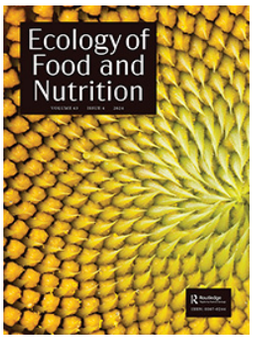
Understanding the Meat-Masculinity Link: Traditional and Non-Traditional Masculine Norms Predicting Men's Meat Consumption



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Understanding the Meat-Masculinity Link: Traditional and Non-Traditional Masculine Norms Predicting Men's Meat Consumption

Lauren Camilleri, Melissa Kirkovski, Jessica Scarfo, Andrew Jago, and Peter Richard Gill

Institute for Health and Sport, Victoria University, Footscray, Australia

ABSTRACT

Conformity to masculinity ideology predicts men's meat consumption and willingness to reduce their meat intake, but it is unknown which specific masculine norms account for these relationships. This study investigated which traditional and non-traditional masculine norms predict meat consumption, red and processed meat consumption, and willingness to reduce meat consumption in 557 Australian and English males. Men who support the use of physical violence and place high importance on sex ate more meat. Willingness to reduce was highest among men with gender egalitarian views. Targeting these specific masculine norms may be important for mitigating men's over-consumption of meat.

KEYWORDS

Conformity to masculine norms; gendered eating; meat-masculinity link; men's red and processed meat consumption; willingness to reduce meat consumption

Introduction

Meat has played a key role in the evolution of the human species, serving as an important source of nutrition and energy (Mann 2018). Currently, proponents of the meat-heavy "carnivore" diet assert that a high meat, low plant-based diet offers health benefits, such as improved sleep, gut health, mental health, cardiovascular health, hormone regulation, weight loss, increased energy levels and reduced inflammation (Cho 2020; Lennerz et al. 2021; Saladino 2020). Indeed, research has found that the majority of carnivore diet adherents self-report many of these health benefits (Lennerz et al. 2021). However, in 2015, a strong body of research evidence prompted the International Agency for Research on Cancer (IARC) to classify processed meat as carcinogenic, and red meat as probably carcinogenic (De Smet and Vossen 2016). As such, the IARC and other research bodies, such as the American Institute of Cancer Research (2024) and the World Cancer Research Fund International (n.d.), recommend that people limit their red and processed meat consumption

CONTACT Lauren Camilleri lauren.camilleri@vu.edu.au Institute for Health and Sport, Victoria University, Ballarat Rd, Footscray, Vic 3011

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(RPMC). Other studies support the recommendation that people should limit their red and processed meat intake, finding links between high levels of RPMC and diseases, such as colorectal and prostate concer, cardiovasular disease, stroke, type 2 diabetes, obesity, and overall mortality (Grosso et al. 2022; Libera, Iłowiecka, and Stasiak 2021; Zheng et al. 2019).

As the biggest meat consumers worldwide (Graça, Godinho, and Truninger 2019; Horgan et al. 2019), men are at greater risk than women of early death from overconsumption of red and processed meat (Battaglia Richi et al. 2015; Rohrmann et al. 2013). Despite these poor health consequences, men demonstrate less willingness than women to reduce their meat intake (Graça, Godinho, and Truninger 2019), and are less likely to reduce their meat consumption, or choose meat-free meals, in intervention studies (Campbell-Arvai, Arvai, and Kalof 2014; Jalil, Tasoff, and Bustamante 2020; Pohlmann 2022). Therefore, it is important to investigate factors contributing to men's meat consumption and reduction, to help inform men's dietary interventions.

One distinguishing factor explaining men's greater meat consumption and unwillingness to reduce their meat intake is conformity to masculine norms. Some men have expressed unwillingness to reduce their meat intake due to their adherence to traditional masculine ideals and expectations of how "real" men ought to behave (Bogueva, Marinova, and Gordon 2020). Many male meat-eaters in the study believed that it is "unmanly" for men to abstain from eating meat. Hence, adherence to traditional masculine norms presents a unique challenge for reducing men's meat intake, and has thus been dubbed a "masculinity dilemma" (Bogueva, Marinova, and Gordon 2020). The present study aimed to expand understandings of the link between men's meat consumption and masculinity by investigating which masculine norms predict men's meat-eating behaviors and attitudes.

The meat-masculinity link

Men's consumption of meat is often investigated through a gender lens, with numerous scholars observing the nexus between eating meat and masculinity (e.g., Adams 1990; Buerkle 2009; Carroll, Capel, and Gallegos 2019; De Backer et al. 2020; Kramer 2011; Lapiņa and Leer 2016; Leary et al. 2023; Nakagawa and Hart 2019; Peeters et al. 2022; Rosenfeld 2023; Rothgerber 2013; Rozin et al. 2012; Salmen and Dhont 2023; Sobal 2006; Stanley, Day, and Brown 2023). For example, in many Western cultures, eating meat is viewed as a stereotypically masculine behavior (Johnston, Baumann, and Oleschuk 2021; Rozin et al. 2012), and meat-eaters are perceived to be more masculine than vegetarians (Bogueva, Marinova, and Gordon 2020; Ruby and Heine 2011). Conversely, vegetarianism and the consumption of meat-alternatives is stereotypically associated with femininity (Bogueva, Marinova, and Gordon 2020; Cavazza, Graziani, and

Guidetti 2020; Clemens and Flannery 2022). It has been theorized that eating meat is a means of gender performance, enabling men to present a traditionally masculine self-image (e.g., Buerkle 2009; Carroll, Capel, and Gallegos 2019; Nakagawa and Hart 2019). Indeed, various experiments have demonstrated that in certain contexts men eat meat to enhance and manage their masculine identity (Leary et al. 2023; Mertens and Oberhoff 2023; Mesler, Leary, and Montford 2022; Pohlmann 2022).

Several researchers have proposed that this meat-masculinity link is perpetuated and explained by conformity to traditional masculinity ideology (e.g., De Backer et al. 2020; Rosenfeld and Tomiyama 2021; Timeo and Suitner 2018). Over the past four decades, a set of dominant and widely adhered to masculine norms have repeatedly been identified, particularly in Western cultures, collectively referred to as "traditional" masculinity (Levant and Wong 2017). Traditional masculinity ideology is multifaceted, encompassing a range of norms that assert, for example, that men should be stoic, powerful, competitive, self-reliant, and sexually virile (Levant and Wong 2017). The core tenants of traditional masculinity ideology are captured in psychometrically validated instruments such as the Conformity to Masculine Norms Inventory (CMNI; Mahalik et al. 2003) and the Male Role Norms Inventory (Levant, Hall, and Rankin 2013).

It is recognized that multiple versions of masculinity coexist and vary according to culture and context (Levant and Wong 2017). However, men in Western countries such as Australia, the UK, and the US are consistently found to conform to traditional masculine norms (Gattario et al. 2015; Wong et al. 2017), with these dominant ideological standards of masculinity even permeating into niche subcultures such as Australian surf and rock culture (Whiting, Klimentou, and Rogers 2019) or British police force culture (Broomfield 2014). Moreover, men of various cultures, races, and sexual orientations have been found to conform to traditional masculine norms (e.g., Isacco and Wade 2017; Rochelle 2019; Vogel et al. 2011). Hence, traditional masculinity ideology appears to influence most men to some degree, and represents what would currently be the most universal, dominant, and widely adhered to set of gender role ideals for men. These traditional masculine norms serve as implicit guides for how men ought to behave (Isacco and Wade 2017).

Research has found that men who conform strongly to traditional masculinity ideology are more likely to eat meat – a stereotypically masculine behavior – and less likely to consider adopting a vegetarian diet, which is stereotypically viewed as more feminine (Rosenfeld and Tomiyama 2021; Rothgerber 2013; Stanley, Day, and Brown 2023). Conversely, men who subscribe to emerging, non-traditional masculine norms have been found to eat less meat and have greater willingness to reduce their meat consumption (De Backer et al. 2020; Peeters et al. 2022). While these studies show that

conformity to masculine norms is associated with meat consumption when masculinity is measured as a single overarching (i.e., unidimensional) construct, this method does not capture the multidimensional nature of masculinity ideologies.

