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Masculinizing plant-based diets as an appeal for dietary change among men

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ABSTRACT

A significant body of research suggests that traditional masculine beliefs act as a barrier to reducing meat consumption and transitioning to a more ethical and sustainable food system. Here, we report a pre-registered experiment examining whether men who eat meat are more open to adopting plant-based diets when these diets are associated with traditional models of masculinity. A total of 1069 men who eat meat were randomly assigned to one of four conditions: a social media post with a plant-based meal featuring a male entrepreneur or a male bodybuilder (two experimental conditions), a social media post with a plant-based meal without a masculine model (social media post control condition), or a condition without any stimuli (no-information control condition). Both the entrepreneur and the bodybuilder were perceived as highly masculine, but these experimental conditions did not significantly affect participants' perceived fit between plant-based eating and masculinity, nor did they affect tendencies to justify eating meat as necessary, attitudes toward plant-based diets, or willingness to adopt a plant-based diet. Nevertheless, the results supported previous research findings indicating that men who strongly identify as meat-eaters and those who consume more meat tend to perceive themselves as more masculine, feel more pressure from societal expectations to eat meat, justify meat-eating more strongly, view plant-based diets as less masculine, and are more negative about and less willing to adopt plant-based diets. Our findings raise questions about the "masculinization" of plant-based diets as a strategy for promoting dietary change among men.

1. Introduction

Animal agriculture has a major impact on the Earth's ecosphere (Gerber et al., 2013; IPCC, 2019), consumes vast amounts of natural resources (Young, 2010), and causes high levels of suffering to farmed animals (Algers et al., 2009; Council of the European Union, 2008; Rowlands, 2008). There is a growing consensus that reducing meat consumption and shifting toward plant-based diets can play an important role in improving human health, addressing sustainability challenges (Godfray et al., 2018; Tilman & Clark, 2014), and reducing animal suffering (Fonseca & Sanchez-Sabate, 2022). Nevertheless, meat consumption remains extremely high in Western countries (Ritchie & Roser, 2017).

Published research has uncovered multiple barriers in promoting meat reduction, including psychological defense mechanisms, perceptions of threat, and identity concerns (De Groeve et al., 2022; Hartmann & Siegrist, 2020; Hinrichs et al., 2022; Reiss et al., 2021; Rothgerber, 2013; Stephan & Stephan, 1996). One prominent barrier to reducing meat consumption is gender, as men are generally more resistant to calls to reduce their meat intake. Accordingly, there is an increased need for research on strategies to promote meat reduction particularly among men. Our aim is to examine one of these strategies: masculinizing plant-based diets. The following introductory sections will first discuss the link between meat and masculinity (§1.1), followed by strategies to reframe plant-based diets as masculine in order to encourage men to adopt such diets (§1.2 and §1.3).

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1.1. Meat and masculinity link

There is extensive evidence on the strong links between meat and masculinity (Love & Sulikowski, 2018; Mertens & Oberhoff, 2023; Rogers, 2009; Rosenfeld, 2023; Rosenfeld & Tomiyama, 2021; Rothgerber, 2013; Sobal, 2005; Vartanian, 2015). Research suggests that meat consumption allows men to express a sense of masculinity (Rosenfeld & Tomiyama, 2021; Salmen & Dhont, 2022), which may contribute to large sex differences in meat consumption (Nakagawa & Hart, 2019), and partially explains why men consume more meat than women. Meat continues to be associated with strength, aggressiveness, dominance and power (Adams, 2015; Kildal & Syse, 2017; Rothgerber, 2020), which may motivate men to develop a stronger emotional attachment to it (Graça et al., 2015; Hinrichs et al., 2022; Rosenfeld, 2018; Rothgerber, 2013).

