



# Are you ready to eat less meat? Consumer segmentation based on the transtheoretical model of behaviour change

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## ABSTRACT

Excess meat production and overconsumption have raised concerns worldwide about meat's potential negative environmental and climate impacts. Reducing these impacts requires behavioural changes among meat consumers as well as an understanding of consumers' stage of change on their meat reduction journey. The transtheoretical model (TTM) of behaviour change offers the potential to reveal consumer readiness for such changes. This study segmented consumers based on their stages of change (pre-contemplation, contemplation, preparation and action) as conceptualised by the TTM and identified these segments' psychographic and demographic characteristics. Data were collected via a nationwide online consumer survey in which flyers with a survey link were sent to households in randomly selected postal codes across Switzerland. Cluster analysis (N = 569) using Ward's method identified four distinct consumer segments: 'Not willing', 'Aware but not ready', 'Aware and involved' and 'Committed and acting'. 'Not willing' consumers appear more likely to be in the pre-contemplation stage of TTM and more sceptical of meat reduction, whereas the 'Committed and acting' segment includes meat reducers, who claim to be in the action stage. The 'Aware but not ready' are mostly at the 'contemplation' or 'preparation' stages and 'Aware and involved' consumers are at the 'preparation' or 'action' stages. These two segments are considered the main target groups that are amenable to reducing meat intake. Consumers from these two segments show a greater intention to reduce meat consumption and increase vegetable consumption. Targeted strategies should be developed to guide each consumer segment towards more advanced stages of meat reduction.

## 1. Introduction

Recent years have brought a focus on how to achieve a more sustainable food transition and provide healthier, sustainable diets to the increasing global population (Giacomuzzo et al., 2024; Happer and Wellesley, 2019; Lucas and Brunner, 2024a). At the same time, excessive meat production and consumption have been acknowledged as one of the major concerns in the current food system (Niva and Vainio, 2021; Verain and Dagevos, 2022), being directly related to health issues and

environmental impacts (Colombani and Brunner, 2024; Hielkema and Lund, 2021; Lund and Halkier, 2024; Tobler et al., 2011).

To address these issues and hasten the reduction in meat consumption, it is vital to understand the factors that influence reduced meat consumption (Bryant et al., 2022). Concern for personal health appears to be a crucial motivation for lowering meat intake (Hartmann and Siegrist, 2017). Specifically, health concerns linked to meat consumption and/or the perceived health benefits of eating less meat are reported to be positively associated with meat reduction (Ha et al., 2024; Reuzé

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et al., 2023). Environmental, animal welfare and ethical concerns are also generally reported to positively influence meat reduction intention. In contrast, taste, meat attachment and meat's sensory properties are reported to hinder the trend towards lowering meat consumption (Hartmann and Siegrist, 2017; Reuzé et al., 2023; Tobler et al., 2011; Verain and Dagevos, 2022).

Furthermore, previous studies report that perceived behavioural control (a construct in the theory of planned behaviour) and perceived self-efficacy (a construct in protection motivation theory) in reducing meat consumption strongly predict the intention to eat less meat (Ha et al., 2024; Wolstenholme et al., 2021). Notably, however, such an intention does not always translate into actual meat reduction (Hielkema and Lund, 2021). In addition, the literature also reveals that the habit of eating meat can be shaped by social context, and social factors, such as the influence of family members and social networks. This influence can either support or prevent individuals' meat reduction (Ha et al., 2024; Lund and Halkier, 2024; Markoni et al., 2023).

Despite understanding the factors that can result in healthier behaviour, it is also vital to investigate consumers' behaviour changes over time. In this context, the transtheoretical model of behaviour change (TTM) from Prochaska and Velicer (1997) can serve this purpose and allow us to assess consumers' readiness to reduce meat consumption (climate-damaging behaviour). Researchers have applied the TTM in empirical analyses of consumer behaviour towards meat reduction to assess consumers' readiness to reduce meat consumption (Arnaudova et al., 2022; Reuzé et al., 2023; Strässner and Hartmann, 2023; Tobler et al., 2011). Results revealed that meat consumers can be at different stages when it comes to meat reduction such as pre-contemplation, contemplation, preparation or action stages (Prochaska and Velicer, 1997). Knowing the stages from which consumers belong allows us to design specific strategies for each consumer group aiming to reduce meat consumption worldwide.

Recent reports revealed that meat consumption in Switzerland is decreasing (Delley et al., 2024). However, the consumption per capita is still above the recommended levels of the EAT-Lancet Commission (Dagevos et al., 2020; Ha et al., 2024). To support meat reduction, a comprehensive and updated knowledge of Swiss consumers' stages of change in meat reduction is needed. However, this understanding is currently lacking. An early study from Switzerland by Tobler et al. (2011) used regression analysis to predict consumers willing to reduce meat consumption using TTM stages (each stage measured by a single item). Given changes in social, economic, political, and environmental conditions in the past decade in Switzerland, changes in consumer behaviour are expected and thus current research is needed to reflect such changes. Arnaudova et al. (2022) have highlighted the characteristics of Swiss consumers in different stages of TTM regarding meat reduction. However, the sample used was limited to Swiss students. By exploring current data from the general Swiss population using segmentation analysis, our study addresses the gaps above. The current study also differs from the other studies published on the topic as we applied new items developed based on the TTM model from Prochaska and Velicer (1997) to segment Swiss consumers. Furthermore, new constructs that were not used before in the context of TTM (e.g. hindering familial influence) were applied to describe the segments. In these ways, the study brings new insights that can support policymakers in designing strategies to further reduce meat intake in Switzerland and serve as a model for other countries.