To the authors' knowledge, only one study has investigated which dimensions of masculinity predict men's meat consumption. In a study of the relationship between four traditional masculine norms and food intake in Portuguese men and women, Campos, Bernardes, and Godinho (2020) found that conformity to norms regarding the use of violence (i.e., whether using physical violence is acceptable), being a "playboy" (i.e., having multiple sexual partners), disdain for homosexuals, and risk-taking did not predict men's meat consumption. However, this study did not measure other traditional masculine norms, nor non-traditional norms. By including a broad range of masculine norms, the current study aimed to extend knowledge of the meat-masculinity link by highlighting the specific masculine norms related to men's meat consumption, and provide insights into the potential barriers and facilitators of men's dietary change.

Masculine norms related to men's meat consumption

Although evidence regarding the relationship between specific masculine norms and men's meat consumption is limited, findings from various studies suggest that certain traditional masculine norms may be the strongest predictors of men's meat consumption. Conformity to the use of violence may be an important predictor of men's meat consumption. Meat consumption is positively associated with having a more accepting attitude to various forms of violence, such as the use of nuclear weapons, capital punishment, and blood sports (Hamilton 2015). Moreover, although Campos, Bernardes, and Godinho (2020) found that conformity to violence did not directly correlate with or predict men's meat consumption, it mediated the relationship between sex and meat consumption, such that men's conformity to the violence norm explained their higher meat intake.

Meat consumption is also associated with traditional masculine ideals, such as social status, being physically tough, and having emotional control. Experiments have found that people have a greater preference for meat when motivated to enhance their perceived social status (Chan and Zlatevska 2019b), suggesting that men who pursue social status may be more likely to eat meat. Men commonly believe that eating meat is necessary for building muscles and physical strength (i.e., being "tough"; Bogueva, Marinova, and Raphaely 2017; Hartmann and Siegrist 2020; Kildal and Syse 2017). Moreover, people who feel empathy for animal suffering are less willing to eat meat (Earle et al. 2019; Kunst and Hohle 2016), and men consistently exhibit less empathy for animals than women (Angantyr, Eklund, and Hansen

2015; Camilleri, Gill, and Jago 2020; Estévez-Moreno et al. 2021). It has been theorized that men may fail to express concern for animal suffering, and therefore, eat more meat, because it conflicts with the masculine norm of restricting and controlling one's emotions (Dillon-Murray, Ward, and Soar 2023; Rothgerber 2013).

Experiments have also found that men show a greater preference for meat when sexually motivated (Chan and Zlatevska 2019a; Timeo and Suitner 2018) and that some women perceive meat-eating men as more sexually attractive (Timeo and Suitner 2018). Hence, heterosexual men in particular may be motivated to eat meat to enhance their sexual appeal. Alternatively, some men believe that eating meat enhances sexual virility (Bogueva, Marinova, and Raphaely 2017). Therefore, when controlling for sexual orientation, men who conform to traditional masculine norms regarding sexuality, such as placing high importance on sex drive, or on being a "playboy" (i.e., obtaining multiple sexual partners), may eat more meat. Although Campos, Bernardes, and Godinho (2020) found that the playboy norm did not predict men's meat consumption, it may predict their willingness to reduce their meat consumption.

Meat consumption has also been linked to male heterosexuality, with scholars observing the glorification of meat consumption in stereotypically heterosexual masculine popular culture and social settings (Buerkle 2009; Lapiņa and Leer 2016). Homophobic comments questioning heterosexual vegetarian men's sexuality also reveal that some people expect heterosexual men to eat meat (Bogueva, Marinova, and Gordon 2020; Mycek 2018). Hence, men who believe it is important to present as heterosexual may be more motivated to eat meat. This need not apply solely to heterosexual men; in heteronormative culture, non-heterosexual men can at times feel pressure to present themselves as heterosexual (Ozbilgin et al. 2022).

In addition to traditional masculine norms, an alternate set of five non-traditional masculine norms have recently been identified and linked to men's meat consumption (De Backer et al. 2020; Kaplan, Rosenmann, and Shuhendler 2017). These new norms endorse non-traditional masculine ideals, including holistic attentiveness (men prioritizing their health by supporting and integrating their mental and physical wellbeing); authenticity (men openly expressing their feelings and self); domesticity and nurturing (men prioritizing and playing a more hands on role in parenting); sensitivity to male privilege (men holding greater gender egalitarian attitudes); and questioning societal definitions of masculinity (men questioning and rejecting traditional gender roles). Men who conform to non-traditional masculinity ideology overall (i.e., as a global construct) have been found to eat less meat and be more willing to reduce their meat intake (De Backer et al. 2020; Peeters et al. 2022). However, no previous studies have investigated the relationship between specific non-traditional norms and meat consumption. Theoretically, because men who

conform to the "questioning definitions of masculinity" norm reject traditional gender roles, they should be more likely to reject stereotypical gender roles related to food (i.e., that men should eat meat), and hence, eat less meat or be more willing to reduce their meat intake. Additionally, "authenticity" endorses the open expression of emotion, potentially removing the barrier to showing empathy for animals, which is a common motivator of meat avoidance (Graça, Godinho, and Truninger 2019; Rosenfeld 2018).

Masculinity and social dominance orientation

Social dominance orientation (SDO; i.e., endorsement of establishing social hierarchies and maintaining power over outgroups) has been linked to meat consumption and avoidance behavior (Dhont and Hodson 2014), being positively associated with meat consumption (Allen et al. 2000; Holler et al. 2021), with meat-eating men scoring higher on SDO than vegetarian or vegan men (Veser, Taylor, and Singer 2015). Conceptually, SDO is a closely related and overlapping construct with facets of traditional masculinity ideology emphasizing the importance of men attaining power (physical, social, and sexual) and high social status. In developing the CMNI, Mahalik et al. (2003) found that the masculine norms emotional control, violence, power over women, and playboy, as well as overall conformity to the CMNI, were positively moderately correlated with SDO. Other studies have found SDO to be positively correlated with the CMNI norms winning, risk-taking, heterosexual self-presentation, and power over women (Fox and Tang 2014). To ensure our results were not explained by men's SDO, we included this factor as a control variable.

Hypotheses

Based on the available empirical evidence in the literature, the following hypotheses were made:

(1) Regarding traditional masculinity, it was hypothesized that, when controlling for demographic variables and SDO, *pursuit of status*; *violence*; *toughness*; *importance of sex*; *being a playboy*; *emotional control*; and *heterosexual self-presentation* would positively predict men's RPMC and total meat consumption, and negatively predict willingness to reduce meat consumption. Due to limited evidence regarding other common traditional masculine norms, the relationships between outcome variables and the remaining traditional masculine norms in the CMNI (Mahalik et al. 2003; *power over women; winning; risk-taking; primacy of work; self-reliance*) were exploratory.
(2) Regarding non-traditional masculinity, it was hypothesized that, when controlling for demographic variables and SDO, *questioning definitions*

of masculinity and *authenticity* would negatively predict men's RPMC and total meat consumption, and positively predict willingness to reduce meat consumption. The relationships between outcome variables and the remaining non-traditional masculine norms (*sensitivity to male privilege; holistic attentiveness; domesticity/nurturing*) were exploratory.

Methods

Data Analysis

A partial least squares structural equation model (PLS-SEM) analysis was conducted in SmartPLS4 version 4.1.0.1 (Ringle, Wende, and Becker 2024) to test the study hypotheses. PLS-SEM is preferable to Covariance-Based SEM (CB-SEM) for exploratory and non-established theoretical frameworks and recommended when the research aim is to predict and explain a particular construct (Dash and Paul 2021; Hair and Alamer 2022; Sarstedt, Ringle, and Hair 2021). Additionally, unlike CB-SEM, PLS-SEM does not have data distribution requirements (Hair and Alamer 2022; Samani 2016), making PLS-SEM the more suitable choice for the current study's data, which had a multivariate non-normal distribution according to Mardia's skewness and kurtosis values.