Research consistently indicates that traditional masculine beliefs present a significant obstacle to reducing meat consumption and transitioning to plant-based diets (Bryant, 2019; Peeters et al., 2022; Rosenfeld, 2023; Rosenfeld & Tomiyama, 2021; Ruby & Heine, 2011). Traditional masculine norms exert conformity pressures that discourage men from changing their attitudes and behavior toward meat (Camilleri et al., 2023; Feinberg et al., 2019; Rosenfeld & Tomiyama, 2021; Rothgerber, 2013). Conversely, when men abstain from eating meat, they contradict the traditional meat-masculinity link (Salmen & Dhont, 2022) and as a consequence vegetarian and vegan (veg*n) men may be perceived as lacking masculinity (Rosenfeld, 2023; Ruby & Heine, 2011). Additionally, plant-based food has traditionally been perceived as "women's food" (Adams, 2015), lacking protein (Fiddes, 1992), while emasculating and effeminizing men (Salmen & Dhont, 2022), particularly when referring to soy products (Gambert & Linne, 2019; Rosenfeld, 2018; Ruby & Heine, 2011). This is evident in stereotypes of veg*n men as physically weak 'soyboys' (Salmen & Dhont, 2022) or hypersensitive (Vandermoere et al., 2019). Thus, men tend to receive more social disapproval for being veg*n than women (Rosenfeld, 2023), and it is therefore not surprising that men are less likely to be (or self-identify as) veg*n (Salmen & Dhont, 2022; Ruby, 2012) and show less approval of veg*n diets (Bryant, 2019; Hinrichs et al., 2022; Rosenfeld & Tomiyama, 2021; Rothgerber, 2020). In addition to veg*n men typically being perceived as less masculine than men who eat meat, plant-based foods are often viewed as less masculine compared to meat products and meat-centric meals (Adams, 2015; Mycek, 2018; Rozin et al., 2012; Ruby & Heine, 2011). However, offering meat alternatives that closely resemble real meat (e.g., burgers or burritos) and aligning these foods with ethical consumption goals may encourage more men to opt for these alternatives (Leary et al., 2023).

Establishing a connection between plant-based eating and masculinity through the lens of traditional masculine values could be a way to reduce men's defensiveness toward plant-based diets. Although there are numerous studies on the link between meat and masculinity, experimental research testing approaches to reduce men's meat consumption through the masculinization of plant-based diets is limited (Rosenfeld, 2023). To address this gap, the current study aimed to experimentally examine whether men who eat meat are more open to adopting plant-based diets when these diets are associated with stereotypical models of masculinity, in particular social status (entrepreneurship) and athleticism (bodybuilding).

1.2. Associating plant-based diets with social status

The demonstration of success plays a significant role in how men tend to construct their identities (Giazitzoglu & Down, 2017). Entrepreneurship, in particular, is frequently portrayed in cultural stereotypes as encompassing traits such as competitiveness, rationality, risk-taking, self-control (Giazitzoglu & Down, 2017; Hamilton, 2013), assertiveness, power, success, authority and, in some cases, institutional influence in politics or the business world (Connell, 1995). The consumption of meat, particularly red meat, assists in the production of a hegemonic masculine identity (Adams, 2015; Rogers, 2009; Rosenfeld & Tomiyama, 2021; Sumpter, 2015), which results in veg*n men having their masculinity questioned (Nath, 2011; Thomas, 2016). However, Greenebaum and Dexter (2018) found that veg*n men can challenge the narrow definition of hegemonic masculinity, and embody a hybrid masculinity, by rebranding veganism from its feminine associations to align with many of the prevailing notions of masculinity.

Physical appearance can be a mechanism for reinforcing masculine norms, social status, and authority. In Western societies, men's suits are often linked to conceptions of hegemonic masculinity that signify power, wealth, and high social status (Barry & Weiner, 2019; Connell, 1998). Here, we test whether veg*n men who appear to be involved in entrepreneurship may potentially sidestep associations with stereotypical notions of femininity, and instead activate associations with traditional masculine traits such as competitiveness, power, and success. The rationale is that seeing a veg*n man wearing a suit and promoting plant-based diets assertively, akin to "calling the shots" and "running the show" (Messerschmidt, 2012), may reinforce an association between plant-based diets and masculinity.

1.3. Associating plant-based diets with athleticism

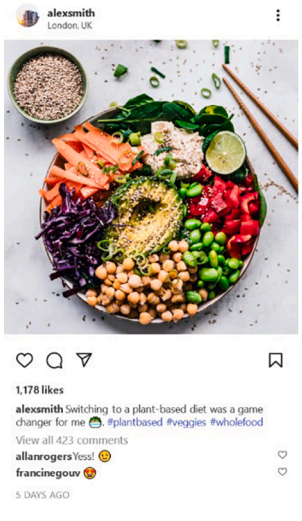
A growing number of male athletes on social media (e.g., Nimai Delgado, Patrik Baboumian, Brendan Brazier) have been challenging the notion that meat is necessary to be a healthy, physically strong man with a stereotypically "masculine" appearance. Moreover, these male athletes embody traditional masculine virtues (Alsop et al., 2002) such as strength, stamina, and bravery, which may challenge the discourses of veg*n men as weak, and animal-based protein consumption as a prerequisite for masculinity. In addition, well-planned plant-based diets are suitable for individuals of all ages, including athletes (Johnson et al., 2021). Well-toned, muscular male bodies are often seen as a symbol of power, dominance, associated to feelings of confidence in social situations (Grogan et al., 2002; Rousseau et al., 2020), and are usually linked to meat consumption (Parasecoli, 2006). Bodybuilding in particular is rooted in an ideal of masculine identity (Denham, 2008; White & Gillett, 1994). Despite the general popular belief that animal flesh is vital for human health, and especially to build strong muscles, bodybuilders who follow a plant-based diet may challenge the premise that men need to eat meat in order to be physically strong, and therefore reinforce an association between plant-based diets and masculinity.

