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Diversity among flexitarian consumers; stratifying meat reducers by their underlying motivations to move to a plant-based diet

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ABSTRACT

Concerns surrounding environmental and health impacts of meat production and consumption have motivated consumers to reduce their intake of animal-based products, with many adopting a 'flexitarian' diet that involves reduction of animal-based products, without complete abstinence. The underlying motivations driving this dietary shift remain unclear.

Two online studies investigated whether subgroups of flexitarian consumers could be identified through individual differences in psychological traits that were hypothesised to be related to flexitarianism. Consumer subgroups were compared on their self-reported meat consumption and factors important to their dietary choices.

In Study 1, self-identified flexitarians ($N = 353$) completed questionnaires comprising validated items related to psychological aspects of food choices (e.g., food-neophobia, food-involvement, health-consciousness). Consumer segments were created based on clusters of differences in motivations to follow a flexitarian diet. Study 2 ($N = 297$) sought to validate these initial clusters in a naïve sample of self-identified flexitarians.

In Study 1, consumers grouped into three distinct clusters defined as 'health-driven', 'trend-cautious', and 'adventurous' flexitarians. Differences in food choice motivations and the importance of reducing meat intake were observed between clusters, but not reflected in differences in meat consumption. In Study 2, four consumer segments were defined as 'health-only', 'traditional trend-cautious', 'adventurous' and 'health-focused' flexitarians. Again, differences in food motivations, health interest, justifications for meat consumption and the importance of reducing meat intake were observed between clusters, but not reflected in differences in meat consumption.

We provide a novel description of the diverse motivations among flexitarian consumers to reduce animal-based product intake.

1. Introduction

A movement towards plant-based diets with reduced animal products may improve both planetary and human health (Fasolin et al., 2019; Fresán & Sabaté, 2019). As such, flexitarianism has been widely adopted by many consumers trying to find an effective way to reduce their meat consumption (Derbyshire, 2017), while potentially having both environmental and health benefits associated with vegetarian and vegan diets (Aston, Smith, & Powles, 2012; Kim et al., 2020; Shukla, Skea, Buendia, Masson-Delmotte, Pörtner, Roberts, Zhai, Slade, Connors, van Diemen, Ferrat, Haughey, Luz, Neogi, Pathak, Petzold, Pereira, Vyas,

Huntley, & Malley, 2019). A flexitarian diet involves reductions of animal products including meat, dairy and eggs, without complete abstinence (as with vegetarianism or veganism). In the current study, we define a flexitarian as 'someone who is (or has) actively reducing the amount of (animal) meat products they consume but is not eliminating them completely from their diet'. Consumers who identify as 'flexitarians' are actively trying to reduce their intake of animal products and are likely to consume alternative protein sources such as plant-based meat or nut-milks (Dagevos, 2021). Globally, an increasing number of consumers have reported adopting a 'flexitarian' diet to reduce their meat and dairy consumption in recent years (De Backer & Hudders,

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2014). Two recent surveys (one global (Ipsos, 2018) and one with a Canadian sample (Charlebois, Somogyi, Music, & Caron, 2020)) indicate that, although most individuals report not following any dietary restrictions (82 %) or being omnivores (73 %), the largest majority identify as flexitarian diets (10–14 %), with other options such as a vegetarian or vegan garnering less than 2–5 % response rates. When asked, more than 40 % of a Canadian sample stated that they had reduced their consumption of red meat to once or twice a week (Charlebois et al., 2020).

Although there has been extensive research into why vegetarians and vegans choose to abstain from animal products, there has been much less research into what motivates flexitarians to reduce their meat consumption. Previously 'flexitarianism' has been conceptualised as a 'mid-point' between omnivores and vegans (Janda & Trocchia, 2001; Rothgerber, 2014), or a transitional phase between the two. However, 'flexitarianism' is now understood to be a unique dietary group that is much more diverse in their motivations and consumption patterns than both the unrestricted omnivores, and sub-groups of vegetarians (i.e. meat avoiders or ovo-lacto-vegetarian). Flexitarians are neither strongly attached to meat, nor seeking to wholly abstain from it (Dagevos, 2021). Whereas vegetarian or vegan diets are clearly delineated by animal meat and/or the removal of all or some specific animal products, flexitarian diets differ widely in both the frequency and quality of animal products they choose to reduce (Corrin & Papadopoulou, 2017; De Backer & Hudders, 2014; Derbyshire, 2017; Rosenfeld, 2018).

This diversity in diet motivations and consumption frequency has inspired recent interest in within-group differences amongst flexitarians (Dagevos, 2021; Dagevos & Voordouw, 2013; Malek & Umberger, 2021; Verain, Dagevos, & Antonides, 2015; Verain, Dagevos, & Jaspers, 2021). Many studies distinguish between individual flexitarian groups based on their meat reduction frequency, where behaviours range from minor adjustments to regular meat consumption practices to a more structural departure from routine meat consumption (e.g., only eating meat once a week) (Dagevos & Voordouw, 2013; Malek & Umberger, 2021; Verain et al., 2015). For example, a recent study differentiated flexitarians from 'pro-flexitarians', the first having substantially moderated their consumption of meat compared to the medium meat-eating pro-flexitarians (de Gavelle et al., 2019). Others have separated flexitarians into semi-vegetarians who eat meat on 2 days a week at most, compared to the light semi-vegetarians who eat meat three days a week or more (De Backer & Hudders, 2014). Those identified as having a relatively low meat consumption frequency have also been called the 'active' flexitarian group (Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013), or split into 3 groups of light meat reducers with different flexitarian dietary patterns, depending on their consumption of specific types of meat (Malek & Umberger, 2021). The heterogeneity in the literature describing 'flexitarians' is as wide as the diversity in the frequency of meat consumption among flexitarians. Studies also differ on the reported motivations for meat reduction, with some showing heavy meat reducers were more motivated by animal welfare concerns to follow a flexitarian diet (Malek & Umberger, 2021). The pro-flexitarians group identified by de Gavelle et al. (2019) were primarily motivated to reduce their meat intake in favour of alternative products for environmental reasons, while 'flexitarians' were more motivated for personal health and animal welfare reasons (Miki, Livingston, Karlsen, Folta, & McKeown, 2020). Research investigating motivations to consume a plant-based diet found that semi-vegetarians tended to cite 'health motivations' (Verain et al., 2021).

As the ways by which flexitarians adhere to a diet reduced in animal products can be varied, we propose that flexitarians are also not homogenous in their underlying motivations for following such a 'flexitarian' diet. We hypothesise that individual differences between consumers in their motivation to adhere to a flexitarian diet will be linked to their dietary patterns and frequency of meat consumption. We sought to test whether these differences in flexitarians motivation to adopt a dietary strategy that reduces meat intake were reflected in

differences in psychological traits and food choice motivations thought to be linked to the frequency with which they reduce their meat intake, and an increased acceptance of non-animal alternative protein sources. Exploring psychological traits and food choice motivations will highlight differences between flexitarians with regards to what is important to them as a flexitarian, with implications around how to inspire further reduce meat intake of flexitarians whose intake is still considered high and how to encourage increased consumption of alternatives to meat in different flexitarian subgroups.

