat to stay healthy ( $\chi^2 = 30.52$ ,  $p = 0.00$ ), and that they were eating meat because they cooked for others ( $\chi^2 = 7.24$ ,  $p = 0.03$ ). There was no significant difference between diets regarding the following reasons: someone else prepares my food ( $\chi^2 = 1.21$ ,  $p = 0.55$ ), social situations ( $\chi^2 = 2.16$ ,  $p = 0.21$ ), and people important to me believe I should eat meat ( $\chi^2 = 4.36$ ,  $p = 0.11$ ).

Table 5 shows why some meat eaters (23.8 % of meat eaters<sup>1</sup>) and meat reducers were attempting to reduce their meat consumption. Both groups were mostly eating less meat because of the cost (61.3 % and 52.3 %) and environmental concerns (40.6 % and 36.2 %), believing that meat was neither a healthy option (35.6 % and 33.6 %) and an ethical one (33.8 % and 28.2 %). Meat reducers reported fewer concerns with social pressures (2 % vs 5.6 %), spirituality/religion (1.3 % vs 3.1 %), and image (3.4 % vs 9.4 %) than current meat eaters. Many more meat reducers indicated that they were reducing their meat intake because they did not like the taste of meat (10.1 % vs 3.1 %).

Table 5. Reasons for meat reduction.

<b>Reason for meat reduction</b>	<b>Meat Eater</b>	<b>Reducer</b>
n	160 (23.8 %)	149 (100 %)
Meat is too expensive	61.3 %	52.3 %
Environmental concerns	40.6 %	36.2 %
Meat is not a healthy option	35.6 %	33.6 %
Concern for animal welfare	33.8 %	28.2 %
I feel guilty if I eat meat	11.9 %	10.1 %
It is good for my image	9.4 %	3.4 %
Social pressures from others	5.6 %	2.0 %
Spiritual/religious reasons	3.1 %	1.3 %

### Reason for meat reduction Meat Eater Reducer

I don't like the taste of meat 3.1 % 10.1 %

However, most of these reasons for meat-reduction differences were not significant between dietary groups. Only meat reducers were more likely to indicate that they did not like the taste of meat ( $\chi^2 = 6.30$ ,  $p = 0.01$ ). There was no significant difference across all respondent groups in concern for animal welfare ( $\chi^2 = 0.96$ ,  $p = 0.33$ ), environmental concerns ( $\chi^2 = 0.88$ ,  $p = 0.35$ ), meat as too expensive ( $\chi^2 = 2.82$ ,  $p = 0.09$ ), meat as a non-healthy choice ( $\chi^2 = 0.09$ ,  $p = 0.77$ ), spiritual/religious ( $\chi^2 = 1.07$ ,  $p = 0.30$ ), feel guilty about eating meat ( $\chi^2 = 0.22$ ,  $p = 0.64$ ), and good image ( $\chi^2 = 2.62$ ,  $p = 0.11$ ). Thus, reasons for meat reduction did not significantly differ between dietary groups.

#### 4.2.4. Sustainable and healthy food behaviors, beliefs, and attitudes

This section reports sustainable food production beliefs and sustainable and healthy eating behaviors and beliefs. There were significant differences in respondents' environmental perceptions of meat-based diets (see Table 6). Meat eaters were less likely to believe that farming cows is harmful to the environment and that it is a cause of global warming than meat reducers and occasional meat eaters. Meat eaters were also less likely to think of themselves as people who care about the environment than meat reducers but not occasional meat eaters (see Table 7). Yet all respondents with meat-based diets had similar beliefs that animal welfare is important.

Table 6. Sustainable food production beliefs.

Beliefs about food production	Meat Eater	Reducer	Occasional	P	F
Plant protein production is more environmentally friendly than animal protein production	4.61 <sup>a</sup>	5.30 <sup>b</sup>	5.00 <sup>b</sup>	0.00	10.48
Reducing red meat consumption helps to prevent disease	4.34 <sup>a</sup>	5.41 <sup>b</sup>	5.20 <sup>b</sup>	0.00	36.96
The farming of cows is harmful to the environment	3.95 <sup>a</sup>	5.01 <sup>b</sup>	4.60 <sup>b</sup>	0.00	22.80
The farming of cows is a cause of global warming	3.6 <sup>a</sup>	4.62 <sup>b</sup>	4.33 <sup>b</sup>	0.00	22.00
Most people will accept 'cultured' meat (lab grown meat) in the future	3.71 <sup>a</sup>	4.2 <sup>b</sup>	4.38 <sup>b</sup>	0.00	7.31
Growing food in urban centres (buildings within cities) rather than on farms is a good idea for the future.	3.83 <sup>a</sup>	4.55 <sup>b</sup>	4.33 <sup>a,b</sup>	0.00	8.90
Protein from meat is different to protein from plants	5.37	5.07	5.4	0.12	2.10
The names "meat" and "milk" should only be used to describe animal products and not plant-based imitations	5.68 <sup>a</sup>	5.06 <sup>b</sup>	5.05 <sup>b</sup>	0.00	10.36
The farming of animals is an important part of the New Zealand economy	6.07 <sup>a</sup>	5.76 <sup>a,b</sup>	5.44 <sup>b</sup>	0.00	7.86
Animal welfare is important	6.02	6.19	6.11	0.30	1.20

<b>Beliefs about food production</b>	<b>Meat Eater</b>	<b>Reducer</b>	<b>Occasional</b>	<b>P</b>	<b>F</b>
Processed meats are bad for your health	4.99 <sup>a</sup>	5.28 <sup>a,b</sup>	5.55 <sup>b</sup>	0.00	5.50
Plant-based diet is healthier than one which includes meat	3.7 <sup>a</sup>	4.71 <sup>b</sup>	5.01 <sup>b</sup>	0.00	34.69

Likert scale 1–7 (strongly disagree-strongly agree). Mean values followed by different letters are significantly different ( $p < 0.05$ ).

Table 7. Sustainable and healthy eating beliefs and behaviours.