1.4. Current study: Hypotheses and objectives

Negative representations of plant-based diets among men pose a barrier for meat curtailment and more sustainable food systems. This study examined whether men who eat meat are more positive toward plant-based diets when these diets are associated with stereotypical representations of masculinity. Does portraying men who follow a plant-based diet as stereotypically ultra-masculine reduce omnivorous men's justifications of meat as necessary and increase their willingness to adopt a plant-based diet?

To answer this research question, we conducted a pre-registered experiment that assigned participants to one of four conditions: a *no information control condition*, with no stimulus; a *social media post of a plant-based meal* (social media post control condition); a *social media post of a plant-based entrepreneur* embodying success and high social status (experimental condition 1); or a *social media post showing a plant-based bodybuilder* (experimental condition 2) embodying athleticism and physical strength (Table 1). We hypothesized both *experimental conditions* (compared to the *control conditions*) would *(H1)* decrease *justifications of meat as necessary*, (*H2)* increase positive *attitudes toward plant-based diets*, and (*H3*) increase *plant-based masculinity fit* (i.e., perceived alignment between masculinity and plant-based diets). Since bodybuilding is associated with an ideal masculine identity (White & Gillett,

Table 1
Study control and experimental conditions.

Control conditions (0) No-information control condition	Experimental conditions (1,2) Social media post featuring a plant-based meal	Social media post featuring a plant-based entrepreneur	Social media post featuring a plant-based bodybuilder
(No stimuli)			

Note: higher resolution stimuli are available on OSF: https://osf.io/hbmwq.

1994), we also hypothesized that exposure to the *bodybuilder* (compared to the *entrepreneur*) condition would (*H4*) decrease *justifications of meat as necessary*, (*H5*) increase positive *attitudes toward plant-based diets*, and (*H6*) increase *plant-based masculinity fit*. We further expected that a higher *willingness to follow a plant-based diet* would be predicted by *(H7)* increased positive *attitudes toward plant-based diets*, *(H8)* decreased *justifications of meat as necessary*, and *(H9)* increased *plant-based masculinity fit*. Our hypotheses (Fig. 1) were preregistered on AsPredicted (OSF: https://osf.io/cfkmq/?view_only=1abf1754f7284593a8824ae3d8573373).

2. Method

2.1. Sample

A power analysis with G*Power 3.1.9.7 (one-way ANOVA) indicated that a total sample size of 1096 (274 per condition) would allow for the detection of a small effect size ($f = 0.10$) with a power of 0.80 at a standard alpha error probability of 0.05. All participants are from the U. K. and were recruited via the crowdsourcing platform Prolific. We initially recruited 1105 participants and removed those that did not meet our inclusion criteria, i.e., adult men (≥18 years) who consume meat. We excluded 36 participants (i.e., two people who identified as women, two who did not disclose their gender; 17 indicated that they did *not* consume meat, poultry or seafood; in addition, 15 were excluded due to incomplete data). Our final sample comprised 1069 men who reported eating meat, with ages ranging from 18 to 83 ($M_{age} = 43.49$ years, $SD_{age} = 13.38$ years). To avoid sampling biases and influencing participants' expectations, they were informed that the study aimed to "examine beliefs and preferences related to food consumption" and that their participation involved "reading materials and answering questions about dietary preferences". This study received ethical approval from the IRB of Iscte-IUL (University Institute of Lisbon; reference 58/2023).

2.1.1. Procedure, design and stimuli

After providing informed consent, participants were asked demographic questions (i.e., gender, age, education) after which they were randomly assigned to one of four conditions shown in Table 1. Three conditions featured a social media post on Instagram (simulated by Code Beautify), while one condition – the first control condition – did not contain any stimuli. The second control condition featured a social media post depicting a plant-based meal without any associations with