## 2. Background

The TTM postulates that changes in health behaviour involve a six-stage process: pre-contemplation, contemplation, preparation, action,

maintenance and termination (Prochaska and Velicer, 1997). In pre-contemplation (stage 1), consumers do not yet agree with the specified issue or are unaware of the negative impact of their behaviour. In contemplation (stage 2), consumers are aware of the consequences but do not yet seem ready to change their behaviour. In preparation (stage 3), consumers not only acknowledge the issue but also intend to change. In action (stage 4), consumers change their behaviour and execute the plan (Prochaska and Velicer, 1997). Ongoing behavioural change and confidence in sustaining it differentiate the maintenance stage from the preceding action stage. In some cases, individuals may relapse to an earlier stage. In the termination stage, self-efficacy is at its highest, and consumers experience no temptation to relapse (Prochaska and Velicer, 1997; Prochaska et al., 2008).

Reuzé et al. (2023) observed that French consumers in the later stages of meat reduction consumed more plant-based meat substitutes. The study also revealed that enjoying meat was one of the factors hindering consumers' meat reduction in the pre-contemplation stage. According to the authors, participants at this stage also believe that meat is a good source of protein, which contributes to meat intake. Wolstenholme et al. (2021) evaluated the influence of psychosocial factors to predict the intention to reduce meat intake in the different stages of change and found cross-national differences between Italy and the UK, with perceived behavioural control predicting intention only among the UK participants. Hielkema and Lund (2021) reported that the drivers of reduced meat intake in Denmark include the influence of social networks comprising meat reducers/rejecters as well as awareness of the climate impact of meat production and consumption.

This study focuses on Switzerland, an interesting case study for exploring meat consumption reduction behaviour. Switzerland's meat consumption per capita (51 kg in 2023) is declining (Ha et al., 2024) but still far above the threshold of sustainable and healthy meat intake recommended by the EAT-Lancet Commission (Dagevos et al., 2020; Ha et al., 2024). A decline in individual meat consumption (Delley et al., 2024) and Swiss consumers' openness to adopting healthier eating habits (Giacomuzzo et al., 2024; Lucas and Brunner, 2024b) represent great opportunities for further reducing meat consumption in the Swiss population. However, considerable challenges still lie ahead due to the large gap between current meat intake and that recommended for health and sustainability in Switzerland. Another obstacle to reducing meat consumption is that the process is not instantaneous but a gradual shift away from higher meat consumption (Strässner and Hartmann, 2023; Verain et al., 2024). Segmenting consumers and associating them with different stages of behavioural change related to meat reduction can inform the development of strategies to reach distinct consumer groups. Understanding the demographics, attitudes and food choice motivations of each segment can reveal factors that enable and constrain meat reduction (Bryant et al., 2022; Verain and Dagevos, 2022), knowledge that offers useful tools to support even more Swiss meat eaters in moving along the stages of change towards lower meat consumption.

The objective of this study is to segment consumers using items assumed to be related to the stages of the TTM and explore how the identified segments differ socio-demographically as well as in multiple social and psychological motivations for meat reduction. The latter includes an interest in animal welfare and environmental protection, preference for local and seasonal food, meat attachment, perception of the health aspects of meat consumption, perceived self-efficacy of meat reduction and familial influence.

Specific strategies and communication approaches aiming to reduce meat consumption among different segments of Swiss consumers will be highlighted, adding to the limited available literature. The results of the present study can support policymakers, the food industry and marketers in designing strategies to foster meat reduction and may offer an

example for other countries with similar characteristics.

### 3. Methods

#### 3.1. Data collection and participants

An online survey was conducted in Switzerland in November and December of 2022. Flyers containing the link to the questionnaire (Unipark survey tool) were sent to Swiss households located in French and German-speaking cantons (Giacomuzzo et al., 2024). Households were randomly selected based on postal codes. All the participants agreed to participate in the survey before filling out the questionnaire and were informed of their right to withdraw at any time without providing a reason. After the removal of cases that failed the consistency check or the instructional manipulation check, 643 valid questionnaires were obtained. Because this study concerns meat consumption, 72

participants who declared that they were vegetarians or vegans were also excluded from the analyses, resulting in a useable sample of 571 meat eaters. Table 1 details the sample characteristics and the Swiss resident population characteristics.

#### 3.2. Survey

This study developed the TTM survey items based on the stages of change described by Prochaska and Velicer (1997) and the extant literature (Arnaudova et al., 2022; Tobler et al., 2011) (Table 2). The original TTM considers six stages of change, including pre-contemplation, contemplation, preparation, action, maintenance and termination. However, we were interested only in the first four stages in the present study, as we aimed to provide insights into fostering meat reduction among the meat eaters, who most need to reduce meat intake. Thus, we did not evaluate the maintenance and termination stages as consumers in these stages are already meat reducers and tend to sustain their behaviour, besides having less chance to relapse. This exclusion is also seen in previous studies (Arnaudova et al., 2022; Wolstenholme et al., 2021). The respondents answered the TTM items (Table 2) on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). 6-point Likert scales were applied throughout the survey to avoid non-opinion answers.