<b>Beliefs and behaviours about eating</b>	<b>Meat Eater</b>	<b>Reducer</b>	<b>Occasional</b>	<b>P</b>	<b>F</b>
I think of myself as being a healthy eater	4.77	4.94	4.83	0.47	0.764
I know a lot about the nutritional aspects of food	4.20 <sup>a</sup>	4.84 <sup>b</sup>	4.64 <sup>b</sup>	0.00	15.18
I try (where possible) try to eat organically produced foods	3.74 <sup>a</sup>	4.51 <sup>b</sup>	4.54 <sup>b</sup>	0.00	16.91
I think of myself as someone who cares about the environment	5.21 <sup>a</sup>	5.54 <sup>b</sup>	5.50 <sup>b</sup>	0.01	4.99
Changing my food habits is something I find easy to do	3.74 <sup>a</sup>	4.52 <sup>b</sup>	4.42 <sup>b</sup>	0.00	17.58
It is important to me that my food choices are not harmful to the environment	4.48 <sup>a</sup>	5.16 <sup>b</sup>	5.08 <sup>b</sup>	0.00	20.48
I enjoy cooking	5.20	5.18	5.21	0.10	0.01
I love thinking about food	5.06	5.10	4.80	0.31	1.19
It is socially acceptable to be a vegan	4.76 <sup>a</sup>	5.24 <sup>b</sup>	5.40 <sup>b</sup>	0.00	8.83
Meat substitute products would help them eat less than meat	3.49 <sup>a</sup>	4.71 <sup>b</sup>	4.48 <sup>b</sup>	0.00	34.39
Most people that they know eat meat	6.10 <sup>a</sup>	5.76 <sup>b</sup>	5.45 <sup>b</sup>	0.00	11.82
I think vegetarian food is bland and boring	4.30 <sup>a</sup>	3.20 <sup>b</sup>	3.24 <sup>b</sup>	0.00	29.51

Likert scale 1–7 (strongly disagree-strongly agree). Mean values followed by different letters are significantly different ( $p < 0.05$ ) based.

Regarding health, overall, meat eaters had significantly lower levels of belief in the sustainability and health benefits of plant proteins than meat reducers and occasional meat eaters. Specifically, meat eaters were less likely to agree that a plant-based diet is healthier than one that includes meat than meat reducers and occasional meat eaters, and meat eaters were less likely to agree that reducing red meat consumption helps prevent disease than meat reducers and occasional meat eaters. Meat eaters were less likely to agree that processed meats are bad for your health than occasional meat eaters, but there was no significant difference between meat eaters and meat reducers. Yet, there was no significant difference between all respondent groups indicating that they considered themselves to be healthy eaters. However, meat eaters indicated that they had less knowledge about the nutritional aspects of food than meat reducers.

There was a difference in respondent perceptions of the favorability and social acceptability of plant-based diets. Meat eaters were less likely to agree that meat-substitute products would help them eat less meat and more likely to think that vegetarian food is bland and boring than meat reducers and occasional meat eaters. In addition, meat eaters were less likely to state that most people they know eat meat and were less likely to agree that it is socially acceptable to be a vegan than meat reducers and occasional meat eaters.

Meat eaters had significantly more red- and chicken-meat attachment than meat reducers and occasional meat eaters. Respondents in all groups reported similar enjoyment of food. However, meat eaters were less likely to think that it was easy to change their food habits than meat reducers and occasional meat eaters.

The difference between meat eaters and meat reducers was more pronounced in attitudes toward future foods (Table 8). Compared with meat reducers, meat eaters found cultured meat and fish less appealing. Meat eaters were less likely to agree that most people will accept “cultured” meat (i.e., lab-grown meat) in the future than meat reducers and occasional meat eaters. However, attitudes toward insect products did not differ significantly between respondents. Plant-based meat was significantly less appealing to meat eaters than meat reducers and occasional meat eaters. Only meat eaters compared with meat reducers found plant-based chicken less appealing. For foods fortified with added plant protein and for non-dairy cheeses, meat eaters again found these less appealing than meat reducers. All respondents shared a similar belief that meat protein differs from plant protein. However, meat eaters had a stronger belief that the names “meat” and “milk” should only be used to describe animal products and not plant-based imitations. Meat eaters were also less convinced than meat reducers that growing food in urban centers (buildings within cities) rather than on farms is a good idea for the future.

Table 8. Attitudes towards future foods.

Appeal of future food	Meat Eater	Reducer	Occasional	P	F
Cultured Meat	2.95 <sup>a</sup>	3.98 <sup>b</sup>	3.41 <sup>a,b</sup>	0.00	9.89
Plant based red meat	3.33 <sup>a</sup>	4.21 <sup>b</sup>	4.40 <sup>b</sup>	0.00	12.59
Plant based chicken	3.41 <sup>a</sup>	4.27 <sup>b</sup>	3.83 <sup>a,b</sup>	0.00	6.68
Insect products	2.83	3.07	3.06	0.52	0.65
Foods fortified with added plant proteins	4.13 <sup>a</sup>	5.07 <sup>b</sup>	4.67 <sup>a,b</sup>	0.00	9.59
Non-Dairy Cheeses	3.68 <sup>a</sup>	4.31 <sup>b</sup>	4.09 <sup>a,b</sup>	0.02	4.28
Cultured Fish	2.99 <sup>a</sup>	3.71 <sup>b</sup>	3.14 <sup>a,b</sup>	0.01	4.49

Likert scale 1–7 (Disgusting to me–appealing to me). Mean values followed by different letters are significantly different ( $p < 0.05$ ).

## 5. Discussion

### 5.1. General discussion

Many different diets exist in the world today: omnivore, flexitarian, semi-vegetarian, vegetarian and vegan, to name just a few. Most research to date has focused on meat eaters

(Lentz et al., 2018), vegetarians, vegans (Rosenfeld, 2018) and, increasingly, flexitarians (Kemper and White, 2021, Verain et al., 2022). However, limited research has examined the differences between meat eaters (de Boer et al., 2017) and flexitarians (Rosenfeld, 2018), despite the dramatic variability in the frequency of meat consumption in these groups, from daily consumption to once weekly or once monthly. This research examined the differences between meat eaters, meat reducers, and occasional meat eaters in terms of their meat consumption (consumption frequency and reduced consumption of red and white meat, fish, and meat substitutes) and reasons for and against meat reduction. We also investigated respondents' attachment to red and chicken meat, perceived appeal of future foods, and their healthy and sustainable food beliefs, attitudes, and behaviors.