PLS-SEM model evaluation involves two parts. Firstly, measurement (outer) model evaluation assesses the reliability and validity of study constructs by investigating the relationships between latent constructs and their items. The reliability of the indicator is assessed first, whereby construct items with factor loadings $< .7$ are deleted, unless the loading is $> .4$ and removing the item detracts from the construct's internal consistency and convergent validity; however, all items with loadings $< .4$ should be deleted (Hair and Alamer 2022; Hair et al. 2021). Internal consistency reliability is measured with Cronbach's alpha and composite reliability (CR), the recommended threshold for both being ≥ 0.70, though values ≥ 0.60 for exploratory research are acceptable (Dash and Paul 2021; Hair et al. 2021). Convergent validity is assessed with average variance extracted (AVE) above 0.5 (Dash and Paul 2021). Discriminant validity ensures study constructs are distinct, confirmed with Fornell and Larcker's (1981) criterion whereby the square root of the AVE for each construct should be greater than correlations with other model constructs.

Secondly, structural (inner) model evaluation assesses the relationships between latent variables. Goodness of model fit is assessed with the Standardized Root Mean Square Residual (SRMR) score < 0.08 (Hu and Bentler 1999). The model's in-sample explanatory power (R^2) indicates the amount of variance in the outcome variable explained by the model ($\approx$0.25,

≈0.50, and ≈ 0.75 indicating weak, moderate, and strong explanatory power, respectively; Hair et al. 2021). Path coefficient and significance values with bootstrapping (10,000 samples) assess relationships between latent constructs in the model and test study hypotheses. The model's out-of-sample predictive power is assessed with Shmueli et al.'s (2019) k-fold cross validation technique using the $PLS_{predict}$ algorithm, by testing the root-mean-square error (RMSE) values, which quantify the degree of prediction error. Strong predictive power is demonstrated when the RMSE value of each indicator of the outcome construct is less than the naïve linear regression model (LM) benchmark RMSE values (Shmueli et al. 2019). Q^2 values evaluate the model's predictive relevance, with values > 0, ≈0.25, and ≈ 0.50 indicating adequate, medium, and strong predictive relevance (Hair et al. 2022).

PLS-SEM assumptions outlined by Goller and Hilkenmeier (2022) were addressed before conducting the analysis. Twenty-one missing values were treated with personal mean replacement, a method with minimal impact on PLS-SEM results when missingness < 5% (Hair et al. 2021). Univariate outliers were treated using a Winsorisation technique (Kwak and Kim 2017). Thirteen multivariate outliers detected with Mahalanobis distance exceeding the chi-square critical value of 49.73 ($df = 23$, $p < .001$) and were excluded from the analysis. All variance inflation factors (VIF) were less than 3, indicating no multivariate multicollinearity (Hair et al. 2021). Standardized residuals plotted against standardized predicted values indicated that the assumption of homoscedasticity was met. The studied variables met the assumption of strict exogeneity. According to Kock and Hadaya's (2018) inverse square root method, assuming a significance level of 5% and a minimum path coefficient of 0.10, the minimum sample size required for the analysis was 618. This value exceeds the current sample size of 557 participants, however, simulation analyses show that the inverse square root method consistently overestimates minimum sample size requirements (Kock and Hadaya 2018).

Participants & procedure

The study was approved by the Victoria University Human Research Ethics Committee (Application ID: HRE21–162). A convenience sample of Australian and English participants, who self-identified their gender as male, was obtained from an online recruitment site "Prolific" (https://www.prolific.co/) as part of a broader study on men's meat consumption (Camilleri et al. 2023). An additional 45 Australian participants were recruited on Facebook via survey participant recruitment groups as well as the principal researcher's personal network. Participants provided informed consent before completing the survey online via Qualtrics, and were paid $12 AUD for their time. Twenty-nine incomplete datasets were deleted, leaving 575 men who had completed all survey measures. Twenty-

one missing values were replaced with the participant's mean score on that variable. Five cases with single-item demographic questions missing (income and geographic location), which could not be replaced with the participant's mean score, were deleted listwise from the analysis. Thirteen multivariate outliers were deleted, leaving a final sample of 557 Australian and English men (56.2% Australian; mean age 38.5, *SD* = 13.3). Overall, the sample was predominantly heterosexual, left-wing, well-educated men living in metropolitan areas, aged 18–44 (Table 1).

Materials

See Supplementary A for the complete questionnaire used in the current study; Supplementary B for the complete list of questionnaire materials used as part

Table 1. Sociodemographic Statistics of Sample.

Demographic Variable	*N*	%
Country		
Australia	313	56.2%
England	244	43.8%
Self-identified diet		
Unrestricted meat-eater	330	59.2%
Meat-reducer	181	32.5%
Meat-avoider	46	8.3%
Age		
18–29	164	29.4%
30–44	240	43.1%
45–59	103	18.5%
≥60	50	9.0%
Education		
≤ Secondary school	121	21.7%
Trade/vocational training	95	17.1%
Bachelor's degree	236	42.4%
Postgraduate degree	105	18.9%
Geographic Location		
Metropolitan	440	79.0%
Rural	117	21.0%
Sexual Orientation		
Heterosexual	496	89.0%
Homo/bisexual	61	11.0%
Political Views		
Left-wing	281	50.4%
Centre	161	28.9%
Right-wing	115	20.6%
Religion		
None	370	66.9%
Buddhism	10	1.8%
Christianity	126	22.8%
Hindu	7	1.3%
Islam	12	2.2%
Judaism	4	0.7%
Other	24	4.3%

Note. "Meat reducer" refers to self-identified pescatarians and participants who reported intentionally limiting their meat consumption; "meat avoider" refers to vegetarians and vegans. *N* = 557.

Table 2. Internal Consistency Reliability and Convergent Validity Evaluation of Study Constructs.

	Meat Consumption Model			RPMC Model			WRMC Model		
Variable	α	CR	AVE	α	CR	AVE	α	CR	AVE
Meat consumption	0.51	0.75	0.50	—	—	—	—	—	—
Red & processed meat consumption	—	—	—	0.30	0.73	0.58	—	—	—
Willingness to reduce meat consumption	—	—	—	—	—	—	0.86	0.92	0.79
Social dominance orientation	0.82	0.88	0.65	0.82	0.88	0.65	0.82	0.88	0.65
Authenticity (NTM)	0.71	0.87	0.77	0.79	0.87	0.68	0.79	0.87	0.69
Domesticity/nurturing (NTM)	0.60	0.78	0.55	0.60	0.79	0.55	0.60	0.79	0.56
Holistic attentiveness (NTM)	0.65	0.78	0.55	0.65	0.78	0.55	0.73	0.82	0.54
QDOM (NTM)	0.75	0.86	0.67	0.75	0.86	0.67	0.75	0.86	0.67
Sensitivity to male privilege (NTM)	0.36	0.76	0.61	0.36	0.76	0.61	0.36	0.76	0.61
Emotional control (TM)	0.91	0.94	0.83	0.91	0.94	0.84	0.91	0.94	0.85
Heterosexual presentation (TM)	0.93	0.96	0.88	0.93	0.96	0.88	0.93	0.96	0.88
Importance of sex (TM)	0.83	0.90	0.75	0.83	0.90	0.75	0.83	0.90	0.75
Playboy (TM)	0.82	0.90	0.74	0.72	0.86	0.75	—	—	—
Power over women (TM)	0.78	0.87	0.70	0.78	0.87	0.70	0.78	0.87	0.69
Primacy of work (TM)	0.88	0.92	0.80	0.88	0.92	0.80	0.88	0.92	0.79
Pursuit of status (TM)	0.68	0.81	0.59	0.68	0.81	0.59	0.68	0.80	0.57
Risk-taking (TM)	0.89	0.93	0.81	0.89	0.93	0.81	0.89	0.92	0.79
Self-reliance (TM)	0.76	0.88	0.79	0.76	0.89	0.81	0.76	0.84	0.73
Toughness (TM)	0.74	0.85	0.66	0.74	0.85	0.66	0.74	0.85	0.66
Violence (TM)	0.75	0.85	0.65	0.75	0.84	0.64	0.75	0.85	0.65
Winning (TM)	0.70	0.83	0.62	0.69	0.85	0.74	0.70	0.83	0.63

Note. α = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted. α and CR should be ≥ .60 to demonstrate reliability; AVE should be ≥ .50 to demonstrate convergent validity (Hair et al. 2021). The playboy norm was not used in the willingness to reduce meat consumption model due to poor indicator reliability. RPMC = red and processed meat consumption; WRMC = willingness to reduce meat consumption; QDOM = questioning definitions of masculinity; NTM = non-traditional masculine norm; TM = traditional masculine norm.

of the broader meat consumption study (Camilleri et al. 2023); and Table 2 for each construct's psychometric values in the current study.