Table 3 shows 13 constructs used in the profiling step to describe consumer segments. These constructs reflect multiple social and behavioural dimensions of meat consumption. Five of them capture consumer perceptions of the health aspects of meat consumption (perceived health risk of overconsuming meat; perceived vulnerability of overconsuming meat; response efficacy of eating less meat; response cost of eating less meat; meat safety concerns). The remaining eight constructs measure attitudes towards animal welfare and the environment in food consumption, preference for local and seasonal food, attachment to eating meat (meat attachment), perceived confidence in reducing meat consumption (self-efficacy of meat reduction), social context of meat-eating practices (familial influence) and behavioural intention (intention to reduce meat consumption, intention to increase vegetable consumption). Most of these constructs are proven, important factors influencing meat reduction (see the Introduction section) (Hielkema and Lund, 2021; Verain and Dagevos, 2022). The variable 'Intention to increase vegetable consumption' was added to explore its relationship with the stages of change in meat reduction. This possible relationship is suggested by some empirical studies finding that vegetables are among the replacements for animal-based food (Hayat et al., 2016; Şahinli and Fidan, 2012).

Each construct was measured by three items validated in previous studies (see Table 3). All the constructs presented good internal consistency (Cronbach's  $\alpha \geq .65$ ). At the end of the survey, the participants indicated their socio-demographic characteristics, such as sex, age, employment status and education level, which were used to describe the identified segments.

**Table 1**

Characteristics of the final sample of meat eaters (N = 571) and the Swiss resident population.

Characteristic	% Sample	% Swiss population <sup>d,e,f,g,h</sup>
Sex		
Female	55.4	50.3
Male	44.6	49.7
Age groups <sup>a</sup>		
18–39 years old	23.8	34.1
40–59 years old	38.4	34.4
60–older	37.8	31.5
Employment status		
Not working <sup>b</sup>	36.3	35.0
Working	63.7	64.9
University degree		
Yes	42.9	23.6
No	57.1	76.4
Dietary type <sup>c</sup>		
Omnivore	65.8	70.5
Flexitarian	34.2	29.5

Note.

<sup>a</sup> Refers solely to the adult population.

<sup>b</sup> Unemployed, education/training, homemaker, retired.

<sup>c</sup> Refers solely to meat consumers who filled out the survey and Swiss residents' meat consumers (omnivores or flexitarians).

<sup>d</sup> Permanent resident population by sex in 2023 (Federal Statistical Office, 2024a).

<sup>e</sup> Permanent resident population by age in 2023 (Federal Statistical Office, 2024b).

<sup>f</sup> Employment status in 2023: Distribution of the Swiss resident population aged 15 or over in percent - Swiss Labour Force Survey (Federal Statistical Office, 2024c).

<sup>g</sup> Highest completed education in Switzerland in 2023 (time serie) among the permanent resident population aged 25 years and above (Federal Statistical Office, 2025).

<sup>h</sup> Diet type among meat consumers in 2024 (Eggenschwiler et al., 2025).

**Table 2**

Items measuring four different stages of behavioural change towards meat reduction.

Stage of change	Item
1-Pre-contemplation	I don't have to reduce my meat consumption unless I am explicitly asked to do so. I don't have to eat less meat when there is no problem with my current consumption.
2-Contemplation	I am considering reducing my meat consumption, but I need more time to evaluate my options. I may reduce my meat intake in the next few months, but I'm not ready for that change yet.
3-Preparation	I want to reduce my meat consumption and plan to do so soon. The information I have reinforces my intention to reduce my meat consumption. I will soon reduce my meat intake, given the benefits associated with it.
4-Action	I have reduced my meat consumption and am happy with it. I have reduced my meat consumption and feel able to maintain it at this level.

Note: The mean of the items was used to create the four constructs employed as segmentation variables. Exploratory factor analysis was conducted (see section 3.3). The respondents answered questions on a 6-point Likert scale.

**Table 3**

Scales on meat habits and general behavioural patterns (variables for describing the resulting clusters).

Constructs	Example of item	Cronbach $\alpha$	Scale range	Source
Perceived health risk of overconsuming meat	A high meat consumption is not good for my health because meat is high in saturated fat and cholesterol.	0.73	1-strongly disagree to 6-strongly agree	Arnaudova et al. (2022); Delley et al. (2024)
Perceived vulnerability of overconsuming meat	I am at risk of developing a cardiovascular disease in the next few years if I don't eat less meat.	0.92	1-strongly disagree to 6-strongly agree	Ha et al. (2024); Salter (2018)
Response efficacy of eating less meat	By eating less meat, I avoid developing high cholesterol.	0.78	1-strongly disagree to 6-strongly agree	González et al. (2020); Ha et al. (2024)
Response cost of eating less meat	By reducing my meat consumption, I will feel tired and lack energy.	0.86	1-strongly disagree to 6-strongly agree	Ha et al. (2024)
Meat safety concern <sup>a</sup>	Hormones (growth stimulators) and drugs (antibiotics) residues in meat.	0.79	1-not concerned at all to 6-extremely concerned	Ha et al. (2019, 2024)
Animal welfare <sup>b</sup>	Is produced in an animal friendly way.	0.91	1- not important at all to 6-very important	Lindeman and Väänänen (2000); Verain et al. (2021)
Environmental protection <sup>b</sup>	Is prepared in an environmentally friendly way.	0.94	1- not important at all to 6-very important	Lindeman and Väänänen (2000); Verain et al. (2021)
Local and seasonal <sup>b</sup>	Is a local/regional product.	0.90	1- not important at all to 6-very important	Verain et al. (2021)
Meat attachment	Eating meat provides me irreplaceable sensory pleasure.	0.74	1-strongly disagree to 6-strongly agree	Arnaudova et al. (2022); Delley et al. (2024)
Self-efficacy of meat reduction	I am able to find alternatives to reduce my meat consumption.	0.82	1-strongly disagree to 6-strongly agree	Delley et al. (2024)
Hindering familial influence	The specific needs of other members of my household (e.g. children, sick people) prevent me from adopting new eating habits.	0.65	1-strongly disagree to 6-strongly agree	Giacomuzzo et al. (2024)
Intention to reduce meat consumption	It is likely that I will eat less meat in the next few months	0.97	1-strongly disagree to 6-strongly agree	Delley et al. (2024); Prochaska et al. (2008)
Intention to increase vegetable consumption	I am likely to eat more vegetables in the coming months	0.96	1-strongly disagree to 6-strongly agree	Giacomuzzo et al. (2024)