Few studies have explored flexitarian motivations from the perspective of the psychology of eating behaviour and food choice. The current study investigated whether there are differences among flexitarians in the psychological drivers of their motivations to follow a flexitarian diet. Given we expected the most likely expression of flexitarian behaviour within the local Singaporean population to be reducing intake of (animal) meat products, we defined and recruited flexitarians as individuals who reported reducing their meat intake at least 1 day a week. Across two online studies, flexitarian consumers were recruited to compare the uniformity of their psychological motivations for adopting a meat-reduced diet. Specifically, we sought (1) to investigate whether subgroups of flexitarian consumers can be identified through individual differences in psychological factors related to flexitarianism, and (2) whether these subgroups differed in how important reducing their meat consumption was to them, what factors are important in dietary choices, (self-reported) meat consumption and acceptance of plant-based meat alternatives.

2. Method

2.1. Psychological traits related to flexitarianism

An initial list of psychological traits was drafted following a comprehensive literature review that focused on the psychological aspects related to meat reduction or avoidance, vegetarian, vegan and flexitarian consumer food choice behaviour. From the initial list, overlapping psychological traits and food-related attitudes and motivations were consolidated into an initial list of consumer attributes that we hypothesised were relevant in motivating individuals to adopt a flexitarian diet (see Table 1 and Supplementary Materials 1). Specific traits were included and combined if identified as relevant to reducing meat intake, being healthy, and meat-related justifications. Previous literature on self-identified flexitarians (Apostolidis & McLeay, 2019; Dagevos, 2021; Dagevos & Voordouw, 2013; De Backer & Hudders, 2014; Forestell, 2018; Hoek, Luning, Stafleu, & De Graaf, 2004; Kemper & White, 2020; Malek & Umberger, 2021; Mullee et al., 2017; Mylan, 2018) highlighted that motivations to eat less meat, but not abstain from completely, usually arise for health-related and/or moral reasons. This flexibility in meat reduction provides scope for variations in the degree of reduction and the way in which reduction can be achieved when following a flexitarian diet (Dagevos, 2021; Dagevos & Voordouw, 2013). We also included aspects relating to consumer traits and motivations to explore and consume novel foods, and hypothesised that the recent surge in alternative meat products may appeal more to individuals keen to explore 'novel foods' (i.e., food neophilic), as an alternative to traditional animal meat sources in their diet. To ensure the instruments used were robust, the questionnaire items were limited to validated psychometric scales that address these specific behavioral aspects.

2.2. Study 1: Initial development and application of a flexitarian psychological trait questionnaire

2.2.1. Study design

Participants who identify as consuming a 'flexitarian' diet were recruited to complete an online survey, taking approximately 30 min. Participants provided basic demographic information and answered a

Table 1
Psychological traits and food-related psychological aspects.

INVESTIGATING	SCALE	ORIGINAL ITEMS	USED ITEMS	SCORING	REFERENCE	EXAMPLE ITEM
Behavioural avoidance tendencies	The BIS/BAS Scale	14	4	4-point Likert scale; “Strongly disagree” to “Strongly agree” (no mid-point)	(Carver & White, 1994)	“I worry about making mistakes”
Behavioural approach tendencies	The BIS/BAS Scale	1	4	4-point Likert scale; “Strongly disagree” to “Strongly agree” (no mid-point)	(Carver & White, 1994)	“I’m always willing to try something new if I think it will be fun”
Empathy (general/human)	EQ-Revised	15	4	4-point Likert scale; “Strongly disagree” to “Strongly agree” (no mid-point)	(Muncer & Ling, 2006)	“I am good at predicting how someone will feel”
Food neophilia	VARSEEK Scale	8	4	5-point Likert scale; “Strongly disagree” to “Strongly agree”	(Van Trijp & Steenkamp, 1992)	“I think it is fun to try out food items one is not familiar with”
Disgust	The Disgust Propensity and Sensitivity Scale	16	4	5-point Likert scale; “Never” (1) to “Always” (5).	(van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006)	“Disgusting things make my stomach turn”
Sensation Seeking	Brief Sensation Seeking Scale (BSSS)	8	4	5-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002)	“I would like to take off on a trip with no pre-planned routes or timetables”
Meat attachment	Meat Attachment Questionnaire	16	4	5-point Likert scale; “Strongly disagree” to “Strongly agree”	(Graça, Calheiros, & Oliveira, 2015)	“To eat meat is one of the good pleasures in life”
Moral disengagement in meat questionnaire	Moral Disengagement in Meat Questionnaire	20	5	5-point Likert scale; “Strongly disagree” to “Strongly agree”	(Graça, Calheiros, & Oliveira, 2016)	“It would be difficult for me to watch an animal being killed for food purposes”
Food neophobia	Abbreviated Food Neophobia Scale	6	4	6-point Likert scale; “Strongly disagree” to “Strongly agree” (with no mid-point).	(Schnettler et al., 2013)	“I am afraid to eat things I have never eaten before”
Food Technology Neophobia	Food Technology Neophobia Scale	9	4	6-point Likert scale; “Strongly disagree” to “Strongly agree” (with no mid-point).	(Schnettler et al., 2016)	“It can be risky to switch to new food technologies too quickly”
Naturalness	Food Naturalness Scale	9	4	6-point Likert scale; “Strongly disagree” to “Strongly agree” (with no mid-point).	(Michel & Siegrist, 2019)	“I make sure to buy products that are preferably free from artificial ingredients”
Promotion focus	Promotion Focus Subscale	5	2	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Haws, Dholakia, & Bearden, 2010)	“I see myself as someone who is primarily striving to reach my “ideal self” - to fulfil my hopes, wishes, and aspirations”
Prevention focus	Prevention Focus Subscale	5	2	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Haws et al., 2010)	“I see myself as someone who is primarily striving to become the self I “ought” to be - to fulfil my duties, responsibilities and obligations”
Food involvement	Food Involvement Scale	12	4	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Bell & Marshall, 2003)	“Talking about what I ate or am going to eat is something I like to do”
Empathic concern for animals	Animal Sensitivity Scale	7	4	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Niemyjska, Cantarero, Byrka, & Bilewicz, 2018)	“When I see an animal being taken advantage of, I feel kind of protective towards them”
Health consciousness/concerns	General Health interest (subscale of Health and Taste Attitudes)	8	4	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Roininen, Lähteenmäki, & Tuorila, 1999)	“The healthiness of food has little impact on my food choices”
Environmental concerns	Environmental self-identity scale	3	3	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(van der Werff, Steg, & Keizer, 2014)	“Acting environmentally friendly is an important part of who I am”
Animal welfare concerns	Animal Attitudes scale 5-item version;	5/9	3	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Cembalo et al., 2016; Herzog, Grayson, & McCord, 2015)	“It is important that the food I normally eat has been produced in a way that animals’ rights have been respected”
Impression Management	Impression management items to assess Food Choice Motives	4	3	7-point Likert scale; “Strongly disagree” to “Strongly agree”.	(Pula, Parks, & Ross, 2014)	“It is important to me that the food I ate on a typical day... portrays a positive image of me”