Outcome variables

Participants completed a scale developed to measure *meat consumption*. Prior to running the PLS-SEM analysis, exploratory factor analysis (EFA) and confirmatory factor analyses (CFA) were conducted on two independent Australian samples to validate the meat consumption scale. In the EFA, Velicer's minimum average partial test (Velicer, Eaton, and Fava 2000) confirmed the presence of one factor representing overall meat consumption. The single factor model was confirmed in the CFA, with the meat consumption scale demonstrating good model fit (CMIN/DF = 2.28, NFI = 0.965, TLI = 0.980, CFI = 0.979, RMSEA = 0.052, SRMR = 0.0246) according to model fit criteria for structural equation modeling (Dash and Paul 2021). In the EFA sample, the meat consumption scale demonstrated good internal consistency reliability (α=.68, CR = .71), however, reliability was lower in the CFA sample (α=.50, CR = .55). Participants reported their consumption of beef, lamb, poultry, pork, bacon/ham, and other processed meats in the past 2 weeks, indicating for each meat category 1) meat frequency: the number of times they ate each type of meat; and 2) meat quantity: the average quantity of each serving for each meat type (1 = very small (less than 10% of a typical meal); 2 = small (10–20% of a typical meal); 3 = medium (21–30% of a typical meal); 4 = large (31–40% of a typical meal; and 5 = very large (more than 40% of a typical meal)). For scoring, when meat type frequency = 0, the corresponding portion size question was skipped and automatically given a score of zero. For each of the six meat categories, frequency scores were multiplied by quantity scores to produce indicators for the meat consumption construct. A single combined pork/bacon/ham indicator item was created by summing the total pork score with the total bacon/ham score. A single combined beef/lamb indicator item was created by summing the total beef score with the total lamb score. This created four indicators for the meat consumption construct: MC1 (beef/lamb), MC2 (poultry), MC3 (pork/bacon/ham), and MC4 (other processed meats), and three indicators for the RPMC construct: RPMC1 (beef/lamb), RPMC2 (pork/bacon/ham), RPMC3 (other processed meats). Higher scores indicated greater meat consumption.

To measure *willingness to reduce meat consumption* we adapted a 3-item scale used in the previous research that has demonstrated good reliability (Graça et al., 2015). The scale comprised three items asking the extent of the participants' willingness to 1) "slightly reduce your meat consumption;" 2) "drastically reduce your meat consumption;" and 3) "stop eating meat altogether," from 1 (*very unwilling*) to 5 (*very willing*). Higher scores indicated greater willingness to reduce one's meat consumption.

Predictors

For traditional masculine norms, ten subscales of the Conformity to Masculine Norms Inventory Short Form (CMNI-30; Levant et al. 2020), a short version of the original CMNI (Mahalik et al. 2003), each containing three items, measured: *winning*; *emotional control*; *playboy*; *violence*; *heterosexual self-presentation*; *pursuit of status*; *primacy of work*; *power over women*; *self-reliance*; and *risk-taking*. The CMNI-30 subscales have demonstrated good model fit, convergent validity, test-retest reliability, and internal reliability (α between .71 and .94) in various ethnic groups (Krivoshchekov, Gulevich, and Ostroverkhova 2022; Levant et al. 2020). Additionally, two subscales were taken from the Male Role Norms Inventory Short Form (MRNI-SF; Levant, Hall, and Rankin 2013) to test the hypotheses regarding *toughness* and *importance of sex*. The MRNI-SF subscales have demonstrated good construct, discriminant, and concurrent validity and good internal reliability in previous research (Levant et al. 2015, 2016). All traditional masculinity subscale scores ranged from 3 to 18.

For non-traditional masculine norms, five subscales from the New Masculinity Inventory (NMI; Kaplan, Rosenmann, and Shuhendler 2017) measured: *holistic attentiveness* (4 items; scores ranging from 4 to 24); *questioning definitions of masculinity* (4 items; scores ranging from 4 to 24); *sensitivity to male privilege* (2 items; scores ranging from 2 to 12); *authenticity* (4 items; scores ranging from 4 to 24); and *domesticity/nurturing* (3 items; scores ranging from 3 to 18). The NMI has demonstrated good convergent and discriminant validity (Kaplan, Rosenmann, and Shuhendler 2017). The low internal reliability of the sensitivity to male privilege subscale in our sample is consistent with Kaplan, Rosenmann, and Shuhendler (2017) Israeli sample. Participants answered all traditional and non-traditional masculinity items on a 1 (*strongly disagree*) to 6 (*strongly agree*) scale. Higher scores indicated greater conformity to the masculine norm.

Control variables

Social Dominance Orientation was measured using the 4-item Short Social Dominance Orientation Scale (Pratto et al. 2013), which has demonstrated reliability and construct validity in 20 countries (Braunsberger et al. 2021; Pratto et al. 2013). Higher scores indicate greater SDO. People from urban areas are more likely to follow plant-based diets than people living in rural areas (Graça, Godinho, and Truninger 2019), therefore geographic location was also controlled for (0=urban; 1=rural). As older (Horgan et al. 2019; Pfeiler and Egloff 2020) and more educated (Corrin and Papadopoulos 2017; Ruby 2012) people tend to eat less meat, age (measured continuously) and education (above versus below university education) were also controlled for. People's meat consumption may be partly explained by the affordability of certain meats, hence, personal income was also used as a control variable (measured continuously). Finally, heterosexual men may have more reason to

eat meat than non-heterosexual men, if they believe women find meat-eaters more sexually attractive. Hence, sexual orientation was controlled for (0=heterosexual, 1=non-heterosexual).

Results

Measurement Model Evaluation

Indicator reliability for each construct was assessed according to Hair and Alamer's (2022) recommendations, where indicators with loadings < 0.7 were deleted, except when to do so reduced the construct's internal consistency reliability and validity and the item loading was greater than 0.40. In the meat consumption model, the factor loading of authenticity (item #4) fell below the 0.4 cut-off and was deleted. Factor loadings of self-reliance (item #3), questioning definitions of masculinity (item #4), pursuit of status (item #3), holistic attentiveness (items #1, #2, and #3), authenticity (item #1), domesticity/nurturing (item #1), and meat consumption (items #3 and #4) fell between 0.4 and 0.7, and were evaluated further. The model was rerun, removing the lowest loading item from each of these constructs, to assess whether factor loadings, reliability, and validity improved after removing the items (by comparing α, CR, and AVE values). For authenticity, questioning definitions of masculinity, holistic attentiveness, self-reliance, and meat consumption, CR and AVE values improved after removing the lowest loading indicators. Therefore, these items were dropped and the final model was run predicting meat consumption measured with three indicators (MC1=beef/lamb, MC2=poultry, MC3=pork/bacon/ham). However, as CR and AVE values fell below recommended thresholds when removing indicators from domesticity/nurturing and pursuit of status constructs, and all indicators were significant, these items were retained.