Note: Introductory statements.

<sup>a</sup> 'Indicate the extent of your concern about the following ... '.<sup>b</sup> 'How important is it to you that the food you eat on a typical day ... '.

### 3.3. Data analyses

Specifying four factors and using the principal component extraction method and varimax rotation (Field, 2013), we conducted an exploratory factor analysis on the nine items referring to stages of behavioural change (TTM items as displayed in Table 2) to explore the items' structure. The four factors explained 85.9 % of the variance. The Kaiser-Meyer-Olkin measure, Bartlett's test, anti-image correlation and communalities followed the recommended values (Field, 2013). Table 4 shows the factor loadings after rotation.

The pre-contemplation construct showed a somewhat lower Cronbach's  $\alpha$ , but we retained it following Jolliffe's recommendation (Field, 2013) because its eigenvalue was higher than 0.7 and its measuring items had acceptable factor loadings.

Next, the mean scores of the four constructs obtained (four TTM stages) were used as segmentation variables. The correlation test showed values below 0.8, which is satisfactory (Field, 2013). First, we

conducted hierarchical cluster analysis using the nearest neighbour method and identified and removed two outliers. Second, we employed hierarchical cluster analysis using Ward's method (Euclidean distance) (Sarstedt and Mooi, 2019; Lucas et al., 2022) to identify the number of segments in the sample of 569 consumers.

After observation of the agglomeration schedule and dendrogram, three- and four-cluster solutions were considered as possible solutions. The variance ratio criterion and cluster distribution justified the retention of four distinct clusters as the final solution. After, to evaluate significant differences among the segments, analysis of variance, contrast tests and chi-square were applied (Lucas and Brunner, 2024a). All analyses were performed using IBM SPSS Statistics (v. 29).

**Table 4**

Exploratory factor analysis results for the TTM questions and descriptive statistics for the sample (N = 571).

Factors and corresponding items	<sup>a</sup> Mean (SD)	Factor loadings	Eigenvalues	% of variance explained
<b>Pre-contemplation</b> ( $\alpha = 0.57$ )				
I don't have to reduce my meat consumption unless I am explicitly asked to do so.	1.98 (1.32)	0.92	0.72	8.01
I don't have to eat less meat when there is no problem with my current consumption.	3.26 (1.63)	0.66		
<b>Contemplation</b> ( $\alpha = 0.77$ )				
I may reduce my meat intake in the next few months, but I'm not ready for that change yet.	2.45 (1.24)	0.94	1.20	13.31
I am considering reducing my meat consumption, but I need more time to evaluate my options.	2.70 (1.29)	0.73		
<b>Preparation</b> ( $\alpha = 0.93$ )				
I will soon reduce my meat intake given the benefits associated with it.	3.04 (1.44)	0.90	3.93	43.63
I want to reduce my meat consumption and plan to do so soon.	2.97 (1.42)	0.88		
The information I have reinforces my intention to reduce my meat consumption.	3.38 (1.58)	0.84		
<b>Action</b> ( $\alpha = 0.96$ )				
I have reduced my meat consumption and am happy with it.	3.86 (1.66)	0.95	1.89	20.94
I have reduced my meat consumption and feel able to maintain it at this level.	3.98 (1.68)	0.95		

Note.

<sup>a</sup> Results on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree).

## 4. Results

### 4.1. Cluster analysis

The four-cluster solution revealed segments of consumers in different stages of change towards meat reduction (Fig. 1, Table 5). The segments were labelled (1) Not willing, (2) Aware but not ready, (3) Aware and involved and (4) Committed and acting. In general, the results highlight that a great share of the Swiss sample had already taken action to reduce meat consumption.

#### 4.1.1. Cluster 1 (21 %): not willing

Consumers who were 'Not willing' constitute the second smallest segment ( $n = 120$ ) and scored higher in the pre-contemplation stage of TTM ( $p < .001$ ) than the other segments (Fig. 1, Table 5), meaning they do not intend to reduce their meat consumption as much as the other segments. This segment does not see their current meat consumption as a problem as indicated by the highest score on the item 'I don't have to eat less meat when there is no problem with my current consumption' ( $M = 4.14$ ,  $SD = 1.61$ ). This was confirmed by the lowest scores in the intention to reduce meat consumption ( $p < .001$ ) and the lowest intention to increase vegetable consumption ( $p < .001$ ) (Table 6).