Table 1 provides details on where in previous literature the various items used in our questionnaire were taken from. Note, as different scoring systems were used, z-scores were calculated for each item. To increase readability and ease/speed of completion, we changed all response options relating to agreement to “Strongly agree/disagree” or “Somewhat agree/disagree” respectively.

series of online questionnaires comprising sub-scales of validated items to measure their individual differences in psychological traits and motivations to consume a flexitarian diet. This was supplemented with validated questionnaires to quantify the frequency of consumption of meat, alternative protein products, their meat consumption on the previous day, how important reducing their meat intake is to them, and their food choice motivations.

2.2.2. Participants

The current study focused singularly on meat reduction as a consumer motivation indicating flexitarianism in order to reflect expected expressions of flexitarian behaviours in a Singaporean population. Specifically, participants were included if they reported trying to reduce their meat intake on at least 1 day per week. Further eligibility criteria included residing in Singapore, being aged 21–60 years old, having no history of or current food allergies or eating disorders, being fluent in written and spoken English, having access to a phone or device with internet, and being able to use the Qualtrics survey platform.

2.2.3. Sample size calculation

The sample size was defined to ensure sufficient participants to enable a factor analysis of items linked to the questionnaire survey items. For the initial questionnaire, it was also important to reduce overlapping items on the flexitarian psychological motivations to a smaller number of components to be utilised in a cluster analysis and comparison of consumer segments. This is considered appropriate based on earlier research by Comrey and Lee (2013). The initial Flexitarian Psychological Trait questionnaire (FPTQ) included a total of 70 items to meet this latter recommendation and was the basis for a sample size to accommodate this ($70 \times 5 = 350$), which provided a sufficient sample size to detect a medium effect size ($f = 0.25$) using ANCOVA analyses to investigate differences between flexitarian subgroups. This allowed comparison of flexitarians based on how important reducing their meat consumption is to them, self-reported meat consumption, and the importance given to various food choice motivations.

2.2.4. Online data collection

Participants were recruited and screened through the consumer database of Dynata, a third-party consumer research organisation. Questionnaire responses were captured via the online platform Qualtrics (www.qualtrics.com). As part of data quality checks, response times were screened for each participant to remove those that answered too quickly (<6 min, or less than one third of the average sample completion time), stereotypically (e.g., straight-liners within item batteries), or provided inconsistent responses (i.e. contradictory statements, different answers to corroboration questions). Attention checks were also distributed at appropriate points throughout the study (see 'Measures') and a survey response was immediately terminated following a failed attention check.

2.2.5. Procedure

Once successfully screened, participants first viewed an online information sheet briefly detailing the study aims and procedures (i.e., completion of anonymous questionnaires). They had the option to exit the questionnaire without completing it, or to click to the next page and complete the online consent form, before continuing to the main questionnaire. Participants answered a series of flexitarian screening and demographic questions (i.e. age, gender), before completing a series of questionnaire sub-scales related to a series of pre-defined psychological traits (Table 1), all of which were presented in a randomised order. Participants then completed questions about their commitment to, and observance of a flexitarian diet and questions related to the frequency of their meat and alternative protein consumption. Participants further completed the validated 'Meat Frequency Questionnaire' (Stewart, Frie, Piernas, & Jebb, 2021), and reported whether they currently follow any specific diets or exclude specific foods from their diet. Finally, they

completed the flexitarian screening questions again for corroboration.

2.2.6. Measures

Full questionnaires are provided in the [supplementary materials](#) (see [Supplementary Files 1 and 2](#)).

2.2.6.1. Flexitarian screening questions. To be identified as a flexitarian, participants were required to confirm that they limit their meat intake but still include meat in their diet (Rosenfeld, Rothgerber, & Tomiyama, 2019), and that they try to reduce meat consumption in their meals on at least 1 day a week.

2.2.6.2. Psychological traits and food-related psychological aspects. Participants completed a total of 70 items comprising sub-scales from 19 existing and validated scales used to profile consumer psychological traits, attitudes and motivations. These questionnaire responses consisted of Likert scale responses, and Table 1 summarises the different instruments from which these psychological trait measures were drawn.

2.2.6.3. Exploration of individual differences between flexitarian subgroups. To compare the relative importance of a wide range of choice-related factors, including sensory pleasure, cost, convenience and health, participants completed the 36 items of the Food Choice Questionnaire (FCQ) (Steptoe, Pollard, & Wardle, 1995). To compare differences in how important reducing their meat intake is in their individual following of a flexitarian diet, participants rated this on a 100-point VAS with anchors of 'Not at all important to me' and 'Extremely important to me'.

2.2.6.4. Meat consumption frequency. To measure meat consumption over the previous day, participants completed the Oxford Meat Frequency Questionnaire (MFQ) (Stewart et al., 2021). They were asked to select all types of meat and/or seafood they consumed on the previous day across all meals and eating occasions. They were then asked to state the specific servings of each meat and/or seafood category they selected, and were provided with detailed instructions as to what constitutes a portion in each case (e.g. "1 burger patty OR approx. 100 g"). However, due to unusual responses on part B of the MFQ (e.g. "Did you forget to include anything? Please add."), self-reported meat consumption was calculated from part A only. Of the 344 who answered this section correctly (i.e. gave portions), 111 (32.3 %) reported consuming > 1.5 kg of meat over the past 24 h. After further checks, 233 completed correctly and were not deemed outliers.

2.2.6.5. Other dietary behaviour measures. Participants were asked about whether they had previously consumed meat alternative products, their reasons for doing so, and how often they consume these products. Finally, participants were asked to report details of any foods they avoid or do not consume, or whether they were following a diet that involves avoiding certain foods.

2.2.7. Data analysis

2.2.7.1. Preparing the data. As items were taken from existing questionnaires, the existing scoring systems were retained. Prior to analysis, z-scores were computed (using IBM SPSS Statistics 27) for each of the 19 scales. We assessed Cronbach's alpha for each of the 19 scales used in our study to ensure that internal reliability is maintained, with a Cronbach's alpha value of > 0.60 deemed as acceptable. If a scale yielded a low Cronbach's alpha value ($\alpha < 0.60$), the scale was further investigated, and items removed to improve consistency where possible (see Appendix).

