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**Correlational Study and Randomised Controlled Trial for Understanding and Changing Red
Meat Consumption: The Role of Eating Identities**

Abstract

Rationale: The present studies aimed to contribute to the literature on psychological variables involved in reducing red meat consumption (RMC).

Objective: Study 1 investigated whether the theory of planned behaviour (TPB), plus healthy-eating and meat-eating identities, could explain intentions to reduce RMC. Study 2 evaluated the effectiveness of an SMS intervention on self-monitoring to reduce RMC.

Methods: In Study 1, data were collected daily using online food diaries for one week and a TPB questionnaire. Study 2 was a randomised controlled trial assessing pre and post RMC and TPB constructs by online food diaries and questionnaires over a one-week period. Participants were Italian undergraduates in each study (Study 1: N = 405; Study 2: N = 244). In Study 2, participants were randomly allocated to control and message condition groups. Participants in the message condition group received a daily SMS, which reminded them to monitor RMC, while participants in the control group did not receive any message. Only students who completed all measures were considered in the analyses (Study 1: N = 342; Study 2: N = 228).

Results: Study 1 showed that affective and instrumental attitudes, perceived behavioural control and meat-eating identity explained intentions to reduce RMC, while subjective norm, past behaviour and healthy-eating identity did not. Study 2 showed that an SMS intervention was effective in increasing intentions and reducing RMC. Mediation analyses indicated partial serial mediation through healthy-eating and meat-eating identities and intentions.

Conclusion: The present studies provide support for the predictive validity of TPB in explaining intentions to reduce RMC and for the efficacy of an SMS intervention targeting self-monitoring in reducing RMC. Findings confirmed the important role of eating identities in explaining intentions to reduce RMC and in changing this behaviour.

Keywords: Italy; healthy eating; messages; theory of planned behaviour; red meat; self-monitoring; self-identity; health promotion.

Introduction

During the last century, economic development, urbanisation, and changes in the food industries have produced a massive increase in red meat consumption (RMC; Stabler, 2011; Popkin, 2001) in the Western world. This has led to a vivid debate about this eating behaviour and its impact on the environment and health (e.g., Pluhar, 2010). In this regard, studies indicate a correlation between high consumption of red meat and a high risk of developing different types of cancer, type 2 diabetes, coronary heart diseases, and obesity (e.g., Pan et al., 2012). These findings have been recently endorsed by the World Health Organization (2015), who classified the excessive consumption of red meat as probably carcinogenic to humans.

Despite the proven risks, especially in Western countries, RMC exceeds the recommended amount suggested by health institutions (e.g., WCRF/AICR, 2007). This is not more than two medium servings of red meat per week (approximately 200 grams a week; e.g., Bach-Faig et al., 2011). In fact, Europeans on average consume 51 grams per day of red meat (women consume an average of 33.1 grams per day). In Italy, men consumed an average of 57.8 grams per day of red meat whereas for women it was 40.8 grams (Rohrmann et al., 2013).

Despite the importance of this topic, few scholars have focused their research interests on reduction of meat consumption and no studies have been conducted in southern European populations (but see Bertolotti, Chirchiglia & Catellani, 2016). The present research aimed to address this gap in the literature and contribute to our understanding of which factors are involved in this behaviour.

Theory of planned behaviour for predicting the behaviour to avoid or eat meat

For this purpose, Ajzen's theory of planned behaviour (TPB; Ajzen, 1991) provides a useful model for the analysis of these eating behaviours, as several studies have shown TPB constructs to be strong predictors of dietary behaviours (e.g., Armitage & Conner, 2001; Conner & Norman, 2005; McEachan et al., 2011). This theory argues that intention to perform a behaviour is the best

predictor of that behaviour and that intention is explained by attitude, subjective norm, and perceived behavioural control (PBC) in relation to that behaviour.

