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# The moderating role of food involvement: An application of the theory of planned behaviour model in reducing red meat consumption

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ABSTRACT

Reducing red meat intake is crucial for both planetary sustainability and human health. However, various psychosocial barriers impede this dietary shift, necessitating the application of psychological models such as the Theory of Planned behaviours (TPB) to predict individuals' inclination to reduce red meat consumption. Despite TPB's widespread use, there is a need for a more refined model addressing emotional variables. This study aims to assess TPB's effectiveness in understanding intentions and behaviours regarding red meat reduction, while investigating food involvement's role as a moderator between intention and behaviours. Data were collected through two questionnaires (n = 963, Time 1; n = 541, Time 2) filled out by a representative sample of the Italian population. Using descriptive statistics and structural equation models, findings reveal that attitudes and subjective norms explain 22.2 % of the variance in intentions to reduce red meat consumption. Additionally, perceived behavioural control and intention account for 39.7 % of the variance in self-reported meat consumption behaviours six months later. Moreover, high levels of food involvement hinder the translation of intention into behaviour, highlighting its moderating effect. These results emphasize the necessity of reshaping red meat reduction strategies and promoting alternative consumption choices, fostering habitual practices linked to positive emotions. It is crucial for reducing red meat consumption that this behaviour becomes a cultural symbol of change, identifying individuals as "new consumers" within a society adapting to environmental and health challenges. By integrating emotional factors into behavioural models, interventions can better address barriers and promote sustainable dietary habits.

## 1. Introduction

A significant renovation of existing food consumption habits stands as a crucial requirement to meet climate objectives (Mussardo, 2019) and to follow the recommendations outlined by the World Health Organization (WHO) and the World Cancer Research Fund (Clark & Lee, 2016). Diets in developed nations commonly exhibit elevated consumption of animal-based products (Arrigoni et al., 2023). Over the past 20 years, the availability of beef proteins in Europe has decreased (from 8 g/d in the 1990 s to 6 g/d in 2013), while the supply of pork meat has remained steady (11 g/d), and poultry protein availability has increased significantly from 2 g/d in the 1960 s to 9 g/d in 2013 (Bonnet et al., 2020; FAO, 2021). Meat is also a significant part of the Italian diet: although Italy's poultry protein supply is 17 % lower than the European average, the country provided 30 % more beef and 7 % more pork proteins than the average European country between 2014 and 2018 (FAO, 2021). According to a recent ISMEA report (ISMEA, 2023), spending on meat in Italy increased by 6.7 % overall in 2023 compared to the previous year. Poultry products continue to drive revenue growth. However, the increase in spending on other meats is also significant (+6.5 % for beef and +5.5 % for pork).

This increase in meat consumption negatively impacts environmental sustainability and people's health. Considering the environment, increased meat consumption had led farms to intensify livestock breeding contributing significantly to issues such as the water footprint (WF), water pollution, scarcity, and greenhouse gas emissions (Mekonnen & Hoekstra, 2012). Current estimates suggest that approximately one-fifth of total emissions stem from the agricultural sector, with livestock accounting for roughly 80 % (de Vries & de Boer, 2010; IPCC, 2014). Among various meat types, red one stands out as having the most

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substantial impact on emissions (de Vries & de Boer, 2010).

From a public health standpoint, lots of evidence underscores the link between excessive meat consumption—especially red and processed meat—and heightened risks of premature mortality, notably from conditions like heart disease, stroke, and type 2 diabetes (Zhong et al., 2020) along with specific types of cancers (Farvid et al., 2021; Grosso et al., 2022). Recently, the International Agency for Research on Cancer (IARC) classified red meat consumption as 'probably carcinogenic to humans' based on evidence related to colorectal cancer (Bouvard et al., 2015). A systematic review has also revealed an increased risk of obesity among individuals consuming high quantities of red meat (Rouhani et al., 2014). However, some recent studies have highlighted a weak relationship between unprocessed red meat consumption and cancer, diabetes, and heart disease (Lescinsky et al., 2022; Ruxton & Gordon, 2024), highlighting how processed meats are the most impactful on health. Nevertheless, numerous psycho-social barriers hinder dietary change, and particularly the reduction in meat consumption (Graves & Roelich, 2021; Weibel et al., 2019). Various studies highlighted how individuals who regularly consume red meat often link their intake to notions of health and necessity (Font-i-Furnols & Guerrero, 2022; Piazza et al., 2015). Other barriers, including self-perception, subjective norms, and perceived behavioural control, significantly influence the decision to reduce meat in daily diets (Borusiak et al., 2022; Carfora, Conner, Caso, & Catellani, 2020).

Moreover, emotional involvement in food, particularly meat, appears to be one of the primary barriers obstructing the reduction of meat consumption (Sahakian et al., 2020). A recent systematic review highlighted that the emotional involvement in meat is a critical factor influencing individual responses to interventions aimed at decreasing meat consumption. Consumers emotionally involved in meat exhibit strong positive commitment toward meat-eating and show a strong opposition to the idea of reducing their meat intake (Kwasny et al., 2022). Given these findings, it is imperative to delve into the role of psycho-social variables, particularly emotional involvement in food, in influencing intentions and behaviours related to meat reduction. If some studies have observed how the role of meat attachment can impact the intention to reduce meat consumption (Chen, 2024; Lentz et al., 2018; Wang & Scrimgeour, 2021), however, to the best of our knowledge, no studies have been conducted in Italy analysing the role of emotional involvement within a validated psycho-social model to understand the reduction of red meat consumption. Evaluating the emotional response generated by food, in fact, does not only mean mapping the hedonic response (the pleasure derived from consumption) but also broadening this emotional spectrum to include psychophysical responses related to stress management and mood regulation (Schouteten et al., 2018). The emotional balance factor, which is part of a broader scale called the Psychological Food Involvement Scale (Castellini, Bryant, et al., 2023), can measure a range of emotions related to food consumption, such as pleasure, relaxation, and psychophysical well-being that food can generate, going beyond mere hedonic response. People who score high on this factor are primarily involved in food because it allows them to manage their mood, stress, and psychophysical sensations. Past research on the Psychological Food Involvement Scale and the emotional balance factor has highlighted how the latter effectively explains and predicts food involvement, not only in relation to the intention to reduce meat consumption (Castellini, Savarese, et al., 2023) but also concerning the consumption of healthy products (Castellini, Bryant, et al., 2023). Consequently, incorporating this factor into an established model like the TPB could provide new insights and help understand how the emotional involvement in food can impact the intention to reduce meat consumption, going beyond mere hedonic response mainly measured using the meat attachment scale.