2.2.7.2. Exploratory factor analysis using the principal axis factoring method. We conducted exploratory factor analysis using a varimax

rotation on the remaining variables to discern a smaller number of components, and from this calculated composite scores for each component. We suppressed factor loadings that were below 0.4. These components were then used as clustering variables in a two-step cluster analysis procedure; such that we can see whether high or low scores in each component are associated with particular clusters (i.e. subgroups) of flexitarian individuals.

2.2.7.3. Cluster analysis. Using the participants' scores on the factors from the exploratory factor analysis, an agglomerative, hierarchical procedure was conducted with groupings made on the basis of the average-linking method, with the squared Euclidean distance as the similarity measure. We referred to the initial dendrogram to discern the appropriate number of clusters and in a second step, K-means clustering was used with the appropriate number of clusters, with the optimum number of clusters decided using Ward's method (Ward, 1963).

2.2.7.4. Profiling the clusters (ANCOVA). To profile differences between consumer clusters, we compared importance of reducing meat consumption, self-reported meat consumption and food choice motivations (using the 9 subscales of the FCQ) between clusters. Differences were compared in percentages of different motivations reported by the flexitarians for these subgroups, to see whether there were differences in clusters based on the motivations reported for consuming a flexitarian diet.

Specifically, ANCOVA analyses were conducted to investigate whether the identified flexitarian subgroups (clusters) differed in (1) how important reducing their meat consumption is to them, (2) how much meat they reported consuming in the previous day, and (3) the importance they place on various food choice motivations (using the 9 subscales of the FCQ). Post-hoc comparisons were conducted using Bonferroni correction for multiple comparisons. As the literature highlights gender differences in meat consumption and vegetarianism (which could mean higher/differing consumption of alternative protein sources), and younger individuals are more likely to follow a flexitarian diet or reduce their meat intake, the analysis controlled for age and gender, and results were considered significant at the 5 % confidence interval ($p < 0.05$). All analyses were conducted using IBM SPSS Statistics 27.

2.3. Study 2

The study design and procedure for Study 2 was identical to that in Study 1, with the exception of the changes outlined below.

2.3.1. Participants

All eligibility criteria were identical to Study 1, with the addition of the criteria that participants must not have completed Study 1. We aimed to collect the same sample size as Study 1.

2.3.2. Measures

The measures were identical to those used in Study 1, with the following changes and additions. First, assessment of Cronbach's alpha of the scales utilized in Study 1 resulted in 18 scales (total 59 items) to be utilized in the initial PCA analysis (see [Supplementary materials](#)). Therefore, these 59 items were utilised in Study 2. Second, due to the issues with utilizing the MFQ remotely in Study 1, we created and used an adapted food frequency questionnaire approach to assess self-reported meat intake (Cade, Thompson, Burley, & Warm, 2002) (see Appendix).

Third, an updated version of the FCQ that separated ecological welfare and political values was utilized (see [Supplementary File 2](#)). Fourth, additional measures of meat consumption justifications (the 4 'N's' (Piazza et al., 2015)) and food health interest were included (see [Supplementary File 2](#)). Finally, the 59 items from Study 1 (from 18

existing scales) were utilised to replicate the cluster analysis. The same analytical procedure was followed, with the addition of ANCOVAs to explore differences in their use of 4 justifications for consuming meat, and their food health interest.

3. Results

3.1. Study 1

After removing poor quality data responses (i.e., excessively fast, inconsistent responding, failing attention checks, $n = 71$), a sample of 353 was achieved for analysis (see [Table 2](#)).

3.1.1. Exploratory factor analysis

A total of 18 variables were included in the Exploratory Factor Analysis and a five-factor solution was gained, which explained 58.9 % of the variance (see [Table 3](#)).

The first component was termed 'food-related social consciousness', which included psychological aspects relating to the social impacts of food, and were unrelated to sensory, technology, or other food-specific aspects. The social aspects of food included animal welfare and environmental concerns both of which loaded onto the same component (PC1), as well as aspects relating to goal-directed behaviour (i.e., prevention focus, promotion focus, behavioural approach), impression management and disgust sensitivity. We characterise these as non-food psychological aspects that drive diet. The second component (PC2), we termed 'food interest' and includes variety seeking in relation to food, food involvement, and food neophobia (negatively loaded). This dimension captured variation related to having an interest in food and sensation seeking approach.

The third component (PC3), we termed 'health concern' and includes items related to general health interest, naturalness concerns, sensation seeking (negatively loaded), and meat attachment (negatively loaded). This dimension captured differences in consumer concerns for health, which in turn included lower sensation seeking. The fourth component (PC4) included items related to 'morality of meat', which was distinct from the animal welfare concerns of PC1, and instead included empathy and animal sensitivity capturing items related to animal welfare. The fifth and final component (PC5) we termed 'food technology caution' and included behavioural inhibition and food technology neophobia. This dimension captured differences in consumers acceptance of new technologies and a reluctance to approach novel foods or foods created using novel technologies.

3.1.2. Clusters

The hierarchical cluster analysis yielded a dendrogram from which 3 clusters emerged as the optimal solution, and we conducted k-means cluster analysis with a 3-cluster solution. Final cluster centres are reported in [Table 4](#) and presented visually in [Fig. 1](#).

Cluster 1 ($n = 161$) were characterised by being lower in social consciousness of food, food interest, morality of meat and food technology caution. However, they were comparatively higher in health concern, suggesting a group of flexitarians aiming to reduce their meat intake for health reasons ('Health-driven' flexitarians).

Cluster 2 ($n = 118$) were higher in food interest with concerns for social consciousness, health, and morality of meat. This cluster differed from Cluster 1 in that they were also cautious about novel food technologies. Participants in this group were hesitant towards food trends

Table 2
Study 1 sample split by age and gender.

	21–30	31–40	41–50	51–60	Sample
Male	43	42	44	45	174
Female	45	45	45	44	179
Sample	88	87	89	89	353

Table 3
Rotated component matrix with 18 psychological traits and food-related aspects (using Varimax with Kaiser Normalization).

	Components				
	1	2	3	4	5
Prevention focused	0.767				
Promotion focused	0.700				
Impression management	0.599				
Animal Welfare Concerns	0.529				
Environmental Concerns	0.524				
Behavioural Approach (BAS)	0.524				
Disgust	0.417				
Variety seeking (in food)		0.847			
Food Neophobia		-0.827			
Food involvement		0.575			
General Health Interest			0.757		
Naturalness			0.616		
Sensation Seeking		0.526	-0.580		
Meat attachment			-0.407	-0.401	
Empathy				0.734	
Animal Sensitivity				0.624	
Behavioural Inhibition (BIS)					0.731
Food Technology Neophobia					0.713

Table 4
Final Clusters centres for the three identified flexitarian subgroups (with scores for each component calculated as mean scores).