In the RPMC model, the factor loadings of authenticity (item #4) and questioning definitions of masculinity (item #4) fell below the 0.4 cut-off and were deleted. Factor loadings of self-reliance (item #3), pursuit of status (item #3), holistic attentiveness (items #1, #2, and #3), domesticity/nurturing (item #1), winning (item #3), and RPMC (items #2 and #3) fell between 0.4–0.7 and were evaluated further. When rerunning the model deleting the lowest loading item from these constructs, reliability, and validity improved for authenticity, holistic attentiveness, questioning definitions of masculinity, self-reliance, and winning. Therefore, these items were removed and the model was run predicting RPMC measured with two indicators (RPMC1=beef/lamb, RPMC2=pork/bacon/ham). Removing domesticity/nurturing and pursuit of status items reduced reliability and validity, and these indicators were significant, they were retained. Playboy (item #2) was > .7 but not significant, therefore this item was dropped.

In the willingness to reduce meat consumption model, two playboy items (#1 and #2) did not load significantly onto the construct. To avoid including a single-item construct the playboy norm was excluded from the WRMC model as it did not demonstrate adequate indicator reliability. The factor loadings of questioning definitions of masculinity (item #4) and self-reliance (item #3) fell below the 0.4 cut-off and were deleted. Factor loadings of authenticity (item #4), domesticity/nurturing (item #3), holistic attentiveness (items #1 and #3), self-reliance (item #1), pursuit of status (item #3), and winning (item #3) fell between 0.4 and .7, and were evaluated further. For authenticity, questioning definitions of masculinity, and self-reliance, α, CR and AVE values improved after removing the lowest loading indicators. However, removing indicators caused α, CR, and AVE to fall below acceptable thresholds for holistic attentiveness, domesticity/nurturing, pursuit of status, and winning; and as these indicators loaded significantly onto their constructs these items were retained. In the final meat consumption, RPMC, and willingness to reduce meat consumption models, all indicators for all constructs loaded significantly onto their respective constructs with a minimum factor loading of 0.50 (see Figures 1–3), providing evidence of indicator reliability (Fornell and Larcker 1981; Goller and Hilkenmeier 2022).

Internal consistency reliability was assessed with Cronbach's alpha (α) and composite reliability (CR) ≥0.60 (Hair et al. 2021). Convergent validity was assessed with average variance extracted (AVE) values ≥ .50 (Dash and Paul 2021). Results are displayed in Table 2. All constructs met the minimum α, CR and AVE thresholds except for STMP (α=.36), meat consumption (α=.51), and RPMC (α=.30). These constructs were retained in the analysis because indicator reliability, CR, and AVE were acceptable, and CR is a more accurate and preferable measure of scale reliability in SEM than Cronbach's α (Cheung et al. 2023; McNeish 2018). Discriminant validity was assessed with Fornell and Larcker's criterion (1981), whereby the square root of the AVE for each construct should be greater than correlations with other model constructs (Supplementary C). All constructs met this criterion, demonstrating discriminant validity.

Structural model evaluation

The PLS-SEM was run with 10,000 bootstrapped samples (two-tailed), with the models converging in 11 (meat consumption), 13 (RPMC), and 7 (willingness to reduce meat consumption) iterations. The meat consumption (SRMR = 0.055), RPMC (SRMR = 0.055), and willingness to reduce (SRMR = 0.057) models demonstrated good fit, with SRMR < 0.08. Income, conformity to the violence norm, and conformity to the importance of sex norm were significant positive predictors, and age was a significant negative predictor, of

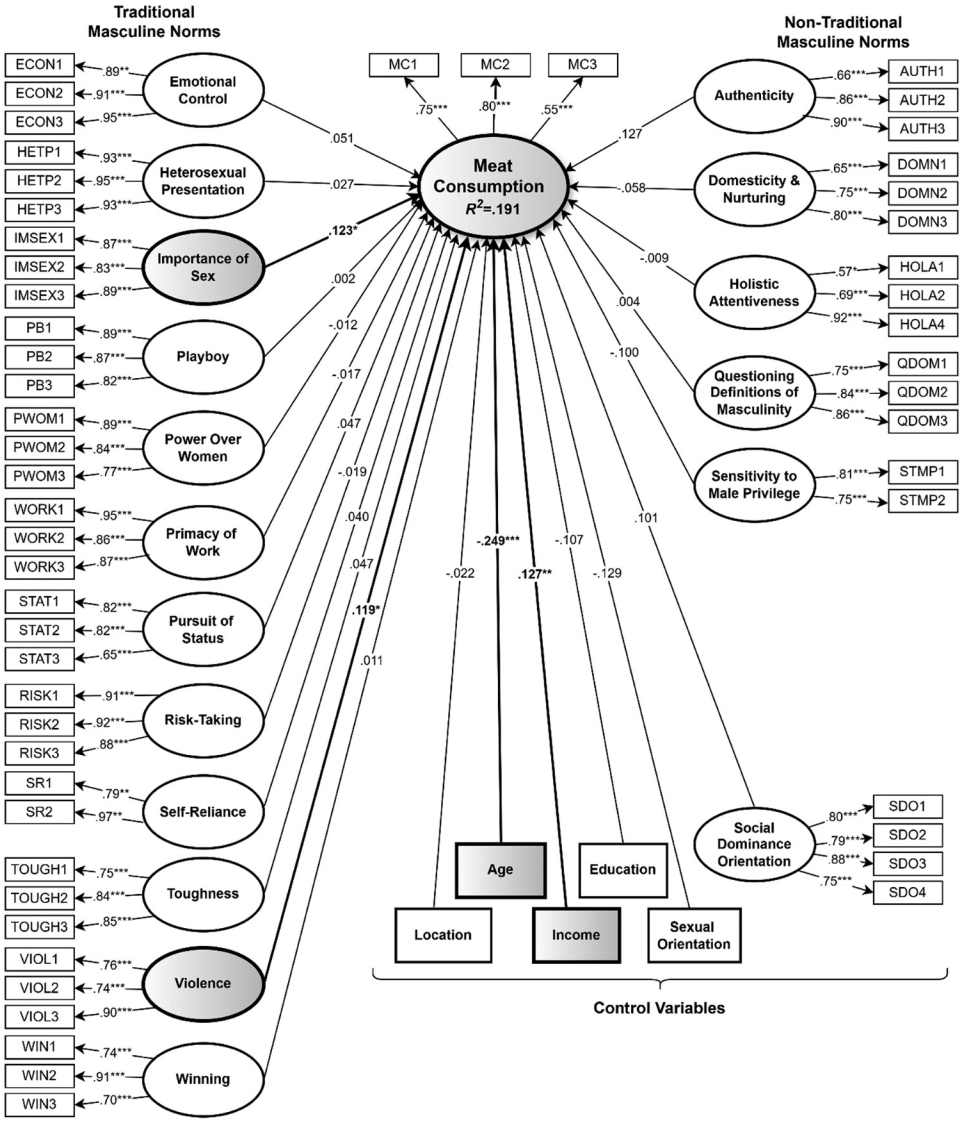

Figure 1. PLS-SEM model predicting meat consumption, including both the measurement (outer) and structural (inner) models. Note. ***= p≤.001, **=p≤.01, *p≤.05. Significant predictors are displayed with shading and bold.

meat consumption. That is, younger men, those with higher incomes, those who endorse the use of physical violence, and place greater importance on sexual virility, tended to eat more meat. Social dominance orientation, violence, and importance of sex were significant positive predictors, and age and sexual orientation were significant negative predictors, of RPMC. That is, younger, heterosexual men, who place a higher importance on sexual virility, and endorse hierarchical inter-group relations and the use of physical violence, tended to eat more red and processed meat. Social dominance orientation was