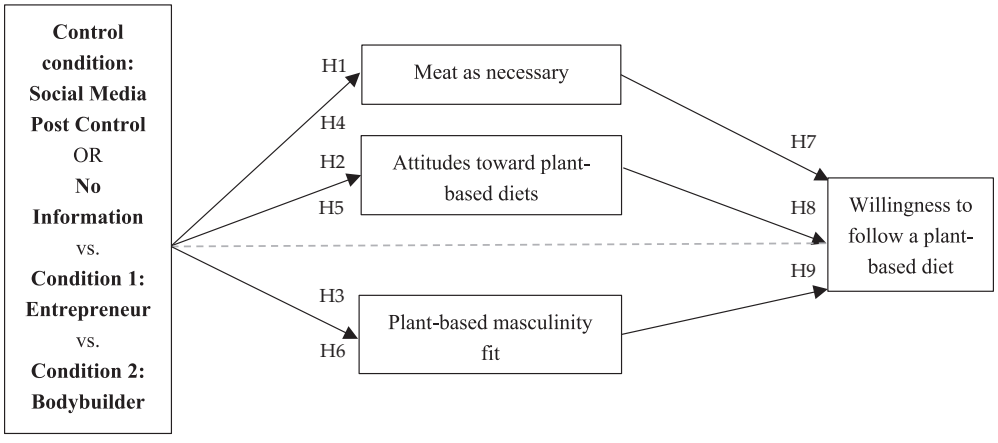


Fig. 1. Conceptual overview of the study hypothesis.

masculinity. The accompanying message read: *"switching to a plant-based diet was a game changer for me. #plantbased #veggies #wholefood"*. The two remaining experimental conditions featured a social media post in which a masculine model was shown alongside a plant-based meal, associating plant-based dieting with masculinity. In particular, the first experimental condition showed an entrepreneur ostensibly sharing the message: *"switching to a plant-based diet was a game changer for my career. #focus #energy # success"*. This message was meant to underscore the connection between plant-based eating and notions of success and high status. The second experimental condition showed a bodybuilder ostensibly sharing the message: *"switching to a plant-based diet was a game changer for my fitness. #power #strength #endurance"*. This message was meant to underscore the connection between plant-based eating and notions of athleticism and strength. Participants who were exposed to the conditions featuring a social media post were asked to look carefully at the post before proceeding with the questionnaire and were made aware that we would ask about their opinions on the post and the topic. Participants assigned to the social media stimuli were then asked for their general opinion of the post.

After being allocated to one of the four conditions, all participants completed confirmatory measures to test our hypotheses. In a random order, we measured participants' *justifications of meat as necessary*, *attitudes toward plant-based diets* and *perceived fit between following a plant-based diet and masculinity*. Next, we measured *willingness to follow a plant-based diet*. After measuring confirmatory variables, we asked questions to measure exploratory variables and to check the effectiveness of our manipulation. Finally, participants were debriefed before returning to Prolific for payment (£0.75 per participant; £12.62 average reward per hour).

2.2. Measures

All measures used in our study are available via OSF: https://osf.io/cfkmq/?view_only=1abf1754f7284593a8824ae3d8573373.

2.2.1. Justifications of meat as necessary

We used four statements to measure participants' *justifications of meat as necessary* (e.g., *"it is necessary to eat meat in order to be healthy"*) (α = 0.93) (Piazza et al., 2015). Answer options ranged from strongly disagree (1) to strongly agree (7), so higher scores indicated stronger justifications of meat as necessary.

2.2.2. Attitudes toward plant-based diets

To assess participant's *attitudes toward plant-based diets*, we adapted a 7-point scale from Povey et al. (2001). Participants were asked to rate plant-based diets using four semantic differential items: *"bad"* to *"good"*, *"harmful"* to *"beneficial"*, *"unpleasant"* to *"pleasant"*, *"unenjoyable"* to *"enjoyable"* (α = 0.90). Higher scores indicated more positive attitudes toward plant-based diets.

2.2.3. Plant-based masculinity fit

In order to assess participants' perceived alignment between masculinity and plant-based diets, we asked *"to what extent do the following words describe a man who follows a plant-based diet?"*. We selected traits traditionally associated with masculinity based on different facets of the "masculine" factor identified by Choi et al. (2007), including "*dominant*", "*decisive*", and "*self-sufficient*". In addition, we rephrased "*act as a leader*" to "*leader*," and included the item "*masculine*". Participants could rate the perceived fit between these masculine traits and following a plant-based diet (α = 0.88) on 7-point scales ranging from "not at all" (1) to "perfectly" (7). Higher positive scores indicated a stronger perceived fit.

2.2.4. Willingness to follow a plant-based diet

To address our secondary aim of predicting participants' increased willingness to adopt a plant-based diet, we asked them to indicate their *willingness to follow a plant-based diet* adapted from Graça et al. (2015), with answer options ranging from 1 "not willing at all" (1) to "very willing" (7). Higher scores indicated a greater willingness among participants to follow a plant-based diet.

2.2.5. Exploratory measures

All participants also responded to exploratory questions, assessing self-rated gender typicality (α = 0.67) with two items (e.g., Traditionally, my beliefs would be regarded as: "very feminine" [1] versus "very masculine" [7]) adapted from Rosenfeld & Tomiyama (2021); perceived conformity pressures to eat meat (α = 0.84) with three items (e.g., "Important individuals in my life expect me to eat meat.") adapted from Feinberg et al. (2019); dietary pattern with six food-related items adapted from Rosenfeld & Burrow (2018); one item to measure meat consumption frequency from De Groeve et al. (2022); and one item to measure meat-eater (vs. vegan) identification from De Groeve et al. (2022). All the items are available in the questionnaire at OSF: https://osf.io/cfkmq/?view_only=1abf1754f7284593a8824ae3d8573373.