Our research shows some interesting and complex patterns within the demographic groups. In general, meat reducers and occasional meat eaters were younger and female. This agrees with the findings of Knaapila et al., (2022) that limiting the consumption of animal products is far more common for women (42.5 %) than men (18.8 %). Notably, in our research those aged 18–24 years old were less likely to be meat reducers and more likely to be meat eaters. As found by Knaapila et al., (2022) in their study of millennials (20-39yrs), over two thirds of participants identified as omnivores (i.e. I eat all animal products). This contrasts with the findings of research indicating that younger consumers are increasingly decreasing and eliminating meat (Colmar Brunton, 2019). However, our sample who identified as vegan were more likely to be younger (statistically significant). An explanation for this finding may be that these young adults, likely studying and living at home, are still influenced and limited by household cooking. Kemper and White (2021) found that young adults were able to reduce their meat consumption only after they moved away from the family home, since it was only then that they had full control over their diets. Previous research has found that attitudes toward meat, plant-based diets, and meat substitutes differ according to demographic factors such as sex and age (e.g., Ghvanidze et al., 2016, Ipsos, 2018, Kemper, 2020, Pfeiler and Egloff, 2018). For example, flexitarians are more likely to be 25–34 years old and single, and vegetarians are more likely to be single or in a couple without children (de Gavelle et al., 2019). Verain, Dagevos and Jaspers (2022) demonstrate that females and younger adults were more likely to be conscious flexitarians (lowest meat consumption) but the study also showed that there was equal distribution for genders for unconscious ('light') and potential ('medium') flexitarians. Consumers over the age of 55 compared with those aged under 34 were more likely to reduce their beef and pork consumption, while those with high household incomes compared with lower incomes were more likely to decrease their consumption of chicken (Malek et al., 2019a). Men are more likely than women to believe that eating meat is natural (Rothgerber, 2013), which may be linked to the idea that meat is associated with masculinity and that vegetarianism (eating no meat) is associated with being less masculine (De Backer et al., 2020). Collectively, these findings explain why greater numbers of females identify as meat reducers and occasional meat eaters.

Further, we found that income was associated with meat reduction. Occasional meat eating was associated with both a very low income, likely because of cost issues, and with wealthier households, likely because of their vegetarian (i.e., ethics, environmental) leanings (Greenebaum, 2017). Similarly, meat reduction was more likely to be associated with wealthier households and education (bachelor degree or higher) in general, demonstrating the ability to determine food consumption based on ethical, health, and sustainability motivations other than cost. Indeed, the ability to make food choices is a privilege (Greenebaum, 2017, Sharaievska et al., 2018).

Our research demonstrates that meat attachment is stronger among meat eaters and that the different types of meats eaten differ between meat diets. Previous research has shown that meat attachment is linked to willingness to reduce meat consumption and to follow a plant-based diet (Circus and Robison, 2019, Graça et al., 2015, Lentz et al., 2018, Wang and Scrimgeour, 2021). Thus, our research is consistent with other research, suggesting that meat eaters are attached to meat and are reluctant to shift away from eating meat (excessively) while meat reducers are less attached to meat and are more in favor of alternative proteins (Graça et al., 2015, Verain et al., 2022).

However, previous research has not necessarily focused on differentiating between different types of meat, such as red and white. Our research indicates that meat eaters had greater attachment to both red and white meat than meat reducers and occasional meat eaters. We also found significant differences in the consumption and reduction of most meats and meat substitutes. Meat eaters and meat reducers ate the same amount of beef, while occasional meat eaters ate the least. Meat eaters also ate more pork and lamb as well as less meat substitutes than meat reducers and occasional meat eaters, and less beans/pulses/legumes than meat reducers. Meat eaters reduced less of their beef, pork, and chicken consumption and increased less of their meat substitutes and beans/pulses/legumes consumption than meat reducers and occasional meat eaters. The only significant differences observed between meat reducers and occasional meat eaters were for beef, lamb, chicken and fish. Meat reducers and occasional meat eaters did not differ on their reduction/increase of meat and substitutes except for fish (occasional eaters were reducing their fish more). Our findings are in contrast with those of Malek and Umberger (2021a), who reported no statistical differences between consumption frequency of chicken, pork, lamb, and fish/seafood between committed meat eaters, willing meat reducers, undecided meat eaters, and prospective vegans. However, other research finds that beef is the most commonly reduced meat (30 %), followed by lamb (22 %), pork (14 %) and chicken (8 %) (Malek et al., 2019a). Distinguishing between meats and determining what food is replaced when meat is reduced is of vital importance. This is because research shows a greater concern for individuals' intake of nutritionally adequate meals (e.g., iron and B12 deficiencies) when they adopt vegetarian/vegan diets (McEvoy et al., 2012). Our findings show that lamb and pork consumption was the only factor that differed significantly between all respondent diets, while beef was consumed similarly by meat eaters and reducers, suggesting this may be more difficult to reduce. Fish was the only meat consumed in reduced quantities at different levels in all diets. Otherwise, meat reducers and occasional meat eaters both decreased their beef, pork, and chicken consumption and increased their meat-substitute (including beans and pulses) consumption at similar rates.

Our research has contributed to the field by identifying the reasons for meat reduction but against meat elimination. This study shows that meat eaters' main reason for continuing to eat meat was because they enjoyed the taste; for meat reducers, it was because they believed meat is a good source of iron. Conversely, occasional meat eaters mainly ate meat because of social situations and because they cooked meat for others in their household. The findings demonstrate, as has previous research, that motivations for meat eating differ, but our research shows that this differentiation is more specifically based on the level of meat reduction. Supporting our findings, reasons against meat elimination have previously been found to revolve around cravings, taste, and concerns for nutrition (Kemper, 2020, Kemper and White, 2021). However, meat reducers justify meat consumption as "nice" and "necessary" (for nutrition/health) but not as "normal" or "natural," as meat eaters do (Kemper, 2020, Piazza et al., 2015). In addition, while health is a reason to reduce meat consumption, it is also inhibiting meat elimination (De Backer and Hudders, 2014, de Boer et

al., 2017, Kemper, 2020, Pohjolainen et al., 2015, Rosenfeld and Tomiyama, 2020). Previous research has also identified that both semi-vegetarians and omnivores eat meat because of taste, habit, and upbringing (Mullee et al., 2017), and convenience is also seen to a factor to increase different types of meat (Malek et al., 2019a). Yet research has also indicated that there may be differences in preferences for the taste of meat between self-identified vegetarians (8 % violated for cravings and 6 % violated for taste) (Rosenfeld & Tomiyama, 2019) and flexitarians (Kemper, 2020, Kemper and White, 2021). As such, reasons for meat reduction differ between meat diets and tailored social marketing campaigns should be implemented.

In our study, the reasons for meat elimination remained largely the same for all meat diets. The price of meat and environmental concerns dominated, with respondents also displaying ethical concerns and beliefs that meat is not a healthy option. Verain, Dagevos and Jaspers (2022) also showed price as a top 3 motivator for meat eaters and unconscious ('light') flexitarians, yet potential ('medium') and conscious flexitarians rated animal and environmental welfare as top motivators. This contrasts with some previous research on motivations, as Lentz et al. (2018) found that meat reducers were more motivated by health benefits than standard consumers, while meat abstainers were more motivated by animal welfare concerns than reducers and standard consumers. More recent research found that health was the top motivator for different types of flexitarians, followed by animal welfare (31 %), price (28 %), environmental impact (25 %) and weight control (24 %) (Malek & Umberger, 2021b). In addition, research on flexitarians (semi-vegetarians) has shown that environmental concerns do not dominate as reasons for meat reduction—rather, health is usually dominant (Mullee et al., 2017). Research on vegetarianism also indicates that health and ethics dominate (De Backer and Hudders, 2014, Fox and Ward, 2008). However, Kemper (2020) also found that flexitarian families were mainly concerned about health and cost, while young adults were more concerned about the environment. Perhaps interestingly, meat reducers in our study showed less concern for social pressures, spirituality/religion, and image than meat eaters. According to previous research, flexitarians often make social compromises and eat meat to avoid awkward social situations (De Backer et al., 2019, Kemper and White, 2021). In addition, in our study, more meat reducers indicated that they were reducing their meat intake because they did not like the taste of meat; this links to previous research on vegetarians in which only a small proportion violated their diets because of taste and cravings (Rosenfeld & Tomiyama, 2019).