In this study, we aim to contribute to this debate by examining the integration of food involvement within the Theory of Planned Behaviour (TPB) (Ajzen, 1991), a theoretical framework primarily focused on rational-based explanations of intentions that are commonly used to explain pro-environmental and food choices (Scalco et al., 2017; Suleman et al., 2021). Thus, the present study aims to (I) understand how TPB's variables impact the intention and behaviours of reducing red meat consumption, and (II) explore the role of emotional involvement in food as a moderator between behavioural intention and actual behaviour.

## 2. Theoretical model and hypothesis development

### *2.1. The theory of planned behaviour model and the reduction of meat consumption*

The Theory of Planned Behaviour (TPB) was initially introduced by Ajzen in 1985, expanding the Theory of Reasoned Action (Ajzen, 1985) by encompassing both personal and social factors to predict behaviour. TPB suggests three distinct determinants—attitude towards the behaviour, subjective norm, and perceived behavioural control (PBC)—which contribute to the development of intention. This intention and PBC, in turn, influence actual behaviour. Attitude represents an individual's psychological inclination towards evaluating a behaviour positively or negatively (Ajzen, 2011). Subjective norm evaluates the societal pressures influencing an individual's decision to either engage or refrain from a particular behaviour, reflecting the motivation to comply with the opinions of significant others (Liou & Contento, 2001). Finally, PBC denotes an individual's perception of performing a specific behaviour (Yang et al., 2012). Considering that the TPB delineates explicit assumptions about the formation of intentions and behaviours, it has found application across diverse fields such as sustainable behaviours and dietary preferences (Li et al., 2019). Moreover, many studies provide substantial support for the TPB's efficacy in predicting environmentally-friendly behaviours (Maki & Rothman, 2017). A *meta*-analysis carried out by Han and Hansen (2012) on Sustainable food consumption showed that PBC, Attitude, and Subjective Norm explained, on average, 48 % of variance of Intention to consume sustainable food, while Intention in turn explained on average 28 % of variance of the Behaviour.

Furthermore, several scholars suggest that the TPB is an effective framework for forecasting meat consumption and the inclination to decrease it (Carfora et al., 2017; 2020; Çoker & van der Linden, 2022). Specifically, in some studies conducted in Italy, the TPB revealed that attitude, subjective norm, and perceived behavioural control played a significant role in determining the intention to reduce meat consumption and real behaviour (Carfora, Conner, Caso, & Catellani, 2020; Wolstenholme et al., 2021). Among these TPB constructs, attitude emerged as the strongest predictor of the intention to reduce consumption, as highlighted in the research conducted by Çoker and van der Linden (2022). Notably, the TPB demonstrated its utility by explaining approximately 57 % of the variance in intention and 31 % of the variance in self-reported reduction of meat consumption.

Despite the widespread use of the TPB, there remains a necessity for a more defined model grounded in quantitative analysis (Scalco et al., 2017). This call for additional studies utilizing the TPB has been reiterated by various scholars, advocating for further empirical and quantitative assessments of the moderating influences of diverse factors (Grimmer & Miles, 2017; Hassan et al., 2016). Particularly, numerous studies explored the gap between intention and behaviour, proposing that certain psychological factors might hamper the translation of intentions into actions (Hassan et al., 2016). Some studies focused on pro-environmental behaviours have demonstrated that certain psychological variables, especially emotional ones, moderate the relationship between intention and behaviour (Martini et al., 2024). Studies conducted on the consumption of organic products have indicated that individuals experiencing positive feelings, emotions, and high level of involvement in these foods are more inclined to purchase them compared to those displaying negative emotions or low involvement, even if they have the same level of intention. This highlights how these variables act as

moderators between intention and behaviour in the context of pro-environmental actions (Kashif et al., 2023; Sultan et al., 2020). A recent study (Castellini, Savarese, et al., 2023) has shown how Psychological Food Involvement, characterized as the deep connection between consumers and food, and particularly the factor called Emotional Balance, can predict the intention to reduce meat consumption. Specifically, people that have high level of Emotional Balance, namely individuals who are involved in food as they use it to achieve psycho-physical well-being, are less likely to reduce their meat consumption than those with low levels. These findings, align with earlier studies, argued that the positive emotions associated with consuming specific foods, such as meat, are significant barriers to dietary change and meat reduction even if consumers are intent on enacting such behaviours (Adamczyk et al., 2022; Cheah et al., 2020).

Given these studies, we hypothesize that (Fig. 1):

H1: An individual's attitude toward reducing red meat consumption is positively related to the intention to reduce the consumption of red meat.

H2: An individual's subjective norms are positively related to the intention to reduce the consumption of red meat.

H3: An individual's perceived behavioural control toward reducing red meat consumption is positively related to the intention to reduce the consumption of red meat.

H4: An individual's perceived behavioural control toward reducing red meat consumption is positively related to the behaviour of reducing red meat intake.

H5: An individual's intention to reduce red meat consumption is positively related to the behaviour of reducing red meat intake.

H6: The Emotional Balance moderates the relationship between intention to reduce red meat consumption and the behaviour.

## 3. Method

The study discussed herein is a segment of a larger project at mapping the intention to reduce meat consumption in Italy, focusing on the role played by psychological variables. The data for this study were collected during two different waves conducted six months apart. The first questionnaire was sent between 20th and 25th February 2023 while the second questionnaire was sent 10th and 15th September. Both surveys were conducted using a CAWI (Computer Assisted Web Interviewing). This study was implemented in full compliance with the Declaration of Helsinki and it has been approved by an independent ethics committee (CERPS). All participants were thoroughly briefed on the overarching objectives of the research and assured of their anonymity; each participant granted informed consent.