This segment of consumers does not perceive health risks related to meat overconsumption as indicated by the significantly lowest scores ( $p < .001$ ) on the scales of perceived health risks of overconsuming meat, perceived vulnerability of overconsuming meat and perceived avoidable

health risks through less meat consumption (response efficacy of eating less meat). Unsurprisingly, these consumers also scored lowest ( $p < .001$ ) in terms of self-efficacy for meat reduction. Consumers who are 'Not willing' yielded the highest scores ( $p < .001$ ) for the response cost of eating less meat.

Consumers in this group also show the strongest meat attachment ( $p < .001$ ) and believe that meat provides irreplaceable sensory pleasure in addition to being a centrepiece of important meals with family and friends (Table 6). They also report the lowest ( $p < .01$ ) meat safety concerns across the segments. This means that, unlike other groups, they are not concerned about meat contamination (e.g. by antibiotic residues, bacteria or preservatives).

On the 6-point Likert scale, consumers in this segment also show an interest in seasonal and local food as well as in animal welfare and environmental protection. However, their interest in these issues is not as high as that of the other segments (Table 6). The majority of 'Not willing' consumers are males ( $p < .01$ ) and Swiss residents without university degrees ( $p < .001$ ).

#### 4.1.2. Cluster 2 (14 %): Aware but not ready

'Aware but not ready' is the smallest group ( $n = 82$ ). This cluster scores highest among all the segments ( $p < .001$ ) in the measures of the contemplation stage. The average score for contemplation was also the highest among the TTM items reported by this group (Fig. 1, Table 5). This means that these consumers may reduce their meat consumption in the future but are not currently ready for this change as confirmed by the

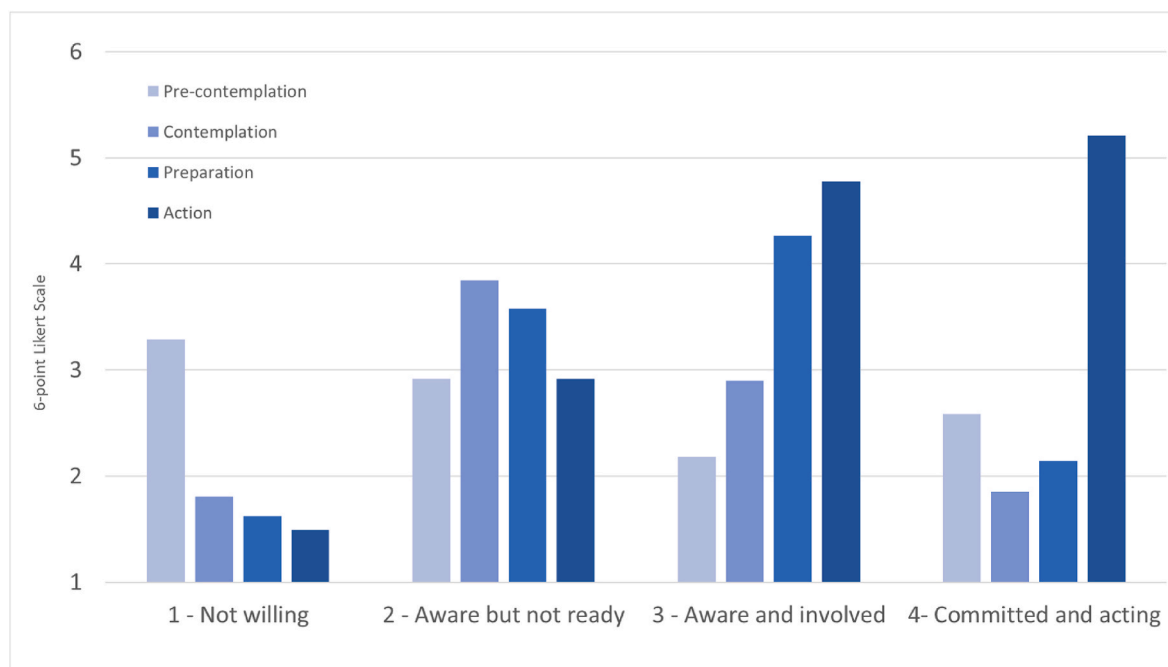


Fig. 1. Segments of consumers in the selected four-cluster solution.

Table 5

Mean  $\pm$  standard deviation obtained for the four clustering variables (items from TTM stages) and results from contrast tests by segment.

Clustering variables (TTM items)	Segments				
	Not willing (n = 120, 21 %)	Aware but not ready (n = 82, 14 %)	Aware and involved (n = 237; 42 %)	Committed and acting (n = 130; 23 %)	Overall mean (N = 569)
Pre-contemplation	3.28 $\pm$ 1.33	2.91 $\pm$ 1.04 <sup>ns</sup>	2.18 $\pm$ 1.11	2.58 $\pm$ 1.15 <sup>ns</sup>	2.61 $\pm$ 1.23
Contemplation	1.80 $\pm$ 0.84	3.84 $\pm$ 0.66	2.90 $\pm$ 1.04	1.85 $\pm$ 0.61	2.56 $\pm$ 1.13
Preparation	1.63 $\pm$ 0.66	3.57 $\pm$ 0.86	4.26 $\pm$ 0.91	2.14 $\pm$ 0.73	3.12 $\pm$ 1.39
Action	1.49 $\pm$ 0.67	2.91 $\pm$ 0.78	4.78 $\pm$ 0.83	5.21 $\pm$ 0.72	3.92 $\pm$ 1.63

Legend: <sup>ns</sup>: non-significant ( $p > .05$ ). For all other results,  $p < .001$ . Results on a 6-point Likert scale.