Our research identified various beliefs around the sustainability, health, and ethics of meat production and consumption. Our findings suggest some clear differences between meat eaters and meat reducers / occasional meat eaters. In general, prior research has found that the “meatier” one’s diet, the lower one’s positive attitudes and beliefs regarding plant-based diets and products (Possidonio et al., 2021, Lentz et al., 2018) and an unwillingness to reduce their meat consumption (Lacroix and Gifford, 2019, Lacroix and Gifford, 2020, Malek et al., 2019b, Marinova and Bogueva, 2019). For example, Mullee et al. (2017) found that semi-vegetarians (17.4 %) more so than vegetarians (55.3 %) believed that meat was unhealthy and that 92.1 % of vegetarians and 52.1 % of semi-vegetarians believed that meat production is bad for the environment. de Gavelle et al. (2019) also found differences in beliefs around the impact of meat on the environment, human and animal health. They found that compared with omnivores, pro-flexitarians believed more in the environmental impacts of meat, while compared with pro-flexitarians, flexitarians had a greater belief in the health impacts of meat. Vegetarians compared with flexitarians, had greater concerns about animal welfare issues (de Gavelle et al., 2019). These findings are perhaps not surprising, as cognitive dissonance



theory suggests that individuals are motivated to maintain attitude–behavior consistency. Therefore, if individuals behave in a manner inconsistent with their attitude, they will change either their attitude or their behavior (Thøgersen, 2004). In contrast to our findings, which demonstrate that all respondents placed equal importance on ethics, previous research has shown that ethical concerns differ between dietary groups (Lund et al., 2016, Rothgerber, 2015). This may be because all consumers are concerned about animals' living conditions and only differ in their views about raising and slaughtering non-human animals (Fox & Ward, 2008), which is more linked to ethical philosophy than ethical practices (Greenebaum, 2012). For example, Kemper (2020) found that flexitarians were concerned about animal ethics in terms of animal living conditions, use of antibiotics, and farming practices.

Lastly, we found differences between meat reducers and meat eaters in their attitudes toward future foods: plant-based substitutes, fortified foods, and cultured meat. Compared with meat eaters, meat reducers generally had a more favorable view of cultured meat, foods fortified with added plant proteins, non-dairy cheeses, and cultured fish, and of the belief that growing food in urban centers (buildings within cities) rather than on farms is a good idea for the future. Meat eaters found plant-based red meat significantly less appealing than meat reducers and occasional meat eaters. Insects were equally disliked by all respondents, and previous research has demonstrated that most consumers are hesitant to try such products (Dagevos, 2021a). In general, we found that meat reducers held more favorable views of future foods, indicating that such products may be aimed at meat reducers rather than occasional meat eaters and meat eaters. Conversely, Bryant and Sanctorum (2021) found that dietary group did not significantly predict purchase intent for cultured meat. Other research shows that higher meat consumers are more willing to try cultured meat (Mancini & Antonioli, 2019) and vegetarians and vegans are less willing to try cultured meat (Wilks & Phillips, 2017). Verbeke (2015) demonstrated that consumers who wanted to reduce their meat consumption had a higher acceptance of insects.

Previous research has also suggested that substitutes that mimic their meat counterparts are more likely to be used and accepted by meat reducers than by vegetarians or vegans (Kerslake et al., 2021). This is in line with our findings as occasional meat eaters did not differ significantly from meat eaters in their assessment of most future foods appeal, suggesting that future foods which mimic or substitute animal proteins are more favoured by (and thus should be marketed at) meat reducers. In contrast to our findings, prior research has also shown that meat substitutes are not a common method for reducing meat consumption (Kemper, 2020). Here, we show that those who sought to reduce their meat consumption were potentially more receptive to future foods that could help them achieve this. Previous research has also shown that lack of knowledge of how to prepare meat-free meals and lack of awareness of appropriate substitutes for meat present strong barriers to change (Lea et al., 2006, Schösler et al., 2012, Tucker, 2014). This low efficacy was particularly seen in the meat eaters (compared with meat reducers and occasional meat eaters) in our study, who believed their own behavior was hard to change. Skills are important, and, even for flexitarians, those who are more confident and experienced in cooking substituted meat for legumes, lentils, and tofu (Kemper, 2020).

## **5.2. Implications**

Our research indicates some key areas of interest for food producers and future foods marketers. Our research highlights, alongside that of others (de Boer et al., 2017, Rothgerber, 2014), that meat eating must be segmented. Research demonstrates that there are different

classifications of flexitarians (e.g. light, medium and heavy reducers), and vegetarians (e.g., pescos-, ovo-, lacto-vegetarians and vegans) (De Backer and Hudders, 2014, Dagevos, 2021b, Malek and Umberger, 2021b), and thus, marketers and academics should make a concentrated effort to distinguish between different types of meat eaters. In this way, meat reduction campaigns can be tailored (Kemper, 2020) to specific audiences and around their requirements, skills, and motivations. Systematic literature reviews (Hartmann and Siegrist, 2017, Harguess et al., 2020, Dagevos, 2021b) found that many contemporary food consumers continue to have strong preferences for meat, and many remain reluctant, or refuse to eat less meat. We found that meat reduction occurred largely because of the high price of meat and because of environmental concerns. These concerns can be highlighted in social marketing campaigns alongside avenues for individuals to upskill cooking so that plant-based meals are portrayed as easy, convenient, and cost-effective to make. In terms of awareness, meat eaters are still less likely to understand the negative impact of meat on the environment and its health implications. Moreover, meat eaters are more attached to meat and are thus reluctant to shift away from eating meat (Graça et al., 2015, Verain et al., 2022).