### 3.1. Participants and design

The initial survey was completed by a sample of 1007 individuals, selected to represent various demographics of the Italian populace including sex, age, occupation, urban center size, and geographic region through a stratified sampling method. Gender was classified in binary terms (male/female) based solely on visible physical characteristics. Participants were chosen randomly from the Norstat srl-managed consumer panel (https://norstat.it/). During this phase, respondents answered questions pertaining to the antecedents of the Theory of Planned Behavior (subjective norms, Perceived Behavioral Control, attitude, intention) and emotional balance. Individuals already adhering to meat-free diets (e.g., vegetarians) were excluded from the analysis, yielding 963 valid responses. Six months later, all 963 participants were invited to complete a follow-up questionnaire assessing the extent of their red meat consumption reduction over the preceding half-year. Of these, 541 individuals responded, resulting in a 44 % attrition rate. Data were not analysed for participants who did not complete the follow-up questionnaire.

### 3.2. Measures

In the first questionnaire information regarding the socio-demographic characteristics of the subjects were collected. Next, they were asked to indicate their intention to reduce red meat consumption, attitudes, subjective norms, and the perceived behavioural control related to the reduction of red meat. Moreover, psychological involvement in food was measured by delving into the emotional dimension of this construct namely the Emotional Balance factors. In the second wave of the study participants were asked to report their behaviour related to

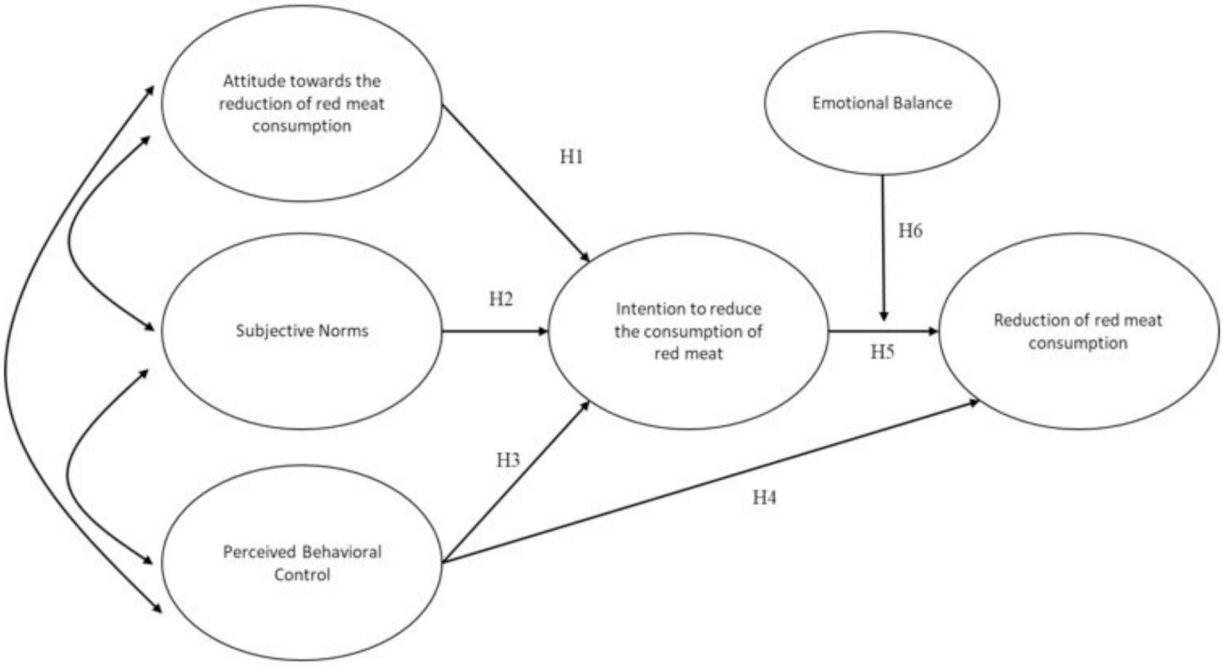


**Fig. 1.** The hypothesized model.

the reduction of red meat consumption. All the measures are explained in detail below. The questions related to TPB constructs were adapted from (Çoker & van der Linden, 2022) and the questionnaire used in this study can be found as Supplementary Material A.

*Intention to reduce red meat consumption:* Respondents were requested to evaluate their intention to decrease red meat consumption over the ensuing six months using a 7-point scale extending from "very unlikely" to "very likely." Additionally, an option "I do not consume these products" was included to accommodate participants already abstaining from meat consumption.

*Attitudes towards the reduction of red meat consumption:* Participants were asked to rate their attitudes towards the reduction of red meat consumption using semantic differential composed of 5 pairs of opposite adjectives (e.g., negative-positive; important-not important) on a 7-point likert scale.

*Perceived Behavioural Control:* Participants were asked to rate three statements related to their perceived self-efficacy on a 7- point scale ranging from "strongly disagree" to "strongly agree" to reduce red meat consumption. An example of item is "It's easy for me to reduce my red meat consumption".

*Subjective Norms*: Participants were asked to rate four statements of subjective normative pressure to reduce red meat consumption using a 7-point scale ranging from "strongly disagree" to "strongly agree". An example of item is "Some people who are important to me have reduced their consumption of red meat".

*Involvement in food:* The Psychological Food Involvement Scale (PFIS), as described by Castellini et al. (Castellini, Bryant, et al., 2023), was employed to assess individuals' engagement with food. Comprising 19 items, this scale gauges the significance individuals attribute to food, particularly focusing on the motivations underlying their psychological involvement, categorized into four domains: Emotional Balance, Social Affirmation, Self-Realization, and Social Bonding (Castellini, Bryant, et al., 2023). The scale's validation study demonstrated robust reliability (Castellini, Bryant, et al., 2023). For the purposes of this study, only the Emotional Balance factor was considered, encompassing a total of five questions. This factor evaluates the extent to which individuals utilize food to achieve psychological and physical well-being. Responses to all items were measured on a seven-point Likert-type scale, ranging from 1 = 'strongly disagree' to 7 = 'strongly agree'. An illustrative item from this factor is "Food allows me to relax".