The few studies on meat consumption using the TPB model have led to divergent results. Although some authors showed that only attitude predicted intentions to reduce meat consumption (Sparks, Guthrie, & Shepherd, 1997; Zur, 2012; Zur & Klöckner, 2014), other researchers found that PBC and subjective norm (Graça, Calheiros, & Oliviera, 2015; Richetin, Conner, & Perugini, 2011) were also important predictors. However, previous studies failed to investigate the role of self-identity on intentions to consume meat even though a number of studies have examined the role of self-identity within the TPB. Finally, there is a lack of studies in the literature that examined the role of self-identity in predicting RMC controlling for past behaviour.

Self-identity

Generally, the concept of self-identity refers to a salient aspect of one's self-perception. In line with identity theory (Stryker, 1968), the self can be considered as a social construct related to the individuals' different roles in social contexts. Roles are formed by internalised expectations about role-appropriate behaviour (Simon, 1992); therefore, the more significant the identity, the more it should enhance the intention to implement the associated behaviours (Charng, Piliavin, & Callero, 1988). Moreover, people could perform a behaviour as a reflection about the kind of person they are (e.g., Ball & Tasaki, 1992). Specifically, consuming different products could be considered as part of a person's self-presentation used as a strategy for expressing their identity to others (Goffman, 1959).

Food consumption acquires an important role in the development of individual identities because food products can be used to construct and preserve individual narratives of the self (Somers, 1994). The choice of a particular food is connected with concerns over identity (e.g., Fox & Ward, 2008; Stead et al., 2011), and people perceive that individuals' character traits can be comparable with the food that they consume (Nemeroff & Rozin, 2000). In summary, the self-identity about personal eating habits is particularly relevant as food is pivotal in our sense of

identity (Fischler, 1988) and identity is linked to eating behaviour (Oyserman, Smith, & Emore, 2014).

Evidence suggests that self-identity represents an additional predictor of dietary intentions over and above TPB variables (Carfora, Caso, & Conner, 2016a; Caso, Carfora & Conner, 2016; Sparks & Guthrie, 1998; Sparks et al., 1995). The only attempt to consider self-identity as an additional component within the TPB applied to meat intake was the research of Povey, Wellens, and Conner (2001), which demonstrated that the self-identity as healthy eater did not have a significant impact on intention. In this work, intention to eat a meat diet was explained by positive attitude, followed by PBC and subjective norm. However, another dimension of self-identity probably could be related to meat consumption. Specifically, in light of findings that nutrition and related health consequences of meat consumption were less relevant when meat identification increased (Allen & Ng, 2003), we hypothesised that meat-eating identity (Blake et al., 2013) could be a useful predictor of intention to reduce meat consumption. Furthermore, this hypothesis is in line with recent findings about the “Discourse on meat,” defined as “talk about meat (speaking), cooking and eating (doing), the enactment of meat-eater identities (being), the assessment of eating behaviours (valuing), and beliefs about meat (believing)” (Bohm et al., 2015; p. 102). This study showed that one of the most important aspects was the centrality of the meat-eater identity, compared with the responsibility for one’s own wellbeing; only the latter was related to the beliefs about the health advantages of reducing meat intake.

Intervention for reducing meat intake

Furthermore, given the previously highlighted benefits of reducing RMC, it could be interesting to use TPB framework to develop and test an intervention to reduce RMC. Few studies have reported interventions to reduce RMC. Scrimgeour (2012) reported a significant effect of an intervention based on web-based information targeting beliefs about meat consumption, meat consumption attitudes, and intention. The intervention was found to decrease positive attitudes towards meat and increase intentions to eat less meat. Allen and Baines (2002) reported a

manipulation of the symbolic meaning of meat to increase intention to eat more fruit and vegetables and their consumption 3 weeks later. Berndsen and van der Pligt (2004) manipulated the relative impact of a cognitive versus affective focus when judging risks concerning the consumption of meat. They found that after 3 weeks, only participants in the affective condition compared with the control condition reported higher intentions to reduce meat intake and less consumption of meat over the past 3 weeks.