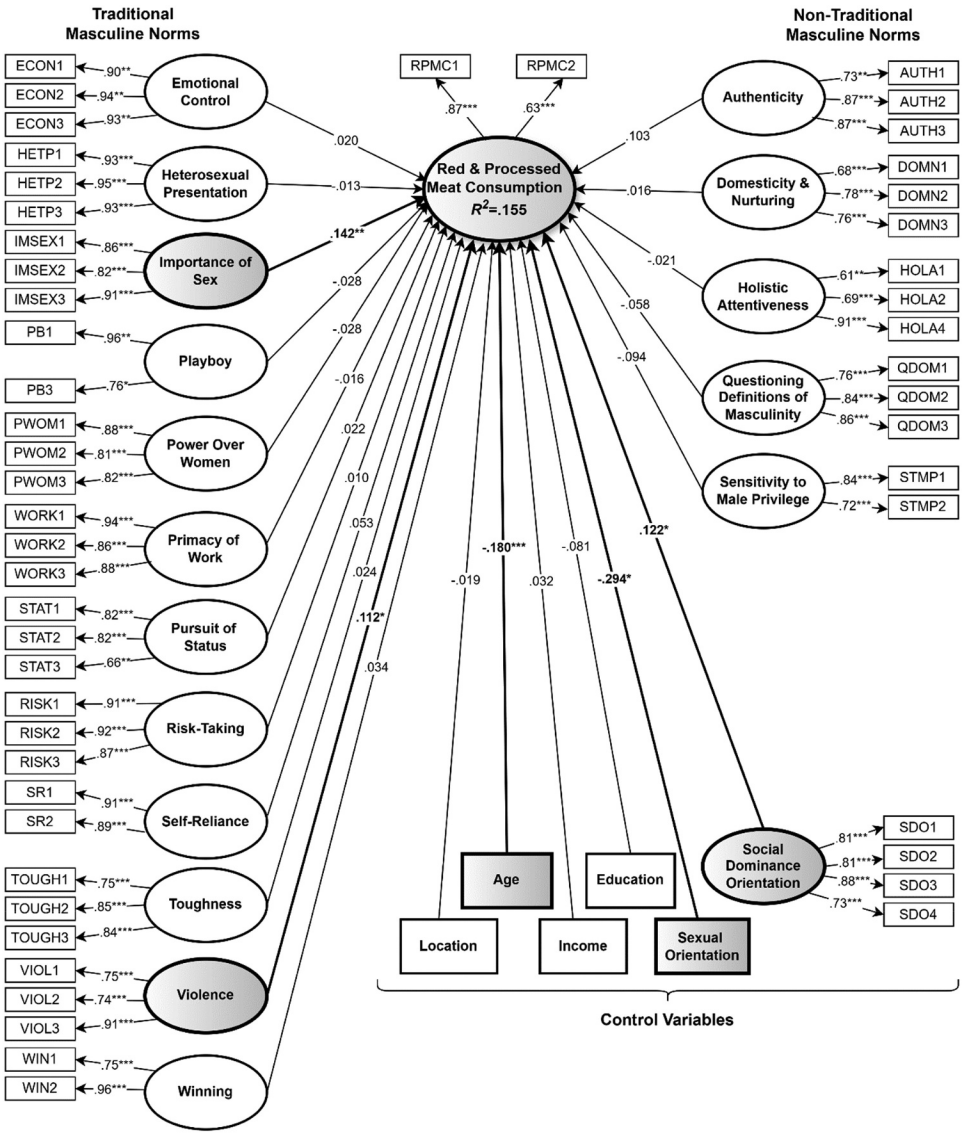

Figure 2. PLS-SEM model predicting red and processed meat consumption, including both the measurement (outer) and structural (inner) models. Note. ***= p≤.001, **=p≤.01, *p < .05. Significant predictors are displayed with shading and bold.

a significant negative predictor, and sensitivity to male privilege was a significant positive predictor, of willingness to reduce meat consumption, such that men with greater preferences for inter-group equality, and those with greater gender egalitarian views, tended to be more willing to reduce their meat consumption.

The models explained 19.1% variance in men's meat consumption (R^2=.191, $p < .001$), 15.5% variance in men's RPMC (R^2=.155, $p < .001$), and

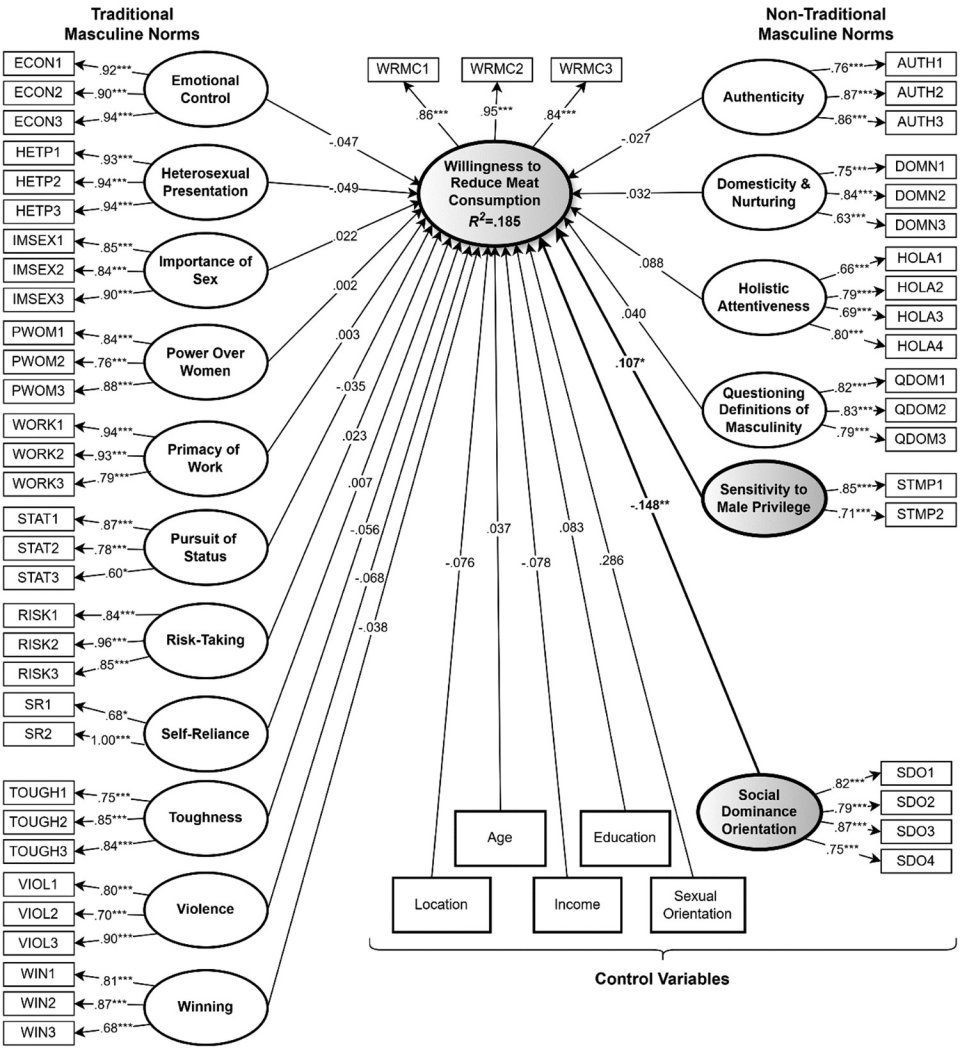

Figure 3. PLS-SEM model predicting willingness to reduce meat consumption, including both the measurement (outer) and structural (inner) models. Note. ***= p≤.001, **=p≤.01, *p≤.05. Significant predictors are displayed with shading and bold.

18.5% variance in men's willingness to reduce their meat consumption (R^2=.185, $p < .001$), which is considered weak explanatory power (Hair et al. 2021). All Q^2 values were greater than 0, but below 0.25 (Table 3), indicating that all models had adequate predictive relevance. The models' predictive power was assessed with Shmueli et al. (2019) k-fold cross validation using the SmartPLS $PLS_{predict}$ algorithm, run with 10 folds and 10 repetitions. As can be seen in Table 3, for all meat consumption, RPMC, and willingness to reduce meat consumption indicators, the PLS-SEM RMSE values were less than the naïve linear regression model benchmark (LM) RMSE values, indicating that all models had high predictive power (Shmueli et al. 2019).

Table 3. Predictive Power of PLS-SEM Models.