**Table 6**

Results of the variables for describing the resulting clusters and the contrast tests by segment.

Describing variables	Segments				
	Not willing	Aware but not ready	Aware and involved	Committed and acting	Overall mean
Perceived health risk of overconsuming meat	<b>3.09***</b>	3.68	<b>4.02***</b>	3.62	3.68
Perceived vulnerability of overconsuming meat	<b>1.81***</b>	<b>2.43***</b>	2.32**	1.83***	2.12
Response efficacy of eating less meat	<b>3.13***</b>	3.82	<b>4.22***</b>	3.82	3.84
Response cost of eating less meat	<b>2.71***</b>	2.39	<b>1.97***</b>	2.06**	2.21
Meat safety concern	<b>3.51**</b>	3.80	<b>4.20***</b>	3.79	3.90
Animal welfare	<b>4.69**</b>	4.80	<b>5.12**</b>	5.00	4.96
Environmental protection	<b>4.63***</b>	4.82	<b>5.24***</b>	5.15**	5.03
Local and seasonal	<b>4.58**</b>	4.71	<b>5.03***</b>	4.99**	4.88
Meat attachment	<b>4.30***</b>	4.04***	3.15***	<b>3.14***</b>	3.52
Self-efficacy of meat reduction	<b>4.24***</b>	4.60**	<b>5.23***</b>	5.21***	4.93
Hindering familial influence	1.90	<b>2.24*</b>	2.19**	<b>1.76***</b>	2.04
Intention to reduce meat consumption	<b>1.71***</b>	<b>3.54***</b>	<b>4.08***</b>	<b>2.45***</b>	3.13
Intention to increase vegetable consumption	<b>2.49***</b>	<b>3.66***</b>	<b>3.83***</b>	3.06**	3.35
Education <sup>a</sup> (% with University degree)	<b>29***</b>	43	<b>51**</b>	43	43
Sex <sup>b</sup> (% of males)	<b>58**</b>	52	<b>37**</b>	42	45
Average age (in years)	52	54	52	53	53
Employment status (% working)	64	60	63	67	64

Note: Scales evaluated on a 6-point Likert scale; N = 569 for the total sample except for education (N = 567 due to two missing cases), sex (N = 565 due to four missing cases) and employment status (N = 566 due to three missing cases).

An asterisk (\*) in the same line indicates significant differences among the segments, where \*\*\*p < .001, \*\*p < .01 and \*p < .05. Values in **bold**: highest score; values in *italic*: lowest score.

only slightly positive average score for the intention to reduce meat consumption and by the second-highest mean for the intention to increase vegetable consumption ( $p < .001$ ).

Unsurprisingly, the cluster that is 'Aware but not ready' yielded the second-highest score for meat attachment ( $p < .001$ ) and the second-lowest score for self-efficacy of meat reduction ( $p < .01$ ). The mean score for hindering family influence was the highest, suggesting that for these consumers, the food choices of their family members have a greater influence on their food consumption than is the case in the other segments ( $p < .05$ ), and this may prevent them from reducing meat. The cluster was 52 % male, and 43 % had a university degree.

#### 4.1.3. Cluster 3 (42 %): Aware and involved

'Aware and involved' consumers constituted the largest segment ( $n = 237$ ) and scored highest on the preparation stage of the TTM among all segments ( $p < .001$ ). This group also scored high on the action stage (Fig. 1, Table 5), meaning that they are planning to reduce their meat consumption and take action soon; in some situations, they had already taken steps to accomplish that.

This segment has the highest scores for self-efficacy of eating less meat ( $p < .001$ ), meaning their perceived ability to find alternatives to replace meat is greater than in the other segments. The replacement of meat may not be a problem for these consumers, as they have the second-lowest scores for meat attachment across the segments ( $p < .001$ ). They indicate the strongest belief in the response efficacy of eating less meat ( $p < .001$ ) (e.g. by reducing meat, they avoid high levels of cholesterol) and have the highest scores for the perceived health risks of overconsuming meat ( $p < .001$ ).

Their highest scores ( $p < .001$ ) for the intention to reduce meat consumption and the intention to increase vegetable consumption also come as no surprise. This group of consumers show the highest interest among all segments in animal welfare ( $p < .01$ ) and the environmental aspects of food production ( $p < .001$ ) as well as in local and seasonal foods ( $p < .001$ ). They also exhibited the highest meat safety concerns ( $p < .001$ ) across the segments. The group has the highest share ( $p < .01$ ) of females (63 %) and of consumers with a university degree (51 %).

#### 4.1.4. Cluster 4 (23 %): committed and Acting

'Committed and acting' consumers ( $n = 130$ ) scored highest for the action stage of TTM among all segments. These consumers are meat reducers and have the weakest meat attachment ( $p < .001$ ) of all segments. Not surprisingly, their intention to reduce meat consumption and

increase vegetable consumption in the future is not high, because they probably have already done that. Moreover, their high score on self-efficacy of meat reduction ( $>5.0$  on a 6-point Likert scale) and second-lowest score on response cost of eating less meat does not come as a surprise.