In the present study, we tested a text message intervention to reduce RMC. In the last decade, the use of text messages (SMS) has been used as strategy to promote health because of their useful characteristics, such as convenience, immediacy, and low cost (e.g., Kharbanda et al., 2009). Particularly, text messaging appears to be a useful method to communicate health messages to undergraduate students given their high use of SMS (Totten et al., 2005). The efficacy of mobile text messaging intervention in producing positive change in health behaviour has been demonstrated in several studies (e.g., Hall, Cole-Lewis, & Bernhardt, 2015; Rodgers et al., 2005; Woolford et al., 2010). For example, a meta-analysis across 38 studies indicated that this intervention produces a significant effect on health behaviour (Orr & King, 2015).

Some studies have shown that SMS reminders to individuals to monitor health was an effective strategy to promote health behaviours linked to diet and weight loss (e.g., Napolitano et al., 2013), physical activity (e.g., Hurling et al., 2007), smoking cessation (e.g., Rodgers et al., 2005), and disease self-management (Franklin et al., 2006). Self-monitoring appears to be a relevant strategy to change eating behaviours linked to weight loss (e.g., Baker & Kirschenbaum, 1993; Butryn et al., 2011), especially when participants used a paper and pencil food diary for recording their food consumption (Burke, Wang, & Sevick, 2011; Helsel, Jakicic, & Otto, 2007). To date, studies that used SMS for reminding individuals to monitor RMC have not been conducted. Self-monitoring of RMC, using a daily food diary, could decrease this consumption because it could help to identify any discrepancies between current and desired levels of consumption (Fishbach et al., 2012; Myrseth & Fishbach, 2009). Specifically, Michie et al. (2009) reported that interventions

that combined self-monitoring with other behavioural change techniques were significantly more effective than the other interventions for health behaviours. In a comprehensive review, Harkin et al. (2016) showed large effects of self-monitoring on behaviour when the information was recorded, perhaps because recording facilitated memory and self-confrontation (Bailey & Sowder, 1970; Schoutrop et al., 2002), reducing the likelihood that this information could be ignored or rejected (Roggeveen & Johar, 2002).

Present research

The present research reports two studies. These studies were conducted following receipt of ethical approval by the Humanities Department of the University of Naples “Federico II”. Study 1 tested whether the TPB plus self-identity and past behaviour measures predicted intentions to reduce RMC. Self-identity was measured with two scales (Blake et al., 2013), which allowed us to distinguish between healthy-eating and meat-eating identities. In Study 2, we used a randomised controlled trial (RCT) design to test the effects of daily SMS compared with a no-message control condition on intentions and behaviour about RMC reduction. In the current study, we used SMS to remind participants to self-monitor RMC using daily food diary. Finally, we hypothesised that any effects of text messages would be mediated by changes in healthy-eating and meat-eating identities and intentions.

Study 1: Intentions to reduce RMC

In study 1, we explored the predictive power of TPB in explaining intention to reduce RMC in young adults, considering the role of self-identity as healthy and meat eater plus past behaviour.

Materials and Methods

Participants and procedures

In September 2015, a total of 478 e-mails with an online food diary were sent to a convenience sample of Italian university students recruited from a list of students who had agreed to participate in university research in order to receive a training credit. A food diary to monitor past

behaviour was completed daily for one week. Inclusion criteria were that participants did not follow a specific diet (diet prescribed by the doctor, vegan, vegetarian, protein, slimming and/or fattening diets). After 1 week, participants completed a TPB questionnaire including self-identity measures. A total of 342 students fully completed the daily food diary plus questionnaire (100 males; 242 females; mean age = 19.58; standard deviation (SD) = 2.03).

Measures

Participants completed an online food diary designed to monitor food consumption. The online food diary required participants to select items for each food eaten at breakfast, lunchtime and dinner plus any snacks consumed. All food items were associated with photographs of three portion sizes of foods typical of the Italian diet (Turconi et al., 2005). For the analyses, only items which referred to red meat were selected. Small-, medium- and large-sized portions were respectively coded as .05, 1 and 1.5 portions. The total number of portions weighted by the size of the portion and summed across the week was used as a measure of past behaviour. After one week, participants received an online questionnaire, which included measures of TPB variables in relation to the consumption of RMC, plus self-identity, gender and age measures.