2.2.6. Attention and manipulation checks

After measuring the key outcome measures and before measuring the exploratory measures, we assessed whether participants paid attention and remembered which condition they were exposed to by asking the question: *"In the beginning of this questionnaire, you were either shown a social media post or not. If you saw a social media post, which one did you see?"*. Participants had to choose one of four options: "*social media post of an entrepreneur*", "*social media post of a bodybuilder*", "*social media post of a plant-based meal*", or "*I did not see a social media post*". Six participants in the *no-information control condition* and two participants in the *social media control condition* did not select the corresponding option in the attention check. Participants in the experimental conditions who did not select the corresponding option included a total of 155 participants in the *social media post of an entrepreneur* and 31 participants in the *social media post of a bodybuilder*. These participants (except for one) chose the option "*social media post of a plant-based meal*" instead. This suggests that the options in our attention check were not sufficiently specific. First, the *social media post of an entrepreneur* featured a man in a business suit posting a message about his career achievements, but the post did not explicitly identify him as an entrepreneur. More importantly, both versions of the experimental stimuli also included a picture of a meal in the top left corner of the image. This means that participants in the experimental conditions who selected the *social media post of a plant-based meal* option cannot be said to have failed the attention check. Nevertheless, to provide a stronger test of our hypotheses, we compared the results of all the analyses with and without participants who did not select the expected response option, even though these participants did not technically fail the attention check.

As a manipulation check, we tested to what extent the masculine models in the experimental conditions were perceived as masculine, expecting that the *bodybuilder* would be perceived as more masculine than the *entrepreneur*. To avoid biased responses in the experimental conditions (entrepreneur and bodybuilder), only participants in the *no-information control* and *social media post control* conditions were asked to rate the masculinity of the *entrepreneur* and *bodybuilder* shown in the experimental conditions, using a scale from "not at all masculine" (1) to "extremely masculine" (7). Since these control groups had no exposure to any masculine model, their ratings would not be influenced by prior exposure. This was measured after participants completed all key outcome variables. The perceived masculinity ratings were high for both stimuli used in the experimental conditions, with the bodybuilder being rated as more masculine ($M = 5.68$, $SD = 1.40$) than the entrepreneur ($M = 5.14$, $SD = 1.04$), $t(264) = -6.87$, $p < 0.001$.

2.3. Statistical approach

Data analysis was conducted using SPSS version 26. We first computed the correlations between all measures used in the study, as well as the demographic variables. Then, to test hypotheses H1-H3, H4-H6, we conducted a one-way (4 × 1) ANOVA for each of our key dependent variables (*justifications of meat as necessary*, *attitudes toward plant-based diets*, *plant-based masculinity fit*) and compared mean scores across the conditions for each variable. For all three variables, the homogeneity assumption was met based on Levene's tests (all p values > 0.05). To examine whether differences between groups in *justifications of meat as necessary*, *attitudes toward plant-based diets*, and *plant-based masculinity fit* predicted *willingness to follow a plant-based diet* (thereby testing H7-H9), we used a multicategorical mediation model with *control/experimental conditions* as multicategorical predictors, *justifications of meat as necessary*, *attitudes toward plant-based diets*, *plant-based masculinity fit* as mediators and *willingness to follow a plant-based diet* as outcome variable.

We used SPSS macro PROCESS (model 4) to calculate indirect, direct and total effects of both experimental conditions on *willingness to follow a plant-based diet*. We calculated this model twice, one model for each control condition. In Model 1, Helmert coding was used to compare effects of (X1) the *social media post control condition* vs. the *experimental conditions* (H1–H3) and (X2) the *entrepreneur condition* vs. the *bodybuilder condition* (H4–H6). In Model 2, Helmert coding was used to compare effects of (X1) the *no-information control condition* vs. the *experimental conditions* (H1–H3) and (X2) the *entrepreneur condition* vs. the *bodybuilder condition* (H4–H6). Statistical inference for total and direct effects is based on unstandardized model coefficients, standard errors, t and p values, and confidence intervals based on ordinary least squares (OLS) regression, with a standard 0.05 alpha error probability. Indirect effects were determined using 95 % percentile-based bootstrap confidence intervals with 10,000 bootstrap samples. We used heteroscedasticity-consistent standard errors (HC3), as recommended by Hayes and Cai (2007). All hypotheses and the statistical approach were specified before data collection and analysis. The dataset and syntax are available on OSF: https://osf.io/cfkmq/?view_only=1abf1754f7284593a8824ae3d8573373.