Among these consumers, the food choices of other members of their households did not prevent them from adopting new eating habits. The lowest average score across the segments ( $p < .001$ ) on the scale 'Hindering familial influence' may indicate that their families do not oppose their decision to reduce meat. They are highly interested in foods produced locally and care about environmental aspects of food production, with the second-highest scores in these scales across the segments ( $p < .01$ ). This segment is predominantly female (58 %), with 43 % of the sample having a university degree.

## 5. Discussion

Swiss consumers' attitudes and behaviours towards meat consumption appear to have changed significantly over the past two decades. In Tobler et al.'s (2011) study from Switzerland, most surveyed consumers were found to be in the pre-contemplation or action stage in the adoption of more ecological practices, including meat reduction. The present study, which was conducted more than 10 years later, found that the greatest share of Swiss respondents were in the preparation or action stage. While earlier studies reported that consumers showed lower awareness of excess meat consumption and production's negative effects on the environment (Hartmann and Siegrist, 2017; Tobler et al., 2011), a recent study by Lucas et al. (2024b) demonstrates that consumers in Switzerland are becoming more aware of meat's negative impact on sustainability. Given the differences in the findings between the present study and that of Tobler et al. (2011), we can observe that positive changes regarding sustainable dietary habits have occurred in Switzerland in the past two decades.

As behaviour can change over time and depends on the context and the cultural background of the evaluated sample (Wolstenholme et al., 2021), this study provides the latest insight into Swiss consumers' meat reduction behaviour, contributes to the literature and provides recommendations for policymakers. We found that two of the four identified segments, namely 'Aware but not ready' and 'Aware and involved', seem open to reducing their meat consumption. The segment 'Committed and acting' is at the action stage, already practising meat reduction, whereas the segment 'Not willing' seems more sceptical and reluctant regarding

lowering meat intake.

It is worth noting that the 'Aware and involved' and 'Committed and acting' segments both show greater confidence in reducing meat, giving animal welfare, environmental protection and local and seasonal food a higher priority. They also have a lower level of meat attachment than the 'Not willing' and 'Aware but not ready' segments. The former two segments express a higher level of engagement or a more advanced stage of change in meat reduction, whereas the latter two show a lower level of engagement or a lesser extent of change. All the above differences suggest the existence of two opposing and dynamic forces throughout the stages of change. First, high meat attachment may act as a force that pulls consumers back to lower stages of change regarding meat reduction. This argument is supported by Kemper et al. (2023), who show that meat eaters are more attached to meat than meat reducers and occasional meat eaters. Second, high awareness of animal welfare and environmental issues, together with a strong preference for local and seasonal foods, may have played a role as a driving force to move consumers towards more advanced stages of change. In this, our results align with those in the extant literature, which note a negative relationship between meat attachment and meat reduction (Kemper et al., 2023) and a positive relationship between positive attitudes towards animal welfare and the environment and meat reduction (Hartmann and Siegrist, 2017; Reuzé et al., 2023).

'Aware and involved', the largest segment, is characterised by the highest scores on the TTM's preparation stage and the strongest intention to reduce meat consumption and increase vegetable consumption. This segment seems to be in transition to the action stage, and for this reason, they may be considered the main target group of interventions to reduce meat consumption. The second important target group comprises consumers who are 'Aware but not ready'; however, they seem to be more attached to meat and not yet ready for the change. Both segments pay attention to the health aspects of meat consumption and therefore have the potential to reduce meat consumption if the provided information on excess meat consumption's health risks is improved.

Surprisingly, the mean of 'perceived vulnerability of overconsuming meat' was low across all segments. This implies that, regardless of the segment, the participants are not aware that they are at risk of developing severe diseases in the short term if they do not reduce meat consumption. However, we observe in comparing the segments that the 'Not willing' segment expressed the greatest denial. The 'Committed and acting' group appears to be unconcerned, probably because they have already reduced their meat consumption and thus perceive low health risks in the short term. Therefore, campaigns that emphasise the short-term as well as the long-term health consequences of excessive meat (especially processed meat) consumption may increase consumers' perceived vulnerability of overconsuming meat, inspiring a greater intention to reduce meat consumption and move along the TTM stages. Wolstenholme et al. (2021) and Hielkema and Lund (2021) also recommended the strategy of highlighting the negative health effects of meat overconsumption and the health benefits of meat reduction, and Hielkema and Lund (2021) also suggested strategies focused on meat reduction (not avoidance) and meat replacement in familiar meals as well as increasing the availability of meatless dishes.