Intentions were measured using three items on a seven-point Likert scale (adapted from Sparks, Guthrie, & Shepherd, 1997; e.g., “I intend to eat less than two medium portions of red meat over the next week...definitely do not – definitely do”). Higher scores indicated greater intention to follow the recommend portions of red meat per week. Cronbach’s alpha was .92. To assess subjective norm, three items on a seven-point Likert scale were used (adapted from Sparks, Guthrie, & Shepherd, 1997; “Most people who are important to me think that I should eat less than two medium portion of red meat per week... extremely likely-extremely unlikely”). Higher scores indicated greater level of subjective norm about the recommend portions of red meat per week. Cronbach’s alpha was .79.

PBC was measured by seven items (adapted from Armitage & Conner, 1999; e.g., “Over the next week, how much do you feel that whether you eat eating less than two medium portion of red

meat is beyond your control?... strongly disagree - strongly agree”; all scored 1–7). Higher scores indicated greater control over eating recommended portions of red meat a week. Cronbach’s alpha was .85. Two dimensions of attitudes were measured (adapted from Armitage & Conner, 1999). Three items were used to assess affective attitudes towards eating less than two medium portions of red meat. Each adjective pair was presented on a seven-point response format (e.g., “Eating less than two medium portion of red meat in the next weeks is... unenjoyable–enjoyable; unpleasant–pleasant; boring–exciting”; all scored 1–7). Cronbach’s alpha was .75. Three items were used to assess instrumental attitude toward RMC. Each adjective pair was presented on a seven-point response format (Armitage & Conner, 1999; e.g., “Eating less than two medium portion of red meat in the next weeks is ... not worthwhile–worthwhile; worthless–valuable”; harmful–beneficial”; all scored 1–7). Higher scores indicated more positive attitude to eat less than two medium portions of red meat in the next week. Cronbach’s alpha was .78.

Healthy-eating identity (from Blake et al., 2013) was assessed by three items (“I am a healthy eater,” “I am someone who eats in a nutritious manner,” “I am someone who is careful about what I eat”; all scored 1–7). Higher scores indicated higher perception of being a healthy eater. Cronbach’s alpha was .90.

Meat-eating identity (from Blake et al., 2013) was assessed by three items (“I am meat eater,” “I am someone who likes meat with every meal,” “I am a junk food eater”; all scored 1–7; although the third item seems to be not coherent, its omission did not change results). Higher scores indicated higher perception of being a meat eater. Cronbach’s alpha was .74.

Data analysis

SPSS was used for data analysis. Correlation analysis was used to verify the relationship between the variables of the TPB model. Multiple regression analysis was conducted to assess the independent predictors of intentions.

Results

Table 1 presents the correlations, mean and SD of TPB and other variables. The items

generally showed reasonable variation. They were not unduly skewed. Examination of the correlations (Table 1) indicated that PBC and affective attitude were the strongest correlates of intentions. Interestingly, meat-eating and healthy-eating identities were negatively correlated with one another.

For detecting multicollinearity, we considered tolerance, variance inflation factor (VIF), eigenvalue and condition indices. In the present study, all variables had tolerance values higher than .66, VIF value less than 1.52 and only the last eigenvalue value was close to 0, but its condition index was less than 30 and importantly it did not contribute substantially to explain more than two variables. Therefore, it can conclude that there were few multicollinearity problems among the study variables.

<INSERT TABLE 1 ABOUT HERE>

A step-wise regression (Table 2) was performed to predict intentions to eat less than two medium portions of red meat on past behaviour (Step 1), TPB predictors (affective attitude, instrumental attitudes, subjective norm, and PBC) (Step 2); healthy-eating identity and meat-eating identity (Step 3). Results (Table 2) showed that past behaviour explained a very small amount of variance in participants' intentions (1% of variance explained, $F(1, 341) = 4.59, p < .05$). Adding TPB predictors, explained a significant amount of additional variance in participants' intentions (36% of variance explained, $F(5, 341) = 81.06, p < .001$). Past behaviour, affective and instrumental attitude and PBC were significant at this step. Adding eating identities, also explained significant additional variance in intentions (R^2 change = .02, $F(7, 341) = 60.96, p < .001$). Meat-eating identity was a significant predictor of intentions, while healthy-eating identity was not. Total explained variance was 38%. The strongest predictors of intentions to reduce RMC were PBC and affective attitude ($\beta = .40$ and $\beta = .14$, respectively) followed by instrumental attitude ($\beta = .19$) and meat-eating identity ($\beta = -.17$; all the p values are $< .001$), while subjective norm, past behaviour, and healthy-eating identity were not significant predictors.