A vital question remains: how do we get people to shift away from meat heavy diets? In our study, meat eaters believed their own behavior was hard to change - more so than meat reducers and occasional meat eaters; that may be one reason meat eaters are reluctant to change diets. Thus, communication messages in social marketing campaigns could focus on driving a belief in the possibility of personal change to enable meat eaters to reduce their meat consumption. For example, Schutte and Bhullar (2017) showed that after being exposed to information about the possibility of change and tasked to think about behavior they had changed and could change regarding sustainability, individuals had a greater intent to purchase sustainable products. A recent systematic review also demonstrated successful interventions at the micro, *meso* and macro level (Kwasny, Doberning & Riefler, 2022). At the micro level this includes communications linking meat to living animals/humanness of animals which induced a negative emotional response and vegetarian cooking classes, while at the meso and macro levels this included increasing the visibility and variety of vegetarian dishes (Kwasny, Doberning & Riefler, 2022). Other research has also segmented flexitarians based on their transition stage to meat reduction (Hielkema & Lund, 2021), which provides another way to tailor communication messages and social marketing services. Moreover, there is evidence to suggest a gradual journey towards meat reduction should be encouraged (Grassian, 2020), such as the Meat Free Monday campaigns which ask consumers for small reductions in meat over a long period of time. Lastly, future foods such as cultured meat and fish, plant-based red meat and chicken, foods fortified with added plant proteins, and non-dairy cheeses may be targeted at meat reducers rather than vegetarians or those who occasionally eat meat.

### **5.3. Limitations and further research**

As with all research, our study has its limitations. Our sample was limited to New Zealand, and while we add to the literature by investigating a country outside the Netherlands, Italy, Germany, and the United States, which dominate in research on consumer acceptance of alternative proteins (Onwezen et al., 2021), our findings may not be representative of other developed countries. We also asked respondents to estimate their consumption frequency rather than measuring their actual behavior. Thus, future research should consider the use of other measures, such as weekly diaries. Further, we provided dietary classifications which may blur the boundaries between intention (i.e., reduced meat) and behavior, and thus, future research should provide more nuanced categories of flexitarian and meat diets.

In terms of our findings, we provide avenues for future research. Our study found that lamb and pork were eaten in different amounts by meat eaters, reducers, and occasional eaters. This is extremely interesting, as research tends to either lump all meat together or focus on red meat (Kemper, 2020) rather than on seafood. Thus, future research should focus on exploring the nuances of differences in consumption, attitudes, and knowledge of various types of meat and seafood, latter of which has implications for overfishing. We also found that beef and chicken were the only meat products that differed significantly in terms of consumption between meat eaters and meat reducers on one end and occasional meat eaters on the other, which shows that these meats may be more difficult to reduce and other meats, such as pork or lamb, and meat substitutes consumption may be the differentiating feature among different “types” of omnivores. In this case, red meat and its health and environmental implications can still play a central role in social marketing campaigns.

## 6. Conclusion

We found that meat eaters form a distinct dietary group from meat reducers and occasional meat eaters. This finding is related to their meat, legume and meat substitute consumption, eating on average more meat and less meat alternatives, and reducing less of their meat intake. While reasons for meat eating differed between dietary groups, reasons for meat reduction did not significantly differ between meat reducers and a proportion of meat eaters who had started to reduce their meat consumption. In addition, meat reducers were also found to differ from meat eaters, especially in terms of perceived appeal of future foods (cultured meat and fish, plant based red meat and chicken, non-dairy cheese and fortified foods), and their healthy and sustainable food beliefs, attitudes, and behaviors. The findings of the study would be beneficial to NGOs and governments exploring options to transition towards a sustainable and healthy diet, for example, informing social marketing campaigns specifically targeted at meat eating segments of the population.

## 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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## References

- Apostolidis, C., & McLeay, F. (2019). To meat or not to meat? Comparing empowered meat consumers' and anti-consumers' preferences for sustainability labels. *Food Quality and Preference*, 77, 109-122.
- Ballingall, J., & Pambudi, D. (2017). *Dairy trade's economic contribution to New Zealand*. Retrieved from NZIER website:  
[https://nzier.org.nz/static/media/filer\\_public/29/33/29336237-3350-40ce-9933-a5a59d25bd31/dairy\\_economic\\_contribution\\_update\\_final\\_21\\_february\\_2017.pdf](https://nzier.org.nz/static/media/filer_public/29/33/29336237-3350-40ce-9933-a5a59d25bd31/dairy_economic_contribution_update_final_21_february_2017.pdf)

- Bellarby, J., Foereid, B., & Hastings, A. (2008). *Cool Farming: Climate impacts of agriculture and mitigation potential*. Greenpeace.
- 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.
- Carlsson-Kanyama, A., & González, A. D. (2009). Potential contributions of food consumption patterns to climate change. *The American Journal of Clinical Nutrition*, *89*(5), 1704S-1709S.
- Cheah, I., Shimul, A. S., Liang, J., & Phau, I. (2020). Drivers and barriers toward reducing meat consumption. *Appetite*, *149*, 104636.
- Churchill, G. A., & Suprenant, C. (1979). A paradigm for developing better measures for marketing of consumer satisfaction. *Journal of Marketing*, 491–504.
- Circus, V. E., & Robison, R. (2019). Exploring perceptions of sustainable proteins and meat attachment. *British Food Journal*.
- Colmar Brunton. (2019). *Hungry for plant-based: New Zealand consumer insights*. Food Frontier and Life Health Foods.
- Dagevos, H. (2021a). A literature review of consumer research on edible insects: Recent evidence and new vistas from 2019 studies. *Journal of Insects as Food and Feed*, *7*(3), 249–259.
- Dagevos, H. (2021b). Finding flexitarians: Current studies on meat eaters and meat reducers. *Trends in Food Science & Technology*, *114*, 530-539.
- De Backer, C., Dare, J., & Costello, L. (2019). *To eat or not to eat meat: how vegetarian dietary choices influence our social lives*. Rowman & Littlefield. London, UK.
- De Backer, C., Erreygers, S., De Cort, C., Vandermoere, F., Dhoest, A., Vrinten, J., & Van Bauwel, S. (2020). Meat and masculinities. Can differences in masculinity predict meat consumption, intentions to reduce meat and attitudes towards vegetarians? *Appetite*, *147*, 104559.
- De Backer, C. J., & 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.
- 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.
- de Gavelle, E., Davidenko, O., Fouillet, H., Delarue, J., Darcel, N., Huneau, J.-F., & Mariotti, F. (2019). Self-declared attitudes and beliefs regarding protein sources are a good prediction of the degree of transition to a low-meat diet in France. *Appetite*, *142*, 104345.
- Food and Agriculture Organization of the United Nations. (2013). *Current Worldwide Annual Meat Consumption per capita*.
- Fox, N., & Ward, K. (2008). Health, ethics and environment: A qualitative study of vegetarian motivations. *Appetite*, *50*(2–3), 422–429.
- Ghvanidze, S., Velikova, N., Dodd, T. H., & Oldewage-Theron, W. (2016). Consumers' environmental and ethical consciousness and the use of the related food products information: The role of perceived consumer effectiveness. *Appetite*, *107*, 311–322.
- 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.
- Greenebaum, J. (2012). Veganism, identity and the quest for authenticity. *Food, Culture & Society*, *15*(1), 129–144.