Model	Model Indicators	Q^2	PLS-SEM RMSE	LM-RMSE
Meat Consumption	MC1 (beef/lamb)	0.055	14.43	15.00
	MC2 (poultry)	0.070	14.88	15.57
	MC3 (pork/bacon/ham)	0.012	11.87	12.43
Red & Processed Meat Consumption	RPMC1 (beef/lamb)	0.048	14.48	15.01
	RPMC2 (pork/bacon/ham)	0.009	11.88	12.39
Willingness to Reduce Meat Consumption	WRMC1	0.100	1.19	1.23
	WRMC2	0.081	1.22	1.27
	WRMC3	0.063	1.25	1.30

Note. To demonstrate predictive power, Q^2 should be > 0, and the PLS-SEM RMSE values must be lower than the LM-RMSE values. PLS-SEM<LM for no indicators = no predictive power; PLS-SEM<LM for a minority of indicators = low predictive power; PLS-SEM<LM for a majority of indicators = medium predictive power; PLS-SEM<LM for all indicators = high predictive power (Shmueli et al. 2019).

Discussion

Throughout Western countries there is a pervasive association between meat and masculinity. Although masculinity ideologies are multifaceted, previous studies have only investigated the relationship between meat consumption and masculinity measured as a global construct. Hence, it is unclear which dimensions of masculinity account for the meat-masculinity link. To extend knowledge of the meat-masculinity link, the current study sought to identify which masculine norms predicted men's total meat consumption, red and processed meat consumption (RPMC), and willingness to reduce meat consumption, while controlling for age, education, personal income, geographic location, sexual orientation, and social dominance orientation (SDO). Insights can potentially refine models of men's meat consumption and improve men's health by informing interventions of which masculine norms may serve as barriers and facilitators to men's meat reduction.

Overall, younger men, and men with higher incomes, tended to eat more meat overall, consistent with findings in UK, US, and Australian samples (Horgan et al. 2019; Neff et al. 2018; Pfeiler and Egloff 2020). Younger, heterosexual men, and those high on SDO tended to eat more red and processed meat. Conformity to the traditional masculine norms of *violence* and *importance of sex* positively predicted men's overall meat consumption and RPMC, whereas conformity to the non-traditional masculine norm *sensitivity to male privilege* positively predicted men's willingness to reduce their meat consumption.

Masculine norms contributing to the meat-masculinity link

In line with hypotheses, the traditional masculine norms supporting the use of violence and placing greater importance on sex were positive predictors of men's meat consumption and RPMC. That is, men who believed that it is acceptable to use physical violence, and placed greater importance on sexuality virility, tended to eat more meat. Campos, Bernardes, and

Godinho (2020) also found a connection between meat and conformity to violence, such that the violence norm mediated the relationship between participant sex and RPMC. They found that men's higher conformity to the violence norm explained why male participants ate greater quantities of meat than female participants. It appears that people who hold more accepting views toward violence are more likely to eat meat (Hamilton 2015), perhaps because this accepting attitude about violence toward others may extend to animals, as animal slaughter is an inherently violent act. It is likely that an individual who feels morally comfortable perpetrating violence against humans would have less objection with violence toward farm animals – as farm animals are generally attributed a low moral status and can be perceived as unworthy of moral consideration (Caviola, Everett, and Faber 2019).

Regarding men's sexuality, the importance of sex norm asserts that men should desire and "be ready" for sex at all times, indicating that men who placed greater importance on being sexually virile tended to eat more meat. It's possible that some men believe that eating meat enhances sex drive, as this was reported as a reason for eating red meat by 22.4% of Australian male meat-eating participants in a previous study (Bogueva, Marinova, and Raphaely 2017) and has been mentioned by European male athletes as a reason for eating meat (van der Horst, Sällylä, and Michielsen 2023). Consistent with Campos, Bernardes, and Godinho (2020) findings, in the current study the playboy norm – that men should have multiple sexual partners – did not predict men's meat consumption. Previous studies have found that men showed a greater preference for meat when sexually motivated (Chan and Zlatevska 2019a; Timeo and Suitner 2018). In both studies, researchers attributed men's preference for meat to the intention to increase their sexual attractiveness. Arguably, men who desire multiple sexual partners have greater motivation to enhance their sexual attractiveness. Therefore, as the playboy norm was not related to men's meat consumption in the current study, our results suggest that men may prefer meat when sexually motivated to enhance their sexual virility, rather than their sexual attractiveness.

Although the heterosexual self-presentation norm was not a significant predictor as hypothesized, sexual orientation was the strongest predictor of RPMC, though not overall meat consumption, such that heterosexual men ate more red and processed meat than non-heterosexual men. This supports the link previous scholars have drawn between meat consumption and heterosexuality, and in particular, red and processed meats such as hotdogs, smoked meats, and beef burgers (Buerkle 2009; Lapiņa and Leer 2016). Our results confirm that heterosexuality is linked specifically to red and processed meat consumption, rather than overall meat consumption patterns, indicating that heterosexual men are more at risk of developing health issues associated with RPMC.

The finding that men's meat consumption and RPMC was predicted only by traditional masculine norms (i.e., violence and importance of sex), but not any of the non-traditional masculine norms, is inconsistent with previous research finding that global conformity to non-traditional masculinity negatively predicts meat consumption (De Backer et al. 2020; Peeters et al. 2022). However, these previous studies used a different measure of meat consumption, did not include both traditional and non-traditional masculinity within the same analysis, nor control for SDO. When considering both types of masculinity ideologies, as well as SDO, the current study demonstrates that traditional masculine norms, and in particular, violence and importance of sex, better predict men's meat consumption than non-traditional masculine norms.

Sensitivity to male privilege was the only masculine norm that predicted men's willingness to reduce their meat consumption, in addition to the control variable SDO. Specifically, men who held greater gender egalitarian views, and who favored egalitarian social structures, were more willing to reduce their meat intake. Both constructs promote values of social equality, which is consistent with previous research finding that values related to power and hierarchy are associated with greater meat consumption and a more negative attitude to meat reduction, whereas values of universalism (i.e., concern for welfare of all people and nature; Schwartz, 2012) are associated with reduced meat consumption and a more positive attitude to meat reduction (Hayley, Zinkiewicz, and Hardiman 2015; Holler et al. 2021). The connection between meat consumption and gender relations has been highlighted by Adams (1990), who argued that meat consumption is a manifestation of patriarchal social structures, in which animals are dominated, objectified, and consumed in the same manner as women. However, in the current study, the traditional masculine norm "power over women" – the belief that women should submit to men's authority – was not a predictor in any model, as would be expected according to Adams' theory. This is potentially a result of controlling for SDO, a conceptually overlapping construct which is likely to share a high amount of variance with power over women (i.e., both SDO and power over women endorse dominance over others; the former more generally, the latter specifically toward women). Moreover, the sensitivity to male privilege norm emphasizes the *male* gender role, and specifically, advantages afforded to men, whereas the power over women norm emphasizes the *female* gender role, and specifically, the need for women to submit to men's control. It may be that sensitivity to male privilege better accounts for the aspect of gender relations related to men's meat consumption, over and above an individual's domination tendency. Although our findings cannot explain how or why higher sensitivity to male privilege relates to men's willingness to reduce their meat intake, it appears that this dimension of non-traditional masculinity is important and warrants further exploration.

Notably, willingness to reduce meat consumption was predicted only by a non-traditional masculine norm, but none of the traditional masculine norms, suggesting that non-traditional masculinity ideology, and specifically, sensitivity to male privilege, is more important than traditional masculine norms for predicting meat reduction-related behaviors. This is supported by findings from a hypothetical food choice experiment that tested the influence of traditional and non-traditional masculinity on men's preference for a meat versus plant-based burger (Leary et al. 2023). Men high in conformity to non-traditional masculinity were more likely to select the plant-based burger, whereas conformity to traditional masculinity did not influence burger choice, suggesting that non-traditional masculinity, rather than traditional masculinity, is instrumental in men's willingness to eat plant-based meat alternatives.