<INSERT TABLE 2 ABOUT HERE>

We repeated the regression including only significant predictors. The pattern of results remain substantively unchanged with affective attitude ($\beta = .32$; $p < .001$), instrumental attitude ($\beta = .15$; $p < .001$), perceived behavioural control ($\beta = .38$; $p < .001$) and meat eating identity ($\beta = -.18$; $p < .001$) each being significant predictors of intentions to reduce RMC and explaining 46.2% of the variance.

Discussion

Study 1 applied the TPB to predict intentions to eat a reduced level of red meat, and the impact of meat-eating and healthy-eating identities plus past behaviour. Correlation analyses showed that PBC and affective attitude were the strongest correlates of intentions to reduce RMC, followed by instrumental attitude. The weakest correlates were subjective norm and healthy-eating identity. Meat-eating identity and past behaviour were negatively correlated with intentions. In regressions, the major predictors of intentions were PBC and affective attitude, followed by instrumental attitude. Meat-eating identity was also a significant predictor, while healthy-eating identity was not a significant predictor. Subjective norm and past behaviour did not show any effect on intentions when controlling for other predictors. The model explained 46% of the variance in intention.

Study 2: SMS intervention to promote a reduction in RMC

In Study 2, we tested whether a daily reminder SMS on self-monitoring levels of RMC was sufficient to reduced self-reported red meat intake.

Materials and Methods

Participants

In November 2015, a total of 262 e-mails with T1 online food diaries were sent to Italian undergraduates enrolled in a list to participate in university research in exchange for receiving training credit. Students who were contacted for Study 1 were excluded. Participants were required to first complete a food diary for 1 week and then an online questionnaire. A total of 244 students fully completed daily food diaries plus questionnaires. During the subsequent intervention, students

continued to complete daily a food diary. After the intervention, all students responded to a further questionnaire.

Participants in each of the two conditions (message and control groups) were randomised to include 122 students. During the intervention, four participants of the message condition group and two of the control group refused to further participate. After the intervention, the sample consisted of 116 participants in the message condition group (females: 84, males: 32; mean age: 19.29; SD: 1.75) and 112 participants in the control condition group (females: 80, males: 32; mean age: 19.29; SD: 1.04; see Figure 1).

Procedure

This study was conducted following receipt of ethical approval by the Department of Humanity of the University of Naples “Federico 2”. Students were contacted online by experimenters. Inclusion criteria were that participants did not follow a specific diet and that they were in possession of a mobile phone with SMS. Those participants who agreed to participate in this study provided their mobile telephone numbers and created a personal code, allowing us to match food diaries and questionnaire responses. A randomisation sequence was created using Excel 2007 (Microsoft). Participants were allocated to control and message condition groups at the ratio of 1:1. Figure 1 shows the flow of participants through the study.

<INSERT FIGURE 1 ABOUT HERE>

Intervention

The intervention was based on self-monitoring of behaviour as a behaviour change technique (code: 2.3; Michie et al., 2013). The study consisted of two groups: a message condition group, in which participants received a daily message and a control group, which did not receive messages. Both groups completed a daily food diary for one week to measure past behaviour. At the beginning of the experimental phase, e-mails sent to the message condition group clarified that the recommended intake of red meat is at most two medium portions for a week (200 grams). In the intervention condition, messages were sent on 7 consecutive days. Each message reminded

participants to monitor RMC in relation to the goal of not exceeding two medium portions of red meat per week (“Remember to monitor your red meat consumption for not exceeding two medium servings per week using daily food diary”). During the intervention, both groups continue to complete a daily food diary. At the end of the interventions, all participants received a feedback on the findings. Moreover, the control group was invited to a lesson on the benefits of monitoring RMC.