3. Results

3.1. Descriptive correlations

Table 2 shows the correlations between confirmatory, exploratory and demographic variables. All variables were correlated with willingness to follow a plant-based diet, while most intercorrelations between the variables were weak to moderate (Cohen, 1988). Perceived conformity pressures to eat meat were negatively correlated with attitudes toward and willingness to follow plant-based diets and positively correlated with justifications of meat as necessary. Correlations with our confirmatory variables were in the same direction but smaller for the exploratory variable self-rated gender typicality (i.e., men rating themselves as more masculine). Meat consumption frequency and meat-eater (vs. vegan) identification were strongly intercorrelated and both variables were negatively correlated with attitudes toward and willingness to follow plant-based diets and plant-based masculinity fit, positively correlated with justifications of meat as necessary, weakly positively correlated with self-rated gender typicality and conformity pressures to eat meat. Concerning demographics, higher education was weakly associated with lower endorsement of justifications of meat as necessary, more positive attitudes toward plant-based diets, and a higher willingness to follow plant-based diets. Age was weakly negatively correlated with plant-based masculinity fit. After removing participants based on the attention check, the pattern of correlations was largely consistent with those obtained with the full sample (cf. Table S1 in the Supplementary Materials).

3.2. Between-group analyses (ANOVA)

The planned one-way ANOVAs indicated that H1 and H4 were not supported, as there were no statistically significant differences in *justifications of meat as necessary* between the *control* and *experimental* (*entrepreneur* vs *bodybuilder*) *conditions*, $F(3, 1065) = 0.709$, $p = 0.547$. Additionally, the results did not support H2 or H5, as no significant differences were found between the *control* and *experimental groups* concerning positive *attitudes toward plant-based diets*, $F(3, 1065) = 2.394$, $p = 0.067$. Similarly, H3 and H6 were not supported due to the absence of significant differences between control and experimental groups in terms of increased *plant-based masculinity fit*, $F(3, 1065) = 1.962$, $p = 0.118$. Concerning *willingness to follow a plant-based diet*, we also did not find significant differences between groups, $F(3, 1065) = 1.074$, $p = 0.359$. ANOVAs conducted after removing participants based on the attention check yielded identical results (Table S2 in the Supplementary Materials) to those obtained with the full sample.

We conducted exploratory interaction analyses using ANOVA to determine whether the effects of the conditions on our outcome variables were moderated by different control variables (i.e., age, education, meat consumption frequency, meat-eater identification, and self-rated gender typicality) (Table S3 in the Supplementary Materials). These analyses initially revealed two possible interaction effects. First, there was an interaction between condition and *meat-eater identification* in predicting *plant-based masculinity fit*, $F(3, 1061) = 2.879$, $p = 0.04$. Specifically, men who identified more strongly as meat-eaters tended to perceive plant-based diets as less masculine, but the association between these two variables appeared to be less pronounced in the *bodybuilder condition* (Fig. S1 in the Supplementary Materials). However, this interaction effect was no longer significant after the removal of one influential data point in the *bodybuilder condition*. Second, an interaction was found between condition and *self-rated gender typicality* in predicting *justifications of meat as necessary*, $F(3, 1061) = 3.598$, $p = 0.01$. In this case, men who rated themselves as more masculine provided stronger justifications for consuming meat, but the association between these two

Table 2
Correlations between confirmatory, exploratory, and demographic variables.

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Attitudes toward plant-based diets	4.19	1.37	–								
2. Plant-based masculinity fit	3.92	1.17	0.45***	–							
3. Justifications of meat as necessary	4.38	1.56	−0.53***	−0.28***	–						
4. Willingsness to follow a plant-based diet	3.14	1.70	0.75***	0.40***	−0.52***	–					
5. Self-rated gender typicality	5.10	0.93	−0.14***	−0.11***	0.19***	−0.19***	–				
6. Conformity pressure to eat meat	3.07	1.40	−0.29***	−0.08***	0.33***	−0.24***	0.12***	–			
7. Meat consumption frequency	5.09	1.69	−0.39***	−0.21***	0.35***	−0.46***	0.14***	0.20***	–		
8. Meat-eater vegan identification	6.05	1.15	−0.51***	−0.21***	0.43***	−0.58***	0.16***	0.23***	0.61***	–	
9. Age	43.5	13.4	0.02	−0.05*	−0.01	−0.05	0.12***	−0.11***	−0.01	−0.06	–
10. Education	3.37	0.83	0.14***	0.09**	−0.16***	0.15***	−0.11***	−0.03	−0.08**	−0.14***	−0.05

Note: 1069 participants for all variables. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

variables appeared to be less pronounced in the *social media post control condition* (Fig. S2 in the Supplementary Materials). Neither of these interactions remained significant after applying a Bonferroni correction for multiple tests. They were therefore considered spurious and deemed not relevant to the main findings. The ANOVAs conducted after removing participants based on the attention check revealed a (spurious) interaction effect between condition and *self-rated gender typicality* in predicting *justifications of meat as necessary*, $F(3, 867) = 3.713$, $p = 0.01$ (Table S4 in the Supplementary Materials), which did not remain significant after applying a Bonferroni correction for multiple tests.