*Behaviour related to the reduction of red meat consumption:* In the second wave, which took place six months after the initial survey, participants were asked to think about the past six months and declare the frequency with which they reduced their consumption of red meat. This was measured on a 7-point scale ranging from "not at all" to "very frequently/ I no longer consume red meat".

### 3.3. Data analysis

To achieve the main objectives of this study, the effectiveness of the original TPB model at predicting people's intention and behaviour to reduce the consumption of red meat was first examined. The Emotional Balance factor, related to Psychological Food Involvement Scale, were further combined with the TPB model as a moderator. Following (Anderson & Gerbing, 1988) two-step analysis, a confirmatory factor analysis (CFA) was first conducted to examine the dimensionality, reliability, and validity of the multiple item measures of the studied constructs before using a structural equation model (SEM) to examine the causal relationships between the predicting variables and the people's intention and behaviour of reducing red meat intake.

In the first step, aimed at testing the goodness of the measurement model, descriptive statistics were computed for each item (asymmetry, kurtosis, mean, median, and standard deviation), and a CFA were run using MPLUS 8 (Muthén & Muthén: Los Angeles, CA, USA). The models were estimated using maximum likelihood estimation and evaluated adopting different goodness-of-fit indices. These included: chi-squared to degrees of freedom ratio (a ratio smaller than 5 was considered a reasonably good indicator of model fit (Kline, 2011); Root Mean Square Error of Approximation (RMSEA) $< 0.08$; Confirmatory Fit Index (CFI) $\geq 0.90$; and Tucker-Lewis Index (TLI) $\geq 0.90$. Moreover, the values of factor loadings, average variance extracted (AVE), and composite reliability (CR) were considered. Factor loadings $< 0.40$ are weak and factor loadings $> 0.60$ can be considered strong (Hooper et al., 2008) and the acceptable threshold value for composite reliability (CR) is above 0.70, while that for average variance extracted (AVE) is above 0.50. Finally, to test the discriminant validity among the constructs the Maximum shared variance (MSV) for each construct was compared with the AVE (Hair et al., 2010).

In the second step, aimed at testing the goodness of TPB's structural model, a SEM was carried out using Maximum likelihood with robust standard errors (MLR) on MPLUS 8 software (Muthén & Muthén: Los Angeles, CA, USA). The goodness of fit of the model was assessed using the following indices: chi-squared to degrees of freedom ratio (a ratio smaller than 5 was considered a reasonably good indicator of model fit (Kline, 2016); Root Mean Square Error of Approximation (RMSEA) $<$ 0.08; Confirmatory Fit Index (CFI) $\geq 0.90$; and Tucker-Lewis Index (TLI) $\geq 0.90$.

To test the moderation effect, the total sample was divided in two sub-sample. One group was composed by people with low emotional balance (n = 195) and the other one by people with high emotional balance (n = 346). Given that the response scale used to measure the level of emotional balance consists of 7 points (1 = completely disagree, 7 = completely agree), we created two groups of subjects. In the first group (subjects with low emotional balance, n = 195), all subjects who scored an average scale score $< 5$ were grouped, indicating levels of disagreement or neutrality towards the items. In the second group (subjects with high emotional balance, n = 346), subjects who scored an average scale score $\geq 5$ were grouped, indicating levels of agreement with the proposed items. Measurement invariance was tested using a confirmatory factor analysis (CFA) to ensure that the variables reflected the same latent factors in both groups (i.e., people with low and high emotional balance). This step implies checking for configural invariance (when the same factor structures are identified across all groups) and metric invariance (when all-factor loading parameters are equal across groups). Then, this two models were compared using $\Delta\chi 2$ p-value (i.e. if $\Delta\ \chi 2$ p-value $> 0.01$ means that the differences between models do not exist) and $\Delta$CFI (i.e., if $\Delta$CFI $< 0.01$ or less: differences between models do not exist) (Cheung & Rensvold, 2002). Last, the model structural invariance was also tested across the two groups (i.e., people with low and high emotional balance). A multi-group analysis was performed to compare the unconstrained and constrained models: in the former model, all parameters were considered free, and in the latter model, the beta coefficient between intention and behaviour was constrained in the two groups (i.e., people with low and high emotional balance). Fit indices of the nested model were compared with the former. The constrained model is considered acceptable when the difference between chi-squares is not significant. Given that the Maximum likelihood with robust standard errors (MLR) was applied, the chi-square difference testing using Satorra-Bentler Scaled Chi Square was carried out.

## 4. Results

### 4.1. Characteristics of the sample

The analyzed sample comprises 541 individuals, with 286 (25.9 %) identifying as male, ranging in age from 18 to 70 years (M = 47.91, SD = 13.24). A comprehensive demographic breakdown is provided in Table 1.

**Table 1**
Demographic profiles of the sample (n = 541).

| | n | % |
|---|---|---|
| **1. Sex** | | |
| Male | 286 | 52.9 |
| Female | 255 | 47.1 |
| **2. Age** | | |
| 18–24 | 25 | 4.6 |
| 25–34 | 79 | 14.6 |
| 35–44 | 115 | 21.3 |
| 45–54 | 131 | 24.2 |
| 55–59 | 52 | 9.6 |
| 60–70 | 139 | 25.7 |
| **3. Education** | | |
| Elementary-Junior high | 70 | 12.9 |
| Senior high | 298 | 55.1 |
| College or university | 173 | 32.0 |
| **4. Geographic area** | | |
| North-West | 144 | 26.6 |
| North-East | 105 | 19.4 |
| Centre | 103 | 19.0 |
| South and Islands | 189 | 34.9 |
| **5. Inhabited centre size** | | |
| Until 10,000 inhabitants | 180 | 33.3 |
| 10/100.000 inhabitants | 243 | 44.9 |
| 100/500.000 inhabitants | 51 | 9.4 |
| More than 500.000 | 64 | 11.8 |
| I do not know | 3 | 0.6 |
| **6. Profession** | | |
| Entrepreneur / freelancer | 68 | 12.6 |
| Manager / middle manager | 11 | 2.0 |
| Employee / teacher / military | 182 | 33.6 |
| Worker / shop assistant / apprentice | 79 | 14.6 |
| Housewife | 59 | 10.9 |
| Student | 29 | 5.4 |
| Retired | 63 | 11.6 |
| Unoccupied | 50 | 9.2 |
| **7. Household net monthly income level** | | |
| Up to 600 € | 16 | 3.0 |
| 601–900 € | 16 | 3.0 |
| 901–1200 € | 53 | 9.8 |
| 1201–1500 € | 59 | 10.9 |
| 1501–1800 € | 54 | 10.0 |
| 1801–2500 € | 180 | 33.3 |
| 2501–3500 € | 98 | 18.1 |
| More than 3501 € | 65 | 12.0 |