	Health-driven (n = 161)	Trend-cautious (n = 118)	Adventurous (n = 74)
Social food-related consciousness (Comp. 1)	-0.45	0.51	0.16
Food interest (Comp. 2)	-0.28	0.91	0.75
Health concern (Comp. 3)	0.41	0.47	0.75
Morality of meat (Comp. 4)	-0.42	0.59	-0.02
Food technology caution (Comp. 5)	0.09	0.46	-0.92

Table 4 displays the final cluster centre values (i.e., the average of each point belonging to that cluster) for each of the 5 components for each of the 3 clusters.

and technology suggesting a group of flexitarians more reluctant to try or adopt novel protein sources, but who are still aware of social issues related to meat consumption. We named this cluster ‘Trend-cautious’ flexitarians.

Cluster 3 (n = 71) were characterised as having a higher interest in food and increased concerns for their health. They were less concerned about social consciousness of food, and scored lower for morality of meat. They had low food technology caution suggesting a group that are more adventurous with food, and potentially interested embrace emerging food and novel technology trends related to animal alternatives. Social and moral aspects of flexitarianism were less of a motivation for this group, and yet they were more accepting of novel protein sources, meat alternatives and technologies. We describe this cluster as ‘Adventurous’ flexitarians.

3.1.3. Demographic profiling of clusters

All clusters had an even balance of males and females and were evenly split across the pre-defined age categories (see Appendix for age and gender distributions for each cluster). The most reported reason for consuming a flexitarian diet was ‘I believe it is better for my health’, followed by ‘I believe it is better for the environment and the planet’ in all three clusters. As can be seen in Table 5., differences in self-reported meat intake were minimal between clusters.

‘Health-driven’ flexitarians rated reducing their meat consumption as significantly less important than the other two clusters. with no significant difference between ‘Traditional’ and ‘Trend-cautious’. ‘Traditional’ flexitarians rated health, mood, natural, weight control and ethical motivations as significantly less important than did ‘Health-driven’ and ‘Trend-Cautious’ flexitarians, would did not significantly differ on any of these motivations. ‘Traditional’ flexitarians also rated familiarity and convenience motivations as significantly more important than ‘Health-driven’ and ‘Trend-Cautious’ flexitarians (no other significant differences). For sensory motivations, ‘Health-driven’ flexitarians rated sensory motivations as significantly less important than ‘Traditional’ flexitarians. For price motivations, ‘Trend-Cautious’ flexitarians rated sensory motivations as significantly less important than ‘Traditional’ flexitarians. Therefore, ‘traditional’ flexitarians considered familiarity, convenience, and sensory motivations as more important, whereas ‘health-driven’ flexitarians were less concerned about overall meat reduction and sensory motivations. Table 6 summarises the

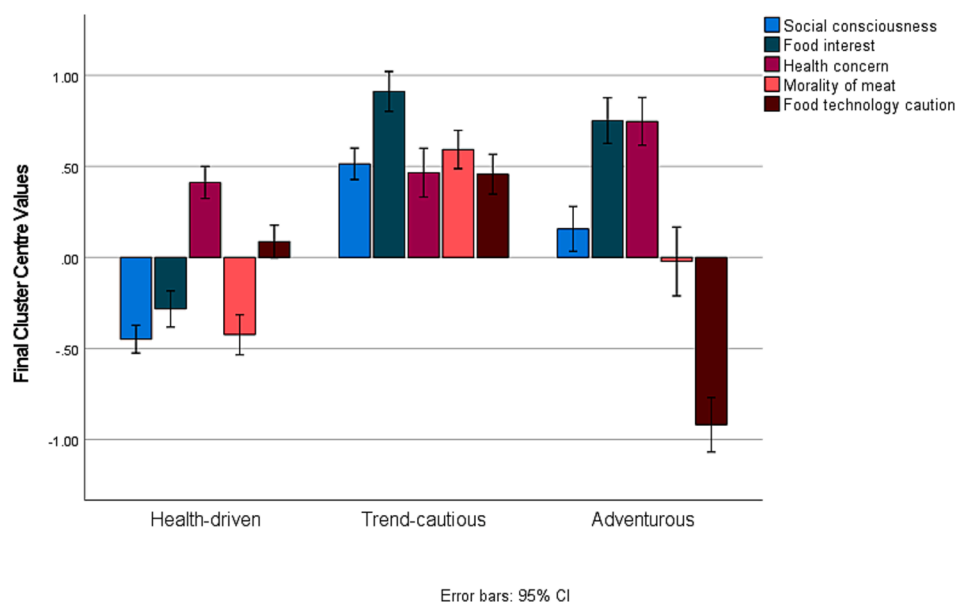


Fig. 1. Bar graph showing final cluster centre values of each component for each cluster. Fig. 1 displays the final cluster centre values (i.e., the average of each point belonging to that cluster) for each of the 5 components. Error bars are 95% confidence intervals.

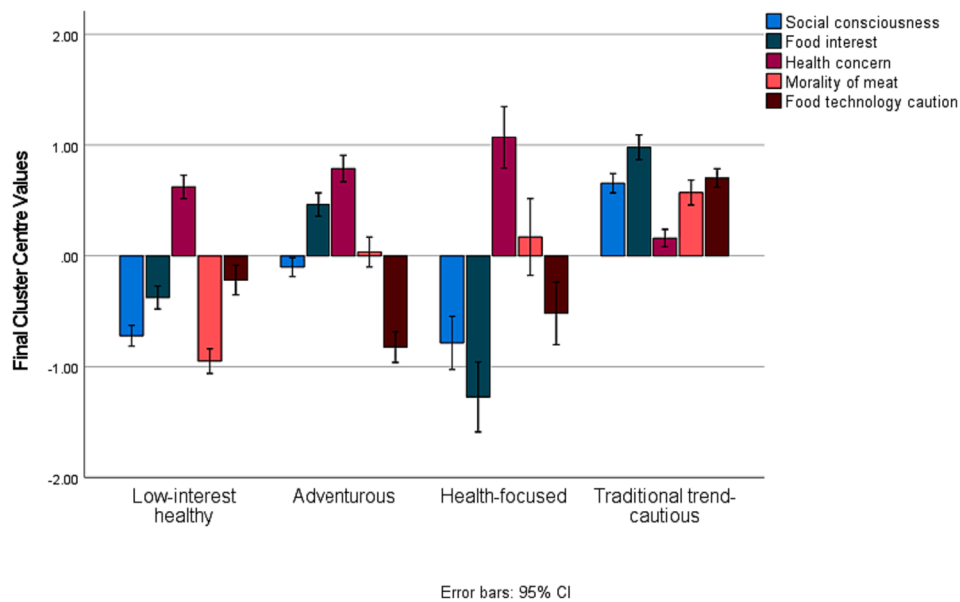


Fig. 2. Bar graph showing final cluster centre values of each component for each cluster. Fig. 2 displays the final cluster centre values (i.e. the average of each point belonging to that cluster) for each of the 5 components. Error bars are 95% confidence intervals.