Measures

Measures were similar in both the message and control condition groups. One week before online questionnaire administration, each participant was invited daily to complete the same online food diary proposed in Study 1. Subsequently, they responded to an online TPB questionnaire before and after the intervention period, which used the same measurements as Study 1 for intentions (T1 $\alpha = .95$; T2 $\alpha = .94$), instrumental attitude (T1 $\alpha = .85$; T2 $\alpha = .94$), affective attitude (T1 $\alpha = .83$; T2 $\alpha = .89$), subjective norm (T1 $\alpha = .78$; T2 $\alpha = .83$), PBC (T1 $\alpha = .82$; T2 $\alpha = .89$), healthy-eating identity (T1 $\alpha = .87$; T2 $\alpha = .93$), and meat-eating identity (T1 $\alpha = .70$; T2 $\alpha = .87$). Before the seven-day intervention, participants completed the daily online food diary (T1), and at the end of the intervention, they responded again to the online questionnaire (T2).

Design and Data analysis

This study investigated the impact of a messaging intervention using a pre–post design for maximising statistical power (Howell, 2006). Analysis of intervention effects of RMC and all descriptive analyses were conducted in SPSS 17.0. To check the randomisation, we used multivariate and univariate analyses. Analyses of variance (ANOVAs) were used to test differences in TPB variables and RMC both at T1 and T2. Finally, sequential mediation analysis was used, with bootstrapping in MPLUS 7, to verify whether differences between conditions in RMC at T2 were mediated by healthy-eating and meat-eating identities and intentions. Healthy-eating identity was considered as mediator, even if it was not a predictor of intentions to reduce RMC (Study 1), in line

with Brouwer and Mosack' findings (2015), which showed that self-identity as healthy eater changes increased healthy-eating behaviours.

Results

Preliminary analysis

Multivariate and univariate analyses at the baseline did not show any significant differences ($p > .52$) in TPB variables and RMC (Table 3) between conditions before the intervention. These findings suggested that randomisation was adequate and the two conditions were matched on baseline measures.

Main analyses

Multivariate analysis of covariance (MANCOVA) on RMC at T2, controlling for past behaviour (RMC at T1) revealed a significant overall effect of condition ($F(8,219) = 15.94$; $p < .001$, $\eta^2 = .37$) and past behaviour as covariate ($F(8,219) = 30.14$; $p < .001$, $\eta^2 = .52$) on measured variables. Results showed significant effects of condition for intention ($F(1,226) = 9.36$; $p < .01$, $\eta^2 = .04$), PBC ($F(1,226) = 5.14$; $p < .05$, $\eta^2 = .02$), instrumental attitude ($F(1,226) = 23.84$; $p < .001$, $\eta^2 = .10$), healthy-eating identity ($F(1,226) = 11.08$; $p < .001$, $\eta^2 = .05$), and weekly RMC at T2 ($F(1,226) = 29.76$; $p < .001$, $\eta^2 = .12$).

<INSERT TABLE 3 ABOUT HERE>

Mediation analyses

Sequential mediation analysis, with a serial mediation model (Model 6 in Stride et al.2015) using maximum likelihood estimation method and bootstrapping in MPLUS 7, was conducted to ascertain whether the effect of condition on RMC at T2 was mediated by change in intentions, healthy-eating and meat-eating identities, controlling for past behaviour (see Figure 2). If the bootstrapped 95% confidence interval (CI) did not include zero, the indirect effects were accepted as significant. Adequacy of fit of the serial mediation model was tested using Chi-Square and incremental goodness-of-fit indexes: RMSEA $< .05$ (Browne & Cudeck, 1992), CFI and TLI $< .90$

(Tucker & Lewis, 1973) and SRMR < .08 (Hu & Bentler, 1999). The model had an acceptable goodness of fit (Chi-square = .19, df = 1, p = .66; RMSEA = 0.00; CFI = 1; TLI = 1; SRMR = .01).

Figure 2 shows