### *4.2. Socio-demographic differences related to behaviour and intention to reduce red meat consumption*

Considering the main differences related to the intention to reduce red meat consumption and actual meat intake reduction for the main socio-demographic variables (i.e., age, sex, educational level, and geographic area) the results show that there are no significant differences between these groups (Table 2).

### *4.3. Confirmatory factor analysis and scale validation*

Means, standard deviations, asymmetry, and kurtosis of all the scales and items were performed, showing that all distribution appears normal even if the Kurtosis of intention is slightly above the reference cut-offs (See Supplementary Material B). Table 3 shows the correlation matrix among the variables included in the model. Moreover, a confirmatory factor analysis was applied to test the goodness of measurement model

**Table 2**
Socio demographic differences related to behaviour and intention to reduce red meat consumption (n = 541).

| Socio-demographic variables | Intention to reduce red meat consumption (Likert scale 1–7) | | | Red meat reduction behaviour (Likert scale 1–7) | | |
|---|---|---|---|---|---|---|
| | Mean (SD) | T/F (df) | p-value | Mean (SD) | T/F(df) | p-value |
| **Sex** | | 0.95 (539) | 0.342 | | −0.96 (539) | 0.335 |
| Male (n = 286) | 3.29 (1.49) | | | 3.26 (1.58) | | |
| Female (n = 255) | 3.16 (1.58) | | | 3.40 (1.64) | | |
| **Age** | | 0.48 (2) | 0.617 | | 0.79(2) | 0.451 |
| 18–35 (n = 116) | 3.26 (1.57) | | | 3.44 (1.64) | | |
| 36–56 (n = 255) | 3.16 (1.53) | | | 3.24 (1.62) | | |
| >56 (n = 170) | 3.31 (1.52) | | | 3.38 (1.56) | | |
| **Educational level** | | 0.45 (2) | 0.635 | | 1.09(2) | 0.336 |
| Elementary-Junior high (n = 70) | 3.27 (1.61) | | | 3.49 (1.54) | | |
| Senior high (n = 298) | 3.17 (1.57) | | | 3.23 (1.68) | | |
| College or university (n = 173) | 3.31 (1.44) | | | 3.42 (1.49) | | |
| **Geographical area** | | 0.20 (3) | 0.893 | | 1.06(3) | 0.364 |
| North-West (n = 144) | 3.16 (1.55) | | | 3.15 (1.58) | | |
| North-East (n = 105) | 3.21 (1.47) | | | 3.48 (1.68) | | |
| Centre (n = 103) | 3.31 (1.50) | | | 3.45 (1.65) | | |
| South and Islands (n = 189) | 3.24 (1.58) | | | 3.31 (1.55) | | |

Note: SD = standard deviation, df = degree of freedom.

**Table 3**
Correlation matrix of employed measures in the model (n = 541).

| Variable | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Attitude | 1 | | | | |
| PBC | 0.542*** | 1 | | | |
| Subjective norms | 0.630*** | 0.532*** | 1 | | |
| Intention | 0.408*** | 0.317*** | 0.428*** | 1 | |
| Behaviour | 0.547*** | 0.409*** | 0.469*** | 0.400*** | 1 |

Note: *** indicate $p < 0.001$.

related to TPB, using maximum likelihood estimation and MPLUS 8 software. Table 4 shows that all the goodness-of-fit criteria for CFA analysis are satisfactory. Moreover, Factor loadings, Cronbach's alpha, composite reliability, and average variance extracted were reported to assess the reliability of multi-items variables, suggesting a strong internal consistency of scales. Finally, maximum shared variance (MSV) for each construct was also lower than AVE, suggesting discriminant validity (Hair et al., 2010).

### *4.4. The structural model*

Finally, the structural equation model related to TPB was run in MPLUS 8 on the total sample (n = 541) to ensure that it adequately fit

**Table 4**
The fit indices of TPB measurement model and Reliability of employed measures (n = 541).

| | TPB MEASURAMENT MODEL $X^2$ 166.363; df = 51; $X^2$ /df = 3.26; CFI = 0.97; TLI = 0.96; RMSEA = 0.06 (LO90 = 0.05, HI90 = 0.07) | | | | | |
|---|---|---|---|---|---|---|
| **Construct** | **Stand. Factor loading** | **P** | **α** | **CR** | **AVE** | **MSV** |
| **Attitude** | | | **0.884** | **0.89** | **0.61** | **0.39** |
| Item 1 | 0.862 | *** | | | | |
| Item 2 | 0.702 | *** | | | | |
| Item 3 | 0.824 | *** | | | | |
| Item 4 | 0.809 | *** | | | | |
| Item 5 | 0.688 | *** | | | | |
| **Subjective norms** | | | **0.916** | **0.92** | **0.74** | **0.39** |
| Item 1 | 0.842 | *** | | | | |
| Item 2 | 0.789 | *** | | | | |
| Item 3 | 0.888 | *** | | | | |
| Item 4 | 0.906 | *** | | | | |
| **Perceived behavioral control** | | | **0.700** | **0.70** | **0.50** | **0.29** |
| Item 1 | 0.713 | *** | | | | |
| Item 2 | 0.571 | *** | | | | |
| Item 3 | 0.692 | *** | | | | |

Note. *** p < 0.001; M = mean; SD = Standard Deviation; A = Asymmetry; K = Kurtosis CR = composite reliability; AVE = average variance extracted; MSV = Maximum shared variance.