3.3. Multicategorical mediation analysis

We conducted the planned multicategorical mediation analyses to test H7-H9. We found that (both in Model 1 and Model 2) *willingness to follow a plant-based diet* was negatively predicted by *justifications of meat as necessary*, $b_1 = -0.20$, $SE = 0.03$, $t(796) = -5.83$, $p < 0.001$, $b_1 = -0.15$, $SE = 0.03$, $t(804) = -4.94$, $p < 0.001$; positively predicted by *attitudes toward plant-based diets*, $b_2 = 0.76$, $SE = 0.04$, $t(796) = 19.93$, $p < 0.001$, $b_2 = 0.81$, $SE = 0.04$, $t(804) = 21.5$, $p < 0.001$; and *perceived plant-based masculinity fit*, $b_3 = 0.08$, $SE = 0.04$, $t(796) = 2.04$, $p = 0.041$, $b_3 = 0.08$ $SE = 0.04$, $t(804) = 2.12$, $p = 0.034$. The effects of the experimental manipulations on these variables were largely in line with the ANOVAs and can be found in the supplementary materials (Table S5, Table S6, Fig. S3, and Fig. S4). However, there was one negative direct effect of interest. Compared to participants in the *social media control condition*, participants exposed to the *experimental conditions* reported less positive *attitudes toward plant-based diets*, $a_2 = -0.27$, $SE = 0.10$, $t(799) = -2.63$, $p = 0.008$, which predicted a lower *willingness to follow a plant-based diet*, $b_2 = 0.76$, $SE = 0.04$, $t(796) = 19.9$, $p < 0.001$. This resulted in a weak indirect effect, $IE = -0.20$, $BootSE = 0.0770$; 95 %, BootCI [−0.3558, −0.0543] (see Table S5; Fig. S3). Multicategorical mediation analyses conducted after removing participants based on the attention check yielded similar results to those obtained with the full sample (Table S7). The only difference (also considered spurious) was that participants in the social media post control reported higher *plant-based masculinity* fit compared to those exposed to the experimental conditions, $a_3 = 0.25$, $SE = 0.12$, $t(615) = 2.02$, $p = 0.044$ (Table S8).

4. Discussion

The present study tested whether men who eat meat would become more positive toward plant-based diets when these diets are associated with stereotypical representations of masculinity. Contrary to our hypotheses, we found no reliable evidence that associating plant-based diets with traditional representations of masculinity affected participants' justifications of meat as necessary, attitudes toward plant-based diets, or perceived fit between plant-based diets and masculinity.

One possible interpretation for these results is that the exemplars used in our study to operationalize idealized forms of masculinity (one as an entrepreneur, symbolizing high status, and the other as a bodybuilder, representing athletic strength; Ricciardelli et al., 2010) were not perceived as relatable role models or group references by our participants. In addition, the perception of entrepreneurs and bodybuilders being typical or aspirational models of masculinity may be outdated. Alternatively, given that both exemplars explicitly self-identified as following a plant-based diet, participants may have perceived these models as diverging from societal expectations and beliefs regarding group (masculine) norms (Markowski & Roxburgh, 2019; Stanaland et al., 2023). It is also possible that our Instagram posts were perceived as artificial and lacking in credibility (Lowry et al., 2014), therefore failing to influence our outcome variables. However, Rosenfeld (2024) also reported unsuccessful attempts to promote meat reduction through masculinization. A brief exposure to a single, static post of countercultural exemplars may not be sufficient to establish a new plant-based masculinity association, or to portray the exemplars as authentic individuals with compelling stories. Consistent with Rosenfeld's (2024) findings, it is also worth noting that there were no clear signs of backlash in response to the experimental manipulations.

Despite the null findings regarding the experimental manipulations, the overall pattern of associations observed between the outcome and exploratory variables was well aligned with previous findings. For example, we found that men who feel more pressured by societal expectations to eat meat, strongly identify as meat-eaters and see themselves as more masculine (Adams, 2015; Rothgerber, 2013; Sobal, 2005; Stanley et al., 2023) tend to hold less favorable attitudes toward plant-based diets (Leary et al., 2023; Nakagawa & Hart, 2019; Stanaland et al., 2023), and are more likely to justify their meat consumption as necessary (Rosenfeld & Tomiyama, 2021; Ruby & Heine, 2012). In line with Salmen and Dhont (2022), we also found that men who more strongly identify as meat eaters are more likely to perceive plant-based diets as less masculine.