- Greenebaum, J. B. (2017). Questioning the concept of vegan privilege: A commentary. *Humanity & Society, 41*(3), 355–372.
- Gunderson, R. (2011). The metabolic rifts of livestock agribusiness. *Organization & Environment, 24*(4), 404–422.
- Grassian, D. T. (2020). The dietary behaviors of participants in UK-based meat reduction and vegan campaigns—A longitudinal, mixed-methods study. *Appetite, 154*, 104788.
- Harguess, J. M., Crespo, N. C., & Hong, M. Y. (2020). Strategies to reduce meat consumption: A systematic literature review of experimental studies. *Appetite, 144*, 104478.
- Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology, 61*, 11-25.
- 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*, 104257.
- Hobbs-Grimmer, D., Givens, D., & Lovegrove, J. (2021). Associations between red meat, processed red meat and total red and processed red meat consumption, nutritional adequacy and markers of health and cardio-metabolic diseases in British adults: A cross-sectional analysis using data from UK National Diet and Nutrition Survey. *European Journal of Nutrition, 1–19*.
- Ipsos. (2018). *An exploration into diets around the world*.  
[https://www.ipsos.com/sites/default/files/ct/news/documents/2018-09/an\\_exploration\\_into\\_diets\\_around\\_the\\_world.pdf](https://www.ipsos.com/sites/default/files/ct/news/documents/2018-09/an_exploration_into_diets_around_the_world.pdf)
- Kemper, J.A. (2020). Motivations, barriers, and strategies for meat reduction at different family lifecycle stages. *Appetite, 104644*.
- Kemper, J. A., & White, S. K. (2021). Young adults' experiences with flexitarianism: The 4Cs. *Appetite, 160*, 105073.
- Kerslake, E., Kemper, J. A., & Conroy, D. (Forthcoming). What's your beef with meat substitutes? Exploring barriers and facilitators for meat substitutes in omnivores vegetarians, and vegans. *Appetite*.
- Knaapila, A., Michel, F., Jouppila, K., Sontag-Strohm, T., & Piironen, V. (2022). Millennials' Consumption of and Attitudes toward Meat and Plant-Based Meat Alternatives by Consumer Segment in Finland. *Foods, 11*(3), 456.
- 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*, 103997.
- Lea, E. J., Crawford, D., & Worsley, A. (2006). Consumers' readiness to eat a plant-based diet. *European Journal of Clinical Nutrition, 60*(3), 342–351.
- Lentz, G., Connelly, S., Miroso, M., & Jowett, T. (2018). Gauging attitudes and behaviours: Meat consumption and potential reduction. *Appetite, 127*, 230–241.
- Lund, T. B., McKeegan, D. E., Cribbin, C., & Sandøe, P. (2016). Animal ethics profiling of vegetarians, vegans and meat-eaters. *Anthrozoös, 29*(1), 89–106.
- Macdiarmid, J. I., Kyle, J., Horgan, G. W., Loe, J., Fyfe, C., Johnstone, A., & McNeill, G. (2012). Sustainable diets for the future: Can we contribute to reducing greenhouse gas emissions by eating a healthy diet? *American Journal of Clinical Nutrition, 96*(3), 632–639. <https://doi.org/10.3945/ajcn.112.038729>
- Mancini, M. C., & Antonioli, F. (2019). Exploring consumers' attitude towards cultured meat in Italy. *Meat Science, 150*, 101-110.

- Malek, L., & Umberger, W. J. (2021). Distinguishing meat reducers from unrestricted omnivores, vegetarians and vegans: A comprehensive comparison of Australian consumers. *Food Quality and Preference*, 88, 104081.
- 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.
- Malek, L., Umberger, W., & Goddard, E. (2019a). Is anti-consumption driving meat consumption changes in Australia? *British Food Journal*, 121(1), 123-138.
- Malek, L., Umberger, W. J., & Goddard, E. (2019b). Committed vs. uncommitted meat eaters: Understanding willingness to change protein consumption. *Appetite*, 138, 115–126.
- Marinova, D., & Bogueva, D. (2019). Planetary health and reduction in meat consumption. *Sustainable Earth*, 2(1), 1-12.
- McEvoy, C. T., Temple, N., & Woodside, J. V. (2012). Vegetarian diets, low-meat diets and health: A review. *Public Health Nutrition*, 15(12), 2287–2294.
- McKinsey. (2020). *Agriculture and Climate Change—Reducing emissions through improved farming practices*.  
<https://www.mckinsey.com/~media/mckinsey/industries/agriculture>
- Micha, R., Wallace, S. K., & Mozaffarian, D. (2010). Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus: A systematic review and meta-analysis. *Circulation*, 121(21), 2271–2283.
- 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 in Nutrition*, 4(3), nzaa013.
- Ministry for the Environment. (2019). *New Zealand's Greenhouse Gas Inventory 1990–2017*.  
<https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/nz-greenhousegas-inventory-2019.pdf>
- Mullee, A., Vermeire, L., Vanaelst, B., Mullie, P., Deriemaeker, P., Leenaert, T., De Henauw, S., Dunne, A., Gunter, M. J., & Clarys, P. (2017). Vegetarianism and meat consumption: A comparison of attitudes and beliefs between vegetarian, semivegetarian, and omnivorous subjects in Belgium. *Appetite*, 114, 299–305.
- Neff, R. A., Edwards, D., Palmer, A., Ramsing, R., Righter, 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.
- Nunnally, J. C. (1967). *Psychometric Theory* (1st ed.). McGraw-Hill.
- NZ.Stat. (2018). *2018 Census*. Statistics New Zealand. <http://nzdotstat.stats.govt.nz>
- Onwezen, M., Bouwman, E., Reinders, M., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, 159, 105058.
- Pfeiler, T. M., & Egloff, B. (2018). Personality and attitudinal correlates of meat consumption: Results of two representative German samples. *Appetite*, 121, 294–301.
- 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.
- Pohjolainen, P., Vinnari, M., & Jokinen, P. (2015). Consumers' perceived barriers to following a plant-based diet. *British Food Journal*, 117(3), 1150–1167.
- Possidonio, C., Prada, M., Graça, J., & Piazza, J. (2021). Consumer perceptions of conventional and alternative protein sources: A mixed-method approach with meal and product framing. *Appetite*, 156, 104860.
- Rosenfeld, D. L. (2018). The psychology of vegetarianism: Recent advances and future directions. *Appetite*, 131, 125–138.