the data using Maximum likelihood with robust standard errors (MLR) on MPLUS 8 software. The model provided a very good fit to the data: $X^2$ = 158.645; df = 71; $X^2$/df = 2.23; CFI = 0.97; TLI = 0.96; RMSEA = 0.04 (LO90 = 0.03, HI90 = 0.05) and the results indicated that this model can explain a 22.2 % variance in the intention of an individual to reduce the consumption of red meat and the 39.7 % the behaviour namely the reduction of red meat intake. The standardized path coefficients of the attitude of an individual toward the reduction of red meat consumption (β = 0.213; p < 0.05) and subjective norms (β = 0.237; p < 0.01) were statistically significant for their intention to reduce red meat consumption, except for Perceived behavioural control (β = 0.082; p = ns) (Fig. 2). Moreover, the intention to reduce meat consumption (β = 0.178; p < 0.01) and the perceived behavioural control (β = 0.537; p < 0.001) significantly impacts red meat reduction behaviour (Fig. 2). Thus, H1, H2, H4 and H5 are supported while H3 is not supported.

### 4.5. The moderating effect of emotional balance

To examine the moderating influence of Emotional Balance, measurement invariance tests were conducted on two distinct groups (individuals with low emotional balance, n = 195; individuals with high emotional balance, n = 346) utilizing maximum likelihood estimation in MPLUS 8 software. The findings of the measurement invariance test for both groups are presented in Table 5. The fit indices for the configural and metric invariance models suggest satisfactory model fit. Furthermore, the non-significant $X^2$ difference between the models ($\Delta X^2$ (9) = 4.094, p = 0.90) and the negligible difference in CFI values between the models (ΔCFI = 0.001), meeting the criteria proposed by Cheung and Rensvold (2002) (ΔCFI < 0.01), indicate minimal impact of group variations on the measurement structure, rendering it negligible. Consequently, the analytical outcomes affirm support for metric invariance, thereby facilitating multigroup analysis.

Finally, we tested the moderating effect of Emotional balance between intention to reduce red meat consumption and the reduction of red meat intake creating two nested models: unconstrained model and constrained model that were compared. Maximum likelihood with robust standard errors (MLR) were applied using MPLUS 8 software. The results show that there is a moderating effect caused by the different level of emotional balance (Satorra-Bentler Scaled Chi Square = 6.19; p < 0.05). In particular, the results show that the path coefficient between the intention to reduce red meat consumption and the reduction of red meat intake in people with low emotional balance is 0.308 (p < 0.001) while it is 0.094 (p = 0.210) in the group of people with high emotional balance. Therefore, H6 is supported. The slope for the association between intention to reduce red meat consumption and the real behaviour is moderated by emotional balance and the association became stronger when it is low (Fig. 3).

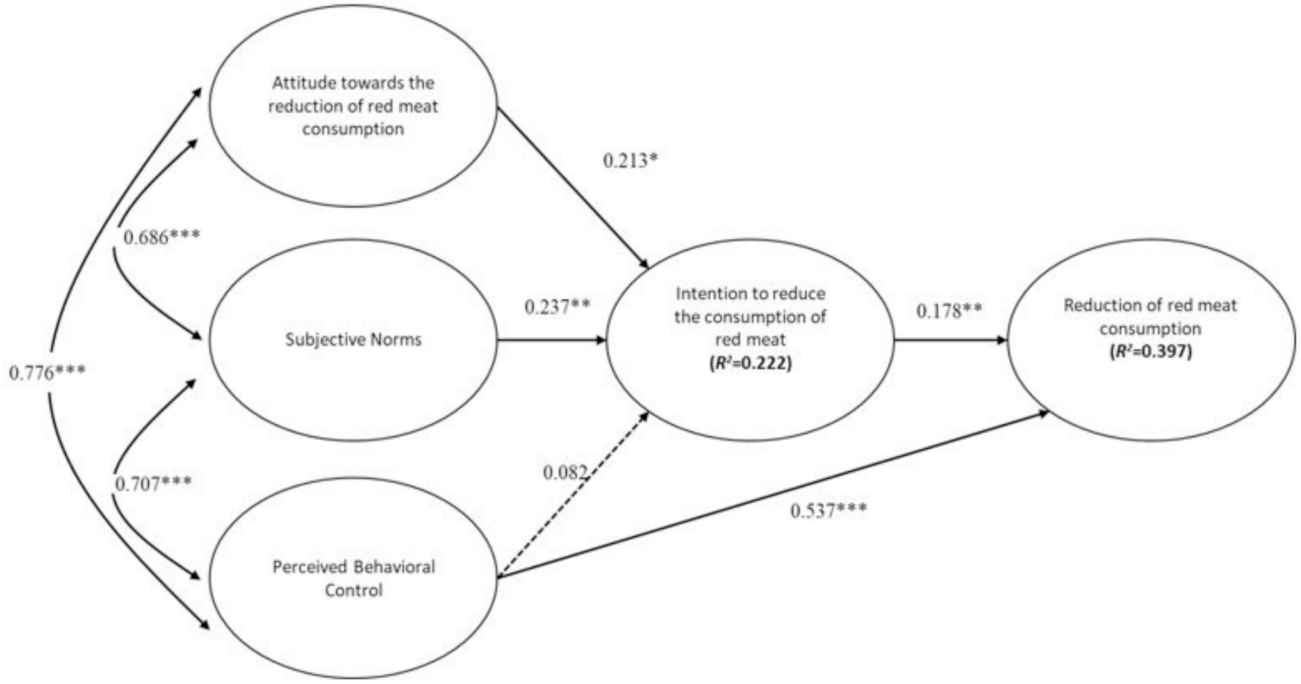


**Fig. 2.** TPB model p-value < 0.001***, p-value < 0.01**, p-value < 0.05*; - –>not significant.

**Table 5**
The results of measurement invariance test.

| Model | $X^2$ | df | $\Delta\chi^2_{(\Delta df)}$ | $\Delta df$ | CFI | TLI | RMSEA | ΔCFI |
|---|---|---|---|---|---|---|---|---|
| Low emotional balance group (n = 195) | 119.046 | 51 | – | – | 0.926 | 0.905 | 0.082 | – |
| High emotional balance group (n = 346) | 144.696 | 51 | – | – | 0.941 | 0.955 | 0.073 | – |
| Configural Invariance | 263.742 | 102 | – | – | 0.958 | 0.946 | 0.077 | – |
| Metric Invariance | 267.836 | 111 | **4.094** $^{ns}$ | 9 | 0.959 | 0.952 | 0.072 | 0.001 |