Table 5
Meat consumption (g) and alternative meat consumption split by flexitarian clusters.

	Health-driven (n = 161)	Trend-cautious (n = 118)	Adventurous (n = 74)
Meat consumption (g) ¹	485.18 (±359.63)	526.09 (±375.75)	580.45 (±394.36)
Alternative meat consumption ²	1.89 (±1.67)	2.80 (±1.54)	3.14 (±1.54)

¹ note, this is with n = 233 participants who completed the Meat Frequency Questionnaire correctly, specifically n = 114 health-driven, n = 64 trend-cautious, and n = 55 Adventurous flexitarians respectively.

² Scores from a 7-point Likert scale with responses of 'Never' (0) to 'Five times per week or more' (6), with higher responses indicating more frequent alternative protein consumption.

differences between clusters and highlights differences in rated importance of reducing meat consumption and food choice motivations. Importantly, there were no significant differences in self-reported meat consumption between the three clusters.

3.2. Study 2

3.2.1. Preparing the data

After removing responses that did not meet our stringent data quality checks (i.e., excessively fast, inconsistent responding) and therefore were identified as poor-quality data responses n = 285), a sample of 299 was included in the final analyses. Of these, two participants reported that they did not consume meat when asked to further questions regarding foods that they avoided in their diet. Therefore, data from 297 self-identified flexitarians was analysed (see Table 7). Seven participants gave conflicting responses when asked about their meat consumed for 1 of the 3 days (e.g., selected at least 1 meal as containing meat, but also selected 'I did not consume any meat on this day'). Therefore, data from 290 participants was used to investigate differences in self-reported meat consumption.

3.2.2. Cluster replication

Component scores were calculated for this second consumer sample (N = 297) and hierarchical cluster analysis yielded a dendrogram from

Table 6
Differences between clusters on importance of reducing meat consumption, meat consumption (g), and food choice motivations (ANCOVAs).

	Health-driven (n = 161)	Trend-cautious (n = 118)	Adventurous (n = 74)	p-value
Importance of meat reduction	62.2 (±1.3) b	69.3 (±1.6) a	68.0 (±1.9) a	0.001**
Meat consumption (g)	492.9 (±34.4) a	513.1 (±46.4) a	579.5 (±49.6) a	0.354
Health ^a	17.8 (±0.3) b	20.6 (±0.3) a	20.3 (±0.4) a	<0.001***
Mood ^a	16.8 (±0.3) b	19.8 (±0.3) a	18.9 (±0.4) a	<0.001***
Convenience ^a	14.8 (±0.2) a	16.7 (±0.3) b	15.5 (±0.3) a	<0.001***
Sensory ^a	11.9 (±0.2) a	13.4 (±0.2) bc	12.6 (±0.3) ac	<0.001***
Natural ^a	8.9 (±0.2) b	10.1 (±0.2) a	10.0 (±0.2) a	<0.001***
Price ^a	9.1 (±0.2) a	9.6 (±0.2) ab	8.8 (±0.2) ac	0.021*
Weight Control ^a	8.3 (±0.2) b	9.8 (±0.2) a	9.3 (±0.2) a	<0.001***
Familiarity ^a	7.9 (±0.2) a	9.0 (±0.2) b	8.0 (±0.2) a	<0.001**
Ethical ^a	7.3 (±0.2) b	9.2 (±0.2) a	8.7 (±0.2) a	<0.001***

Table 6 shows differences between clusters (values are Mean(±SD)) with the associated p value). Importance of meat reduction and the food choice questionnaire items were both measured on 100-point VAS, with meat consumption in grams (over last 24 h) self-reported. Letters a, b and c are used to denote whether mean values were similar or different to each other. *p < .05, **p < .01, ***p < .001.

^a FCQ scale.

which 4 cluster solutions were identified as optimal. As with study 1, a k-means cluster analysis was used with a setting of 4 clusters, and we utilised and reported the consistent cluster analysis results (Table 8).

Cluster 1 (n = 81) were characterised as lower in social consciousness of food, food interest, morality of meat and food technology caution, but were higher in health concern suggesting a group of

Table 7
Study 2 sample split by age and gender.

	21–30	31–40	41–50	51–60	Sample
Male	31	36	35	37	139
Female	40	37	42	39	158
Sample	71	73	77	76	297

Table 8
Final Clusters centres (with scores for each component calculated as mean scores).

	Low-interest healthy (n = 81)	Adventurous-healthy (n = 72)	Health-focused (n = 20)	Traditional trend-cautious (n = 124)
Social food-related consciousness (Comp.1)	-0.72	-0.10	-0.79	0.66
Food interest (Comp. 2)	-0.38	0.46	-1.27	0.98
Health concern (Comp. 3)	0.62	0.79	1.07	0.16
Morality of meat (Comp. 4)	-0.95	0.03	0.17	0.57
Food technology caution (Comp. 5)	-0.22	-0.82	-0.52	0.70

Table 8 displays the final cluster centre values (i.e., the average of each point belonging to that cluster) for each of the 5 components for each of the 4 clusters.

flexitarians who were lower in several identified flexitarian motivations, but high in their health concerns. We describe this cluster as ‘Low-interest / healthy’ flexitarians.

Cluster 2 (n = 72) was characterised by high concern for health and interest in food, who were lower in concerns about the social consciousness of food or the morality of meat consumption. Cluster 2 were low in food technology caution and seem to be more adventurous with food with a higher interest in emerging food/technology trends. Social and moral aspects of flexitarianism were less of a concern for cluster 2 participants, suggesting a group of flexitarians open to trying novel protein sources or novel alternatives to meat. We describe this cluster as ‘Adventurous’ flexitarians.

Cluster 3 (n = 20) were characterised as lower in social consciousness of food, food interest, and food technology caution, with some concern for morality of meat. Comparatively they were higher in the health concerns component than the other three clusters. This indicates that they were motivated to reduce their meat intake primarily for personal health reasons (similar to Cluster 1 in study 1). We describe this cluster as ‘Health-focused’ flexitarians.

Cluster 4 (n = 124) were higher in food interest, social consciousness, morality of meat, and food technology caution and had less concern for health motivations. Participants in this group were hesitant towards new food trends and technology but motivated by social consciousness and morality of food production and consumption. This group of flexitarians were aware of the various issues surrounding meat consumption and were motivated to reduce their consumption of meat for social/moral reasons rather than health. Cluster 4 participants were sceptical about novel food technologies, and we describe this cluster as ‘Traditional trend-cautious’ flexitarians.

3.2.3. Demographic profiling of clusters

All clusters had an even balance of males and females and were evenly split across the pre-defined age categories (see Appendix for age and gender distributions for each cluster). The most reported reason for consuming a flexitarian diet was ‘I believe it is better for my health’, followed by ‘I believe it is better for the environment and the planet’ in

all clusters, with the exception of ‘Traditional trend-cautious’ flexitarians, for whom ‘I believe it is better for animals and their welfare’ was the second most reported reason. As can be seen in Table 9., differences in self-reported meat intake were minimal between clusters.