- Rosenfeld, D. L., & Tomiyama, A. J. (2019). When vegetarians eat meat: Why vegetarians violate their diets and how they feel about doing so. *Appetite, 143*, 1044-17.
- Rosenfeld, D. L., & Tomiyama, A. J. (2020). Taste and health concerns trump anticipated stigma as barriers to vegetarianism. *Appetite, 144*, 1044-69.
- Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: Masculinity and the justification of meat consumption. *Psychology of Men & Masculinity, 14*(4), 363.
- Rothgerber, H. (2014). A comparison of attitudes toward meat and animals among strict and semi-vegetarians. *Appetite, 72*, 98-105.
- Rothgerber, H. (2015). Underlying differences between conscientious omnivores and vegetarians in the evaluation of meat and animals. *Appetite, 87*, 251-258.
- 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.
- 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.
- Schutte, N. S., & Bhullar, N. (2017). Approaching environmental sustainability: Perceptions of self-efficacy and changeability. *The Journal of Psychology, 151*(3), 321-333.
- Sharaievska, I., West, S., & Weddell, M. (2018). The privilege of healthy eating: A qualitative study exploring the local food choices of low-income families from Appalachia. *Journal of Health Disparities Research and Practice, 11*(3), 10.
- Thøgersen, J. (2004). A cognitive dissonance interpretation of consistencies and inconsistencies in environmentally responsible behavior. *Journal of Environmental Psychology, 24*(1), 93-103.
- Tucker, C. A. (2014). The significance of sensory appeal for reduced meat consumption. *Appetite, 81*, 168-179.
- Veganiz. (2020). *Veganiz nutrition study 2020*. <https://veganiz.com/blog/veganiz-nutritionstudy-2020/>
- Verain, M. C., Dagevos, H., & Jaspers, P. (2022). Flexitarianism in the Netherlands in the 2010 decade: Shifts, consumer segments and motives. *Food Quality and Preference, 96*, 104445.
- Verain, M. C., Sijtsema, S. J., & Antonides, G. (2016). Consumer segmentation based on food-category attribute importance: The relation with healthiness and sustainability perceptions. *Food Quality and Preference, 48*, 99-106.
- Verbeke, W. (2015). Profiling consumers who are ready to adopt insects as a meat substitute in a Western society. *Food Quality and Preference, 39*, 147-155.
- Wang, O., & Scrimgeour, F. (2021). Willingness to adopt a more plant-based diet in China and New Zealand: Applying the theories of planned behaviour, meat attachment and food choice motives. *Food Quality and Preference, 93*, 104294.
- Wang, Y., & Beydoun, M. A. (2009). Meat consumption is associated with obesity and central obesity among US adults. *International Journal of Obesity, 33*(6), 621-628.
- Wilks, M., & Phillips, C. J. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. *PloS One, 12*(2), e0171904.
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., & Wood, A. (2019). Food in the Anthropocene: The EAT-Lancet Commission on healthy diets from sustainable food systems. *The Lancet, 393*(10170), 447-492.

<b>Table A1. Meat and Plant Protein Consumption</b>					
					<b>Chi square tests of independence</b>
<b>Beef</b>	<b>Occasional</b>	<b>Reduced</b>	<b>Meat</b>	<b>Overall sample</b>	
Never	14(16.5)	3(2.5)	13(3.1)	30(4.8)	X <sup>2</sup> =114.77 p=0.00 n=628
Occasionally	47(55.3)	46(38.3)	76(18)	169(26.9)	
Once a week	6(7.1)	7(5.8)	75(17.7)	88(14)	
Several times a week	1(1.2)	1(0.8)	11(2.6)	13(2.1)	
Most days	0(0)	1(0.8)	6(1.4)	7(1.1)	
Every day	4(4.7)	2(1.7)	7(1.7)	13(2.1)	
Several times a day	13(15.3)	60(50)	235(55.6)	308(49)	
<b>Lamb</b>					X <sup>2</sup> =95.83 p=0.00 n=842
Never	28(30.8)	14(10.2)	28(4.6)	70(8.3)	
Occasionally	49(53.8)	89(65)	348(56.7)	486(57.7)	
Once a week	3(3.3)	3(2.2)	23(3.7)	29(3.4)	
Several times a week	1(1.1)	0(0)	4(0.7)	5(0.6)	
Most days	0(0)	2(1.5)	3(0.5)	5(0.6)	
Every day	3(3.3)	1(0.7)	8(1.3)	12(1.4)	
Several times a day	7(7.7)	28(20.4)	200(32.6)	235(27.9)	
<b>Pork</b>					X <sup>2</sup> =73.51 p=0.00 n=759
Never	16(17.8)	9(6.7)	33(6.2)	58(7.6)	
Occasionally	55(61.1)	77(57)	191(35.8)	323(42.6)	
Once a week	5(5.6)	2(1.5)	37(6.9)	44(5.8)	
Several times a week	0(0)	1(0.7)	6(1.1)	7(0.9)	
Most days	1(1.1)	1(0.7)	7(1.3)	9(1.2)	
Every day	4(4.4)	2(1.5)	8(1.5)	14(1.8)	
Several times a day	9(10)	43(31.9)	252(47.2)	304(40.1)	
<b>Chicken</b>					X <sup>2</sup> =60.56 p=0.00 n=506
Never	3(3.9)	0(0)	2(0.6)	5(1)	
Occasionally	35(46.1)	15(18.3)	49(14.1)	99(19.6)	
Once a week	7(9.2)	15(18.3)	77(22.1)	99(19.6)	
Several times a week	2(2.6)	1(1.2)	13(3.7)	16(3.2)	
Most days	0(0)	3(3.7)	5(1.4)	8(1.6)	
Every day	4(5.3)	1(1.2)	8(2.3)	13(2.6)	
Several times a day	25(32.9)	47(57.3)	194(55.7)	266(52.6)	
<b>Fish</b>					X <sup>2</sup> =51.44 p=0.00 n=787
Never	13(16.7)	10(8.2)	16(2.7)	39(5)	
Occasionally	41(52.6)	49(40.2)	274(46.7)	364(46.3)	
Once a week	4(5.1)	4(3.3)	23(3.9)	31(3.9)	
Several times a week	1(1.3)	4(3.3)	5(0.9)	10(1.3)	
Most days	1(1.3)	2(1.6)	4(0.7)	7(0.9)	
Every day	3(3.8)	1(0.8)	8(1.4)	12(1.5)	
Several times a day	15(19.2)	52(42.6)	257(43.8)	324(41.2)	
<b>Meat substitute</b>					X <sup>2</sup> =94.58 p=0.00
Never	36(41.9)	66(46.8)	499(75.8)	601(67.9)	