Implications and practical applications

Masculine norms explained a significant but small proportion of variance in men's overall meat consumption, RPMC, and willingness to reduce meat consumption, with all models demonstrating weak explanatory power but strong predictive power. Shmueli et al. (2019) suggest that when a PLS-SEM model has weak explanatory power but strong predictive power the theory may need to be extended. Results therefore indicate that masculine norms are likely to play an important but ancillary role in men's meat consumption and willingness to reduce, and hence, that additional factors are needed to provide a comprehensive model of men's meat consumption. Masculine norms should be considered in conjunction with other important psychosocial factors known to predict meat consumption, such as emotions like empathy and disgust, attitudes, habit, meat-related cognitive dissonance strategies, and practical factors such as perceived behavioral control and the perceived price and convenience of meat and meat-free meals (Graça, Godinho, and Truninger 2019, Rothgerber and Rosenfeld 2021; Stoll-Kleemann and Schmidt 2017). Nevertheless, several masculine norms had a strong ability to predict men's meat consumption over and above six control variables, and results were consistent with previous research demonstrating that conformity to masculine norms predict men's meat consumption and willingness to reduce their meat intake (e.g., Peeters et al. 2022; Rosenfeld and Tomiyama 2021; Stanley, Day, and Brown 2023). Considering that numerous experiments have consistently shown that men's meat consumption is influenced by concerns about feeling or appearing masculine and about meeting gender role expectations (Leary et al. 2023; Mesler, Leary, and Montford 2022; Pohlmann 2022), we argue that a model of men's consumption would be incomplete without the inclusion of masculine norms, and that researchers investigating men's meat consumption should consider the role of masculinity alongside other psychosocial factors.

Only a subset of masculine norms predicted men's meat consumption and willingness to reduce, which has methodological implications for investigating the meat-masculinity link. Global measures of masculinity are a more parsimonious option for predictive models of meat consumption, and may have greater predictive value, but can overlook the specific dimensions of masculinity impeding men's meat reduction or moderating experimental effects. Investigating specific masculine norms may have greater practical utility for informing men's meat reduction interventions. For example, as importance of sex was a positive predictor of meat consumption, there may be an underlying belief that meat enhances men's sex drive, possibly because red meat is rich in zinc, a mineral that supports men's fertility and libido (Fallah, Mohammad-Hasani, and Colagar 2018; Zitzmann, Faber, and Nieschlag 2006). Informing men about alternate sources of zinc could be accompanied with information on the impacts of diet on sexual functioning. For example, a systematic review found high meat consumption is positively associated with erectile dysfunction, against which the Mediterranean diet offers the best protection (Defeudis et al. 2022), which includes higher consumption of vegetables, fruits, nuts, legumes, cereals and fish, and lower meat and dairy consumption (Davis et al. 2015).

In conjunction with the literature, our findings suggest that non-traditional masculinity, particularly sensitivity to male privilege, has the most impact on men's willingness to reduce and meat-reduction-related behaviors. It may therefore be important to promote gender egalitarian attitudes among younger generations to indirectly foster greater openness to meat reduction in the long term, whilst challenging antifeminist and patriarchal ideologies promoted by the "manosphere" (Han and Yin 2023) and social media "manfluencers" such as Andrew Tate, currently popular and highly influential among young males (Roberts and Wescott 2024; Wescott, Roberts, and Zhao 2024). A notable finding was that younger, heterosexual men, high on SDO were more unhealthy meat consumers, tending to eat more red and processed meat. It would therefore be worthwhile for meat-reduction interventions to target this demographic of meat consumers.

Limitations & future research

Several limitations should be noted. Cronbach's alpha for the meat consumption, RPMC, and sensitivity to male privilege constructs was low. This was to be expected with the two-item sensitivity to male privilege scale, which demonstrated low internal consistency (α=.18) in the original validation study (Kaplan, Rosenmann, and Shuhendler 2017), and the two-item RPMC scale, due to the very low number of scale items (Taber 2018). Low internal consistency is also expected with any frequency scale, and especially meat preferences, where there are a wide variety of consumption patterns among

individuals, such as meat lovers, compulsive meat-eaters, flexitarians, pescatarians, and vegetarians/vegans (Kemper et al. 2023). As Cronbach's alpha is a measure of consistency in participants' scale item response patterns, we could therefore expect some level of inconsistency in the response patterns of different types of consumers in our sample, which included participants with meat-eating and meat-avoiding dietary patterns. As CR is a more appropriate measure of reliability for SEM (Cheung et al. 2023; McNeish 2018), and the meat consumption scale underwent psychometric testing with EFA and CFA prior to the analysis, the low Cronbach's alpha for these scales was not viewed as majorly problematic, though researchers may wish to interpret the results cautiously.

Notably, the PLS-SEM analysis needed a minimal sample of 618 participants; hence, with our sample of 557 the analysis may not have had adequate power to detect all effects. However, given the very small effect sizes detected in the study, it's unlikely the current study was underpowered. Moreover, simulation experiments have shown that the inverse square root method consistently overestimates minimum sample sizes requirements (Kock and Hadaya 2018), and PLS-SEM has less stringent sample size requirements than CB-SEM (Willaby et al. 2015); "compared with its covariance-based counterpart, PLS-SEM has higher levels of statistical power in situations with complex model structures and smaller samples sizes" (Hair et al. 2021, 16). Another limitation was that effect sizes in the current study were small. However, considering that a substantial body of literature has consistently identified a relationship between men's meat consumption and masculinity, and that masculine norm effect sizes were similar in Campos, Bernardes, and Godinho's (2020) study, we consider the small effects observed in this sample to be meaningful and more broadly generalizable to male populations, at least in Australian and British culture. Of course, further research is necessary to confirm the results of the current study, as findings were based on data from a convenience sample of Australian and English men. As cross-sectional designs cannot infer causal relationships, future studies could determine whether conformity to the masculine norms highlighted in this study influences meat-preferences in experimental designs or interventions. Moreover, explanations for why these masculine norms predicted men's meat consumption remain speculative. Investigating how and why these norms predict men's meat consumption can better inform theory and interventions.

Conclusion

By modifying the methodological approach commonly used in the previous meat-masculinity research, whereby we utilized a multidimensional rather than global measure of masculinity, the current study extended knowledge of the meat-masculinity link by highlighting which specific masculine

norms contribute to men's meat consumption and reduction. Men who believe it is acceptable to use physical violence and who place a high importance on sexual virility tended to eat more meat overall and more red and processed meat. Willingness to reduce meat consumption tended to be highest among men who hold gender egalitarian views. By controlling for several variables, results were not attributed to differences in participants' age, education, personal income, geographic location, sexual orientation, or endorsement of social dominance orientation. Importantly, by controlling for social dominance orientation, results confirm that the relationships between meat consumption and conceptually related masculine norms (i.e., violence, sensitivity to male privilege) were not explained by participants' preference for hierarchical social structures (i.e., high social dominance orientation), but more specifically, by men's attitudes regarding physical violence toward others and their sensitivity to the advantages afforded to men in patriarchal social structures. By demonstrating that specific dimensions of masculinity predict men's meat consumption, results support a multidimensional perspective of the meat-masculinity link.

The models explained a small but significant portion of variance in outcome variables, indicating that a comprehensive model of men's meat consumption should include masculine norms alongside various additional factors. As the models had strong predictive power, conformity to masculine norms regarding violence, importance of sex, and sensitivity to male privilege appear to have a strong capacity to predict men's meat consumption and level of willingness to reduce their meat intake. Overall, the study highlights the importance of gender role norms for understanding and changing men's meat-eating patterns. Challenging and modifying men's attitudes to violence and beliefs about meat and sexual virility, while fostering gender equality, may be important strategies to reduce men's meat intake and ultimately improve men's health outcomes.

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Authors' contributions

Lauren Camilleri: conceptualization, methodology, data curation, formal analysis, writing – original draft. Peter Richard Gill, Andrew Jago, Jessica Scarfo, Melissa Kirkovski: conceptualization, methodology, supervision, writing – review and editing.

Availability of data and materials

Data is available upon reasonable request at https://doi.org/10.17026/dans-zbe-dzn4.

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ORCID

Lauren Camilleri http://orcid.org/0000-0001-5866-4844
Melissa Kirkovski http://orcid.org/0000-0003-3395-8525
Jessica Scarfo http://orcid.org/0000-0002-7745-9691
Andrew Jago http://orcid.org/0000-0002-0823-9927
Peter Richard Gill http://orcid.org/0000-0001-7772-4849

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