Again, there was no significant difference in self-reported meat consumption (when controlling for confidence in self-report). ‘Traditional trend-cautious’ flexitarians rated reducing their meat intake as significantly more important, but also cited all four justifications for meat consumption significantly more strongly than the other three clusters, with no other significant differences between the remaining three clusters.

Comparison of the food choice motivations between clusters revealed that ‘Low interest/healthy’ flexitarians reported significantly lower food health interest and naturalness concerns than ‘Adventurous’ and ‘Traditional Trend-cautious’ flexitarians, with no other significant differences. ‘Traditional Trend-cautious’ flexitarians reported significantly higher mood, convenience and price motivations than ‘Low interest/healthy’ and ‘Adventurous’ flexitarians, and reported higher weight control, familiarity, ecological welfare and political welfare motivations than the other three clusters. Interestingly, although ‘Traditional Trend-cautious’ flexitarians reported higher importance of meat reduction than all other clusters, they also reported significantly higher justifications for meat consumption than all other clusters. ‘Adventurous’ flexitarians reported significantly higher ecological welfare and political motivations than ‘Low interest/healthy’ flexitarians. Therefore, ‘Traditional Trend-cautious’ flexitarians appeared to hold stronger motivations around reducing meat intake, but also reported stronger justification for continued meat consumption.

4. Discussion

The current study explored individual differences in psychological traits linked to consumer motivations to adopt and consume a flexitarian diet. Broadly, consumers grouped into clusters relating to health as a primary motivator, adventurous motivation to their approaches to food choices, and a third segment had more “traditional” flexitarian motivations relating to the social and moral concerns towards animal meat consumption. Our first study revealed three distinct consumer segments with different motivations to adopt a flexitarian diet and were defined as ‘health-driven’, ‘trend-cautious’, and ‘adventurous’ flexitarians. However, what was striking was despite differences in underlying motivations there were no significant differences in self-reported meat consumption. Differences were limited to food choice motivations and the importance of reducing meat intake between clusters. In a second step we sought to replicate the flexitarian consumer segments but instead identified four clusters which were defined as ‘health-only’, ‘traditional trend-cautious’, ‘adventurous’ and ‘health-focused’

Table 9
Meat consumption occasions (3 days) split by flexitarian clusters.

	Low-interest healthy (n = 81)	Adventurous (n = 72)	Health-focused (n = 20)	Traditional trend-cautious (n = 124)
Meat consumption occasions (3 days)¹	4.14 (±2.00)	3.83 (±1.85)	4.40 (±2.16)	4.69 (±2.25)
Alternative meat consumption ²	2.27 (±1.77)	3.08 (±1.63)	2.65 (±1.66)	3.69 (±1.64)

¹ note, this is with n = 290 participants who responded correctly to the meat intake questions, specifically n = 78 Low-interest healthy, n = 71 Adventurous, n = 20 Health-focused, and n = 121 Traditional trend-cautious flexitarians respectively.

² Scores from a 7-point Likert scale with responses of ‘Never’ (0) to ‘Five times per week or more’ (6), with higher responses indicating more frequent alternative protein consumption.

Table 10Differences between clusters on importance of reducing meat consumption, meat consumption (g), and food choice motivations (ANCOVAs) (values are Mean \pm SE).

	Low-interest healthy (n = 81)	Adventurous (n = 72)	Health-focused (n = 20)	Traditional trend-cautious (n = 124)	p-value
Importance of meat reduction	65.2 (\pm 2.0) a	71.0 (\pm 2.1) a	66.6 (\pm 3.9) a	84.3 (\pm 1.6) b	<0.001***
Meat consumption occasions (3 days)	4.2 (\pm 0.2) a	3.8 (\pm 0.2) a	4.4 (\pm 0.5) a	4.7 (\pm 0.2) a	0.051
“Natural” ^a	17.9 (\pm 0.4) a	17.2 (\pm 0.4) a	17.7 (\pm 0.8) a	23.1 (\pm 0.3) b	<0.001***
“Necessary” ^a	17.7 (\pm 3.8) a	17.4 (\pm 4.1) a	15.6 (\pm 6.1) a	22.8 (\pm 4.6) b	<0.001***
“Normal” ^a	17.5 (\pm 0.4) a	16.8 (\pm 0.4) a	16.6 (\pm 0.8) a	23.2 (\pm 0.3) b	<0.001***
“Nice” ^a	18.5 (\pm 0.4) a	17.8 (\pm 0.5) a	18.3 (\pm 0.9) a	23.6 (\pm 0.4) b	<0.001***
Food Health Interest	16.6 (\pm 0.2) a	18.2 (\pm 0.2) b	17.1 (\pm 0.5) ab	19/0 (\pm 0.2) bc	<0.001***
Health^b	18.6 (\pm 0.3) a	19.9 (\pm 0.3) b	19.3 (\pm 0.6) ab	20.8 (\pm 0.3) b	<0.001***
Mood^b	17.1 (\pm 0.4) a	18.4 (\pm 0.4) a	17.5 (\pm 0.7) a	20.3 (\pm 0.3) b	<0.001***
Convenience^b	14.8 (\pm 0.3) a	15.7 (\pm 0.3) a	15.2 (\pm 0.5) a	16.8 (\pm 0.2) b	<0.001***
Sensory^b	12.0 (\pm 0.2) a	12.8 (\pm 0.2) a	13.0 (\pm 0.4) ab	13.9 (\pm 0.2) bc	<0.001***
Natural^b	9.0 (\pm 0.2) a	9.8 (\pm 0.2) b	9.4 (\pm 0.4) ab	10.4 (\pm 0.2) bc	<0.001***
Price^b	9.0 (\pm 0.2) a	9.0 (\pm 0.2) a	9.4 (\pm 0.4) ab	10.1 (\pm 0.2) b	<0.001***
Weight Control^b	8.7 (\pm 0.2) a	9.4 (\pm 0.2) a	8.8 (\pm 0.4) a	10.2 (\pm 0.2) b	<0.001***
Familiarity^b	8.1 (\pm 0.2) a	8.3 (\pm 0.2) a	7.8 (\pm 0.4) a	10.1 (\pm 0.2) b	<0.001***
Ecological Welfare^b	13.7 (\pm 0.3) a	15.8 (\pm 0.3) a	14.4 (\pm 0.6) a	17.0 (\pm 0.3) b	<0.001***
Political^b	14.9 (\pm 0.3) a	15.7 (\pm 0.3) b	15.2 (\pm 0.6) ab	17.2 (\pm 0.2) c	<0.001***

Table 10 presents the ANCOVA results investigate differences between the four clusters. Importance of meat reduction and the food choice questionnaire items were both measured on 100-point VAS. The total score for meat consumption was 18, denoted meat consumption at every eating occasion over 3 reported days. Data from 271 individuals was analysed to investigate the FCQ subscales, as 26 individuals exhibited evidence of straight lining on one or more aspects of the FCQ. * $p < .05$, ** $p < .01$, *** $p < .001$.