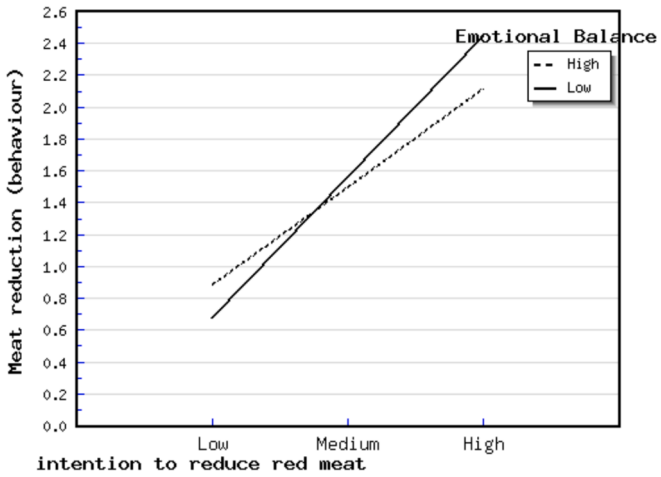


**Fig. 3.** The interactive effect of intention and emotional balance on meat reduction behaviour.

## 5. Discussion

The present study aimed to understand and explain the reduction of red meat consumption by applying the TPB, demonstrating how the relationship between intention and behaviour could be moderated by the emotional balance towards food experienced by people.

Considering the relationships between the intention and behaviour concerning the reduction of red meat consumption and the main socio-demographic variables (sex, age, education level, and geographical area of origin), the results showed that there are no significant differences among these groups. These data have been recently confirmed by the study conducted in Italy by Castellini et al. (2023b), which justified the absence of relationships among these variables by highlighting how pro-environmental consumption is no longer linked to socio-demographic differences but is determined by a cultural and moral change encompassing the entirety of the population (Chekima et al., 2016; Kwasny et al., 2022). Specifically, the research conducted by De Backer et al. (2020) contended that sex disparities are insignificant in comprehending the intent to decrease meat consumption. Instead, they posit that cultural distinctions and varying perceptions of masculinity significantly influence this intention. Furthermore, other studies argued that socio-demographic variables do not directly impact meat consumption but they are mediated by individuals' attitudes toward meat consumption and the environment, as well as their interest in own health, emphasizing the importance of personal beliefs over biological ones in explaining such consumption behaviours (Mata et al., 2023). However, even though the differences in the intention to reduce meat consumption and the related behaviour do not seem to vary by gender, a recent study has highlighted that there is a difference between males and females in the perception of the variables that influence the intention to reduce meat consumption (Fantechi et al., 2024). The findings highlighted that for men, the intention to reduce red meat consumption is negatively associated with cooking skills but positively associated with awareness of the impacts of meat consumption and the experience of time constraints. Conversely, for women, the intention to decrease red meat consumption rises with the increased availability of meat substitutes and decreased purchasing power. These results highlight that, although there does not appear to be a gender difference in the intention to reduce meat consumption, socio-demographic variables, particularly gender, can be useful in identifying the drivers that influence this intention. Additionally, the results showed that the TPB is a good model for explaining the intention and behaviour related to reducing red meat, confirming past studies that tested this theory on various pro-environmental and pro-health consumption behaviours (Gansser & Reich, 2023). Moreover, the data showed that attitudes, subjective norms, and PBC explain approximately 22 % of the variance regarding the intention to reduce red meat consumption, which is consistent with the average reported in previous *meta*-analyses (Randall et al., 2024). In particular, the attitude and subjective norms positively impact the intention to reduce red meat consumption, confirming H1 and H2. Furthermore, subjective norms are the variable that most significantly impacts the intention to reduce meat consumption. This strong relationship can be explained by some previous studies on social influence (Higgs, 2015), which have highlighted that individuals are more influenced by the opinions and behaviours of others when they are uncertain about the consequences of dietary choices and when these norms are well-established and clear within the reference group. Following these norms allows individuals to feel a sense of belonging and acceptance within the group, confirming that they are acting correctly. This scenario seems to characterize the behaviour of reducing meat consumption. In fact, past studies showed that people are unsure of how much reducing meat consumption can positively impact the environment and their health (Austgulen et al., 2018; Habib et al., 2021), associating uncertainties about the effects of this behaviour. Furthermore, it is demonstrated that the reduction of meat consumption is a behaviour that individuals use to gain acceptance from others, to present themselves in the best light, and to appear as they wish (Cheah et al., 2020). This scenario thus enhances the impact of subjective norms on the intention to reduce meat consumption, explaining the strength of this relationship.

However, the perceived behavioural control (PBC) construct does not have a significant impact on the intention, failing to confirm hypothesis H3. Some *meta*-analyses that studied the application of TPB on pro-environmental dietary consumption behaviours have noted that PBC plays a minor role on the behavioural intention (Armitage & Conner, 2001; Randers & Thøgersen, 2023). A recent study that used the TPB to understand the intention of the Norwegian population to consume functional foods did not find a significant relationship between PBC and the intention to consume these foods (Nystrand & Olsen, 2020). It is complex to identify the reason explaining the weak relationship between these variables, and further studies are needed to explore the underlying motivations. However, it can be hypothesized that this weak relationship may be due to the fact that the intention to act pro-environmental consumption behaviour, such as the intention to reduce red meat, is more driven by one's ideals and the values perceived regarding the preservation of planet and health, and less by perceived capabilities and self-efficacy, which have a greater impact on behaviour.