Occasionally	32(37.2)	58(41.1)	117(17.8)	207(23.4)	n=885
Once a week	6(7)	3(2.1)	7(1.1)	16(1.8)	
Several times a week	1(1.2)	0(0)	1(0.2)	2(0.2)	
Most days	3(3.5)	3(2.1)	2(0.3)	8(0.9)	
Every day	2(2.3)	1(0.7)	9(1.4)	12(1.4)	
Several times a day	6(7)	10(7.1)	23(3.5)	39(4.4)	
<b><i>Beans, pulses and/or legumes</i></b>					X <sup>2</sup> =65.83 p=0.00 n=742
Never	9(11.8)	13(11.5)	131(23.7)	153(20.6)	
Occasionally	4(5.3)	6(5.3)	33(6)	43(5.8)	
Once a week	7(9.2)	3(2.7)	35(6.3)	45(6.1)	
Several times a week	27(35.5)	50(44.2)	268(48.5)	345(46.5)	
Most days	14(18.4)	31(27.4)	57(10.3)	102(13.7)	
Every day	13(17.1)	8(7.1)	16(2.9)	37(5)	X <sup>2</sup> =241.99 p=0.00 n=878
Several times a day	2(2.6)	2(1.8)	13(2.4)	17(2.3)	
<b><i>Eat meat free meal</i></b>					
Never	3(3.4)	4(2.8)	156(24.1)	163(18.6)	
Once a week	6(6.9)	25(17.4)	218(33.7)	249(28.4)	
Twice a week	11(12.6)	48(33.3)	142(21.9)	201(22.9)	
Three times a week	23(26.4)	31(21.5)	76(11.7)	130(14.8)	
Four times a week	7(8)	21(14.6)	24(3.7)	52(5.9)	
Five times a week	15(17.2)	9(6.3)	14(2.2)	38(4.3)	
Six times a week	10(11.5)	3(2.1)	4(0.6)	17(1.9)	
Every day	12(13.8)	3(2.1)	13(2)	28(3.2)	

<b>Table A2. Reduced Meat and Plant Protein Consumption</b>					
<b><i>Beef</i></b>	<b>Occasional</b>	<b>Reduced</b>	<b>Meat</b>	<b>Overall sample</b>	<b>Chi square tests of independence</b>
I don't eat this	12(13)	3(2)	15(2.3)	30(3.3)	X <sup>2</sup> =203.57 p=0.00 n=905
I eat a lot less now	24(26.1)	28(19)	34(5.1)	86(9.5)	
I eat less now	29(31.5)	76(51.7)	124(18.6)	229(25.3)	
I eat the same amount	21(22.8)	34(23.1)	454(68.2)	509(56.2)	
I eat more now	4(4.3)	6(4.1)	29(4.4)	39(4.3)	
I eat a lot more now	2(2.2)	0(0)	10(1.5)	12(1.3)	
<b><i>Lamb</i></b>					X <sup>2</sup> =124.67 p=0.00 n=901
I don't eat this	19(21.1)	5(3.4)	28(4.2)	52(5.8)	
I eat a lot less now	23(25.6)	33(22.4)	56(8.4)	111(12.4)	
I eat less now	19(21.1)	58(39.5)	139(20.9)	216(24)	
I eat the same amount	27(30)	44(29.9)	398(59.9)	469(52.1)	
I eat more now	2(2.2)	6(4.1)	34(5.1)	42(4.7)	
I eat a lot more now	0(0)	1(0.7)	9(1.4)	10(1.1)	X <sup>2</sup> = 119.97
<b><i>Pork</i></b>					

I don't eat this	12(12)	9(6.1)	27(4)	48(5.3)	p=0.00 n=907
I eat a lot less now	25(27.2)	26(17.7)	42(6.3)	93(10.3)	
I eat less now	20(21.7)	55(37.4)	107(16)	182(20.1)	
I eat the same amount	27(29.3)	51(34.7)	416(62.3)	494(54.5)	
I eat more now	7(7.8)	6(4.1)	64(9.6)	77(8.5)	
I eat a lot more now	1(1.1)	0(0)	12(1.8)	13(1.4)	
<b><i>Chicken</i></b>					X <sup>2</sup> =107.59 p=0.00 n=905
I don't eat this	2(2.2)	0(0)	3(0.5)	5(0.6)	
I eat a lot less now	14(15.2)	7(5.2)	11(1.7)	32(3.5)	
I eat less now	21(22.8)	26(17.7)	32(4.8)	79(8.7)	
I eat the same amount	36(39.1)	82(55.8)	438(65.8)	556(61.4)	
I eat more now	15(16.3)	27(18.4)	156(23.4)	198(21.9)	
I eat a lot more now	4(4.3)	5(3.4)	26(3.9)	35(3.9)	
<b><i>Fish</i></b>					X <sup>2</sup> =56.09 p=0.00 n=903
I don't eat this	8(8.8)	9(6.1)	11(1.7)	28(3.1)	
I eat a lot less now	13(14.3)	6(4.1)	23(3.5)	42(4.7)	
I eat less now	14(15.4)	18(12.2)	89(13.4)	121(13.4)	
I eat the same amount	29(31.9)	73(49.7)	376(56.5)	478(52.9)	
I eat more now	20(22)	39(26.5)	136(20.5)	195(21.6)	
I eat a lot more now	7(7.7)	2(1.4)	30(4.5)	39(4.3)	
<b><i>Meat substitute</i></b>					X <sup>2</sup> =79.15 p=0.00 n=891
I don't eat this	32(36.4)	60(41.1)	390(59.4)	482(54.1)	
I eat a lot less now	6(6.8)	7(4.8)	21(3.2)	34(3.8)	
I eat less now	11(12.5)	5(3.4)	30(4.6)	46(5.2)	
I eat the same amount	18(20.5)	49(33.6)	183(27.9)	250(28.1)	
I eat more now	17(19.3)	23(15.8)	24(3.7)	64(7.2)	
I eat a lot more now	4(4.5)	2(1.4)	9(1.4)	15(1.7)	
<b><i>Beans, pulses and/or legumes</i></b>					X <sup>2</sup> =74.29 p=0.00 n=896
I don't eat this	9(9.9)	13(8.8)	131(19.9)	153(17.1)	
I eat a lot less now	6(6.6)	6(4.1)	36(5.5)	48(5.4)	
I eat less now	7(7.7)	6(4.1)	38(5.8)	51(5.7)	
I eat the same amount	32(35.2)	62(42.4)	343(52.1)	437(48.8)	
I eat more now	23(25.3)	49(33.3)	89(13.5)	161(18)	
I eat a lot more now	14(15.4)	11(7.5)	21(3.2)	46(5.1)	