^a Justification from The 4Ns, measured on a 7-point Likert scale.

^b FCQ scale. Data from 271 individuals was analysed to investigate the FCQ subscales, as 26 individuals exhibited evidence of straight lining on one or more aspects of the FCQ.

flexitarians. As with the first study, despite distinct differences in underlying motivations to adopt a flexitarian diet, there were no significant differences in self-reported meat consumption. Differences were limited to consumer motivations as reflected in food choice motivations, food health interest, justifications for meat consumption, and importance of reducing meat intake between clusters. These findings highlight that despite the diversity in consumer drivers of behaviour change, self-reported meat intake was equivalent.

Based on previous literature, health concerns associated with excessive meat consumption has previously been identified as a key motivator for consumers to reduce their meat intake (Apostolidis & McLeay, 2019; De Backer & Hudders, 2014; Hoek et al., 2004; Mylan, 2018). Flexitarianism is also widely promoted as a healthy alternative to diets high in animal products, particularly processed meats (Barnard, Levin, & Yokoyama, 2015; Derbyshire, 2017; Dinu, Abbate, Gensini, Casini, & Sofi, 2017). The emerging flexitarian market has also yielded exponential growth in the availability of novel alternative products, and this was a particularly strong motivation for those interested in trying these novel meat alternatives. As with vegetarian and vegan consumers, a third cluster emerged that had a higher awareness of social, moral and animal welfare concerns, and were less concerned by health impact of consuming meat and animal products. Despite these distinct consumer motivations, self-reported meat reduction was not only equivalent between subgroups, but also rather high, suggesting a possible intention-behaviour gap associated with adopting a flexitarian diet that was equal across consumer segments. Intention-behaviour gaps have also been recognised in consumer behaviours related to sustainability (ElHaffar, Durif, & Dubé, 2020; Nguyen, Nguyen, & Hoang, 2019).

Despite the diversity of motivations to adopt a flexitarian diet we did not see large differences in meat intake. The ‘traditional trend-cautious’ flexitarians rated the importance of reducing meat as higher than all others, but still offered strong justifications for continued meat consumption. This echoes previous research that, as well as taste (which suggests continued meat attachment and liking), some flexitarians reported consuming meat when ‘necessary’ to avoid being perceived as rude or inconsiderate in social situations (Kemper & White, 2020; Mylan, 2018). It remains to be seen whether the dietary recall assessment had sufficient sensitivity to differentiate the meat intake of the

different consumer segments. The collection of robust dietary data is an ongoing issue in online research (Naska et al., 2017). Future studies should consider using household purchasing data or more detailed diet recall and tracking to validate this finding, for example by clustering participants by reported meat intake and seeing whether these map onto the flexitarian subgroups. Similarly, we relied on self-report for recruitment of flexitarians in the current study, which may have been a limitation.

This study utilised a novel approach by going beyond stated motivations for a flexitarian diet to explore some of the underlying psychological traits that underpin the flexitarian mindset. In drawing on these underlying psychological traits, we aimed to target a more global representation of consumer motivations for reducing meat intake and delineate between consumer trends for alternative foods to identify previously unexplored elements of flexitarian motivations. In completing the replication of the initial results in a separate sample of flexitarian consumers, we are confident that there is some validity in the 3–4 consumer segments identified and described in the current study. This replication is also important in offsetting the arbitrary nature of consumer cluster analysis (Fu & Perry, 2019; Rovniak et al., 2010). Nevertheless, future research should aim to further validate these preliminary findings in a wider consumer sample and confirm that the traits and motivations profiled in the current study are representative of the factors that discriminate a wider flexitarian population. We suggest that the approach adopted in the current study can also be adapted as a screening tool to recruit specific flexitarian consumer segments for consumer research on emerging trends in traditional meat alternative product acceptance and consumption (i.e., if an individual scores higher or lower in a particular component, they can be designated as a member of a specific cluster). Findings from the questionnaire used in study 2 can be further accentuated with measures such as discrete choice experiments, experimental studies of food intake and sensory measures, and longer-term diet data to track the transition from motivation to behaviour change. Our flexitarian questionnaire could be used to understand how best to communicate to different flexitarian groups, based on the most salient messages relating to product benefits linked to motivations. For example, messages about the health benefits of plant-based diets are likely to resonate with the ‘health conscious’ flexitarian consumers, but

will likely not appeal to those motivated by new sensory experiences. Similarly, communicating on the safety and sustainability of novel alternative products will likely appeal more to those in the 'trend-cautious' flexitarian segment, but will have less impact on those with higher moral concerns for animal production and consumption. Where some studies have explored differences between omnivores, flexitarians and vegetarians in impact of labels on choices (e.g., Apostolidis & McLeay, 2019), none have explored different groups of flexitarians. Rather than treating flexitarian as a single heterogeneous consumer group, future experiments should aim to recruit distinct flexitarian segments when testing product and communication acceptance for novel alternative products. A deeper exploration of the motivations of flexitarian consumers to adopt a reduced meat diet will help to inform more successful strategies to communicate the benefits that resonate most within each consumer segment.

The current manuscript only focused on meat reduction and did not investigate differences in consumer intake for other animal-based food groups such as dairy or eggs. Although we expect the most likely expression of flexitarian behaviour within the local Singaporean population to be reducing intake of (animal) meat products, this could potentially limit the generalisability of the current findings. Future studies should aim to recruit distinct flexitarian consumer segments and track changes in their dietary intakes over time to better understand the specific substitutions and dietary changes they adopt successfully when shifting to reduce animal products in favour or more plant-based dairy and alternative protein sources. Findings from the current study highlight little difference in meat consumption between the 3–4 flexitarian consumer groups, but it is currently less well understood whether these flexitarian segments differ in approaches alternatives for dairy and other animal products.

In conclusion, findings from the current study highlight distinct consumer segments underpinned by diverse psychological traits and motivations to adopt a flexitarian diet. The flexitarian questionnaire used in study provides a novel approach to characterise consumer segments and offers a new approach to describe the different motivations that influence flexitarian consumer groups when attempting to reduce their intake of animal-based products. A deeper understanding of the distinct factors that motivate consumers to adopt more sustainable dietary practices will be central to the development of strategies to better communicate the benefits to health and sustainability that resonate most with these consumers.

Author contributions

FS and CGF conceptualized and designed the study. FS and AJL implemented data collection and analysis. FS and CGF were responsible for manuscript preparation, and all authors contributed to editing of the final manuscript for publication.

Ethical statement

Both studies were approved by the A*STAR Institutional Review Board in May 2021 (A*STAR IRB reference number 2021–055).

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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.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodqual.2023.105022>.

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