Several limitations of this study warrant consideration and suggest priorities for future research. First, a technical challenge in this study was to ensure that the male exemplars (i.e., the entrepreneur and a bodybuilder) were comparable. The original stimulus (i.e., real picture of a bodybuilder) was duplicated and the face was pasted and edited onto an entrepreneur's body with a similar posture, though comparability may have been compromised due to the photo editing process and output.

Second, the hypermasculine exemplar we used in this study to endorse plant-based diets may have reinforced unattainable masculine stereotypes. Hypermasculine stereotypes may not only be perceived as outdated, but could also lead to negative effects by prompting comparisons to idealized standards of appearance, potentially decreasing body satisfaction and self-appreciation (Barron et al., 2021; Blond, 2008; Farquhar & Wasylkiw, 2007; Galioto & Crowther, 2013; Hargreaves & Tiggemann, 2009). Future studies could explore more diverse and attainable 'masculinity scripts' (Sobal, 2005), including 'caring masculinities' that embrace affective, relational, and positive emotions for men and society more broadly (see Elliott, 2016). This could include moving away from unattainable hypermasculine ideals to feature more relatable and realistic male figures who advocate for plant-based diets. Given that conformity pressures to eat meat often involve the need to conform to (male) group validation and cohesion (Camilleri et al., 2023), we suggest using stimuli featuring veg*n masculine men in group settings endorsing plant-based diets with possible approaches that help eliminating the veg*n stigma (Markowski & Roxburgh, 2019).

Another priority for future research is to further increase the persuasiveness and ecological validity of the research materials (in this case, social media posts). Our stimuli were static images and only displayed a plant-based dish next to the model. To enhance the credibility of stimuli, future studies could improve and test persuasive messages with a variety of formats such as videos, infographics, and testimonials. This may include exposure to exemplars actually preparing or consuming plant-based dishes and engaging with their audience (as suggested by Rosenfeld, 2024). Longitudinal and ethnographic social media studies could be used to examine how (charismatic) vegan fitness and lifestyle influencers build social bonds with their followers as authentic individuals and exert influence over a longer period of time. A recent study found that pro-vegetarian women were more effective in encouraging meat reduction among men than other men depicted as pro-vegetarian (Rosenfeld, 2024). Future research could aim to replicate these findings and further examine gender-related persuasive mechanisms.

Persuasive messaging may entail explicitly or tacitly addressing some of the known barriers to following plant-based diets and choosing plant-based meals, such as perceptions of taste and healthfulness (e.g., Reipurth et al., 2019; Rosenfeld & Tomiyama, 2021), appealing to hedonic motivations (Graça et al., 2015; Hinrichs et al., 2022), and representing veg*n men as more socially attractive (De Groeve et al., 2022).

Video testimonials could also tackle the disconnect between meat consumption and its animal origins (e.g., Kunst & Hohle, 2016) while emphasizing the impact of plant-based diets on the environment and the sustainable management of natural resources.

Lastly, while we aimed to be inclusive in assessing participants' gender, future research could differentiate between participants' sex and gender, and offer specific options to capture transgender and nonbinary identities.

5. Conclusion

This pre-registered experiment found no support for the hypothesis that men who eat meat can become more positive toward plant-based diets when these diets are associated with stereotypical representations of masculinity. Specifically, exposure to a hypermasculine exemplar advocating a plant-based diet did not influence participants' perceived fit between plant-based eating and masculinity, endorsement of meat-eating justifications, attitudes toward plant-based diets, or willingness to adopt a plant-based diet. This casts doubt on the expected effectiveness of this type of strategy in promoting healthier and more sustainable dietary habits among men. Future studies could explore this strategy using various operationalizations and expand their scope by targeting additional facets of masculinity.

CRediT authorship contribution statement

Rui Pedro Fonseca: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ben De Groeve:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Conceptualization. **João Graça:** Writing – review & editing, Validation, Methodology, Formal analysis, Conceptualization.

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 available online at: https://osf.io/cfkmq/?view_only=1abf1754f7284593a8824ae3d8573373.

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Ethical approval

This study received ethical approval from the IRB of Iscte-IUL (University Institute of Lisbon; reference 58/2023). Participants were assured of their anonymity, informed that participation in the survey was entirely voluntary, and that they could withdraw at any time without consequence.

Appendix A. Supplementary material

Supplementary data to this article can be found online at: https://osf.io/cfkmq/?view_only=1abf1754f7284593a8824ae3d8573373. Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2024.105341.

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