Other strategies may also effectively reach even more consumers and help them to progress to the action stage. Recently, Strässner and Hartmann (2023) suggested communicating the benefits of plant-based and low-meat diets (e.g. flexitarianism, responsible meat consumption) to promote behavioural change towards meat reduction. The authors further suggest that providing knowledge of how to prepare vegetarian dishes easily and quickly may also result in a change towards meat reduction. Providing tasty, affordable meat substitutes represents another alternative to attracting meat eaters' interest in meatless meals (Verain and Dagevos, 2022). Reuzé et al. (2023) highlighted that improving the attractiveness of plant-based foods can be promising when appealing to consumers who enjoy eating meat. Moreover, public campaigns promoting not only lower meat consumption but also the

consumption of animal-based products of higher quality (e.g. organic) offer a strategy that could benefit meat eaters. Other research supports the idea of providing interventions aiming to change consumers' attitudes towards meat consumption (Frank et al., 2022; Malek and Umberger, 2021). Interventions can be implemented by public or private entities aiming to change consumer behaviour towards meat reduction. These interventions may have different durations and can be implemented in different settings (e.g.: schools, digital, supermarkets). Providing education/information, fostering cooking skills, labelling at the point of purchase or food substitution, are examples of different interventions (Caso et al., 2023; De Cianni et al., 2024; Kachwaha et al., 2024; Kwasny et al., 2022). This variety of interventions opens a range of possibilities to support the achievement of lower meat consumption in Switzerland.

According to Bryant et al. (2022), educating people and encouraging them to reflect on animal farming and suffering can also raise their consciousness and result in progress through the TTM stages and may support some people in maintaining engagement in the later stages. Disclosing the downsides of factory farming can motivate consumers to reduce meat consumption (Verain et al., 2024). Recently, Verain and Dagevos (2022) revealed that Dutch meat abstainers have more ethical considerations towards animal welfare. In the present study, all four clusters scored positive for animal welfare (>4.6 on a 6-point Likert scale). The results are interesting and highlight that even the 'Not willing' segment places high importance on an animal-friendly food production method. Previous literature revealed that meat consumers in Switzerland prioritise meat and dairy products produced with high-quality standards, which ensures animal welfare (Ammann et al., 2024; Richter et al., 2024).

The present study also reveals socio-demographic differences, with females being more likely than males to be in the preparation and action stages. In a previous study conducted in Switzerland, women demonstrated more interest in reducing meat consumption and were more likely to be in the action stage (Tobler et al., 2011). Verain and Dagevos (2022) also verified that meat abstainers, avid meat eaters and committed meat reducers differ in their socio-demographic characteristics.

Despite its interesting findings, this study has limitations. It did not explore other stages cited in the original definition of the TTM, the maintenance and termination stages. We suggest that future research address these stages and make associations with other diet types, such as veganism and vegetarianism. The identification of consumers in the termination stage will enable us to account for consumers who have integrated this new behaviour into their identity.

## 6. Conclusions

The present study revealed four segments regarding their readiness to eat less meat: 'Not willing', 'Aware but not ready', 'Aware and involved' and 'Committed and acting'. The 'Not willing' segment is more sceptical regarding meat reduction, has the highest meat attachment and is composed mostly of males. The 'Committed and Acting' segment comprises meat eaters who claim to have already modified their lifestyle towards meat reduction.

Both the 'Aware but not ready' and 'Aware and involved' segments are deemed more promising for movement to the 'action' stage of TTM. These segments include consumers with stronger intentions to reduce meat consumption and increase vegetable consumption. The obtained results may be useful in moving meat consumers to the later stages of change and consequently to more sustainable diets.

The findings of this study have several important policy implications for promoting meat reduction among Swiss consumers. First, interventions should be tailored to specific consumer segments based on their stage in the meat reduction process. The 'Aware and involved' group, who showed high scores in the preparation stage and have strong intentions to reduce meat consumption, represents the most promising

target for policy efforts aimed at transitioning them to the action stage. Strategies for this segment could focus on providing information about the health risks of excess meat consumption as well as promoting the environmental and animal welfare benefits of reduced meat intake. The 'Aware but not ready' group, although more attached to meat, could benefit from similar interventions emphasising the health impacts of overconsumption and offering practical resources for incorporating plant-based or meat-reduced meals into their diets.

Public health campaigns that highlight the long-term health risks associated with excessive consumption of meat (especially processed meat) may be crucial in increasing awareness and motivating behavioural change. These campaigns should promote a balanced approach, focusing on meat reduction rather than complete avoidance and emphasising the availability of high-quality meat alternatives. Additionally, efforts to improve the attractiveness and accessibility of plant-based foods, along with the provision of simple, tasty vegetarian meal options, could further encourage meat reducers and increase engagement with sustainable dietary practices. Lastly, attention should be given to demographic differences, as females appear more likely to adopt meat-reduction behaviours, suggesting the need for gender-sensitive policies.

### CRedit authorship contribution statement

**Bárbara Franco Lucas:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Thanh Mai Ha:** Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Funding acquisition, Conceptualization. **Franziska Götzte:** Writing – review & editing, Visualization, Funding acquisition, Conceptualization. **Minh Hai Ngo:** Writing – review & editing, Visualization, Funding acquisition, Conceptualization. **Evelyn Markoni:** Writing – review & editing, Visualization, Funding acquisition, Conceptualization. **Thi Lam Bui:** Writing – review & editing, Funding acquisition, Conceptualization. **Anh Duc Nguyen:** Writing – review & editing, Funding acquisition, Conceptualization. **Nhu Thinh Le:** Writing – review & editing, Funding acquisition, Conceptualization. **Mathilde Delley:** Writing – review & editing, Funding acquisition, Conceptualization. **Bao Duong Pham:** Writing – review & editing, Resources, Project administration, Funding acquisition, Conceptualization. **Thomas A. Brunner:** Writing – review & editing, Visualization, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization.

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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

Data and questionnaire can be found at: <https://doi.org/10.34914/olos:sfgeip3ym5b35fl2a75igyivvi>.

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