Considering the behaviours' antecedents, we observed that both intention and PBC positively impact it, explaining about 40 % of the variance, confirm H4 and H5. However, the results showed that PBC has a stronger impact on behaviour compared to intention. This finding is supported by previous studies (Stoll-Kleemann & Schmidt, 2017), which

have highlighted that some individuals, although willing to reduce meat consumption, do not act this behaviour because it requires specific skills and significant efforts that people do not feel able to carry out. For instance, some studies pointed out that the lack of availability of meat alternatives in the markets, the little ability to cook plant-based alternatives and not knowing how to integrate the nutrients lost from reducing meat consumption are strong barriers to dietary change (Stoll-Kleemann & Schmidt, 2017).

Considering the moderating role of emotional involvement in foods, the data support this effect, confirming H6. Indeed, when people have low emotional involvement in food and thus do not use it to achieve psycho-physical well-being the positive relationship between intention to reduce red meat consumption and the behaviour related to the reduction of red meat intake is strong and positive, leading to a greater likelihood of moving from the intention to behaviour. In contrast, the relationship between intention to reduce red meat consumption and actual behaviour is not significant when considering the group of subjects who have high levels of emotional involvement, leading to a lower likelihood of moving from the intention to reduce red meat consumption to actual behaviour. These results highlighted how the component of emotional involvement in food, especially in meat, is becoming an important dimension that influences the decision to translate intentions into behaviours, moderating this relationship. The importance of mapping and addressing this dimension to determine a decrease in meat consumption has already been demonstrated by previous studies (Hielkema & Lund, 2021), which argued that emotional involvement toward certain foods, such as meat, is the primary obstacle to reducing this consumption. A recent study demonstrated how emotional involvement in meat is determined by the fact that this food, in some societies like the Italian one, assumes a symbolic role with deep cultural roots and is involved in the creation of a shared culture and national identity (Sahakian et al., 2020). Individuals who exhibit an emotional involvement in certain foods highlight how these foods represent symbolic practices that allow individuals to identify with their own cultural heritage, distinguishing themselves from the out-group. Consequently, reducing the consumption of these foods results in a form of identity loss and a renunciation of one's origins, making it clear why individuals fail to translate the intention to reduce meat consumption into actual behaviour. According to Scheer (2012), emotions are linked to dietary practices and consumption choices as they enable individuals to express their emotions and communicate them by fostering a form of exchange with others. Following Sahakian (2022), we argue that studying emotions in consumption practices is crucial as it can help uncover how individuals understand priorities in terms of what should be done, revealing tensions or harmonies in the interpretation of various dietary choices. This study supports the assertion made by some authors that an important limitation of the TPB is its disregard for affective processes (Conner & Armitage, 1998; Martini et al., 2024; Qi & Ploeger, 2021; van der Pligt et al., 1997; Van Der Pligt & De Vries, 1998). Affective processes, indeed, could significantly influence attitudes, behavioural intentions, or behaviour (Martini et al., 2024; Van Der Pligt & De Vries, 1998), particularly in food consumption, where the consequences/antecedents of behaviour are heavily linked to emotions (De Pelsmaeker et al., 2017). Thus, there is a need for revising and updating the TPB model in light of new consumption patterns and the unconscious, non-rational processes that increasingly govern food choices nowadays. From an applied perspective, these results highlight how positive psychological involvement in new dietary styles can help people overcome resistance to change, making new eating habits more attractive and less perceived as a deprivation. Additionally, if people associate positive feelings with consuming meat alternatives, they are more likely to maintain these changes in the long term. In summary, emotional involvement in the target behaviour can facilitate the transition, creating a lasting impact on individual health and the environment. Consequently, it is important to create interventions aimed at reducing red meat consumption by focusing on promoting positive emotional experiences associated with alternative dietary choices. For example, public health campaigns and interventions could highlight the immediate and long-term benefits of reducing red meat consumption, such as improved well-being and a sense of contributing to environmental conservation. Additionally, providing social support and creating enjoyable experiences around plant-based meals can further reinforce these positive emotions and encourage sustained behaviour change.

However, this study is not without limitations. A drawback of this research pertains to the measurement of intention and behaviour variables using a sole item, potentially introducing measurement inaccuracies in the TPB constructs. Moreover, the study relied on self-reported data regarding meat consumption rather than observed behaviour. Future experimental investigations could directly assess the behaviour by manipulating environmental choices and incorporating both self-reported and more objective measures, such as observed changes in meat consumption over time. Future researchers can further investigate the role of emotional involvement in food in other countries to confirm the findings of this paper. Finally, it might be interesting to reproduce this study by also using the construct of meat attachment to evaluate how it relates to the emotional balance construct.

## 6. Conclusion

Reducing red meat intake is vital for planetary sustainability and human health. However, psychosocial barriers hinder this shift, requiring psychological models like the Theory of Planned Behaviour (TPB) to predict individuals' inclination to cut red meat consumption. This study aimed to understand how TPB variables influence intentions and behaviours regarding reducing red meat consumption, exploring emotional involvement in food as a moderator. Unlike most TPB studies, we followed participants for six months, enhancing outcome validity. Findings show TPB predicts intention and behaviour to reduce red meat consumption well. Subjective norms significantly impact intention, while perceived behavioural control (PBC) drives actual behaviour. Policymakers should address social context and self-perception regarding meat reduction to encourage change, engaging influential figures for advocacy. Identifying perceived skill gaps is crucial for educational campaigns promoting self-efficacy and awareness. Emotional involvement in food moderates the intention-behaviour relationship, explaining "inclined abstainers" identified by different authors (Celik & Cagiltay, 2024; More & Phillips, 2022; Orbell & Sheeran, 1998; Rivis et al., 2006) as those who plan to perform a behaviour but ultimately do not follow through. These results suggest rethinking TPB by incorporating non-rational processes related to food choices in this model. Instead of reducing food involvement, efforts should focus on culturally embedding alternatives and positive emotional associations with reduced meat consumption. The goal is to make these practices habitual and culturally significant. Ultimately, reducing red meat consumption should symbolize cultural change, identifying individuals as "new consumers" adapting to environmental and health challenges in society.

## CRediT authorship contribution statement

**Greta Castellini:** Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Guendalina Graffigna:** Writing – review & editing, Supervision.

## 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 will be made available on request.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2024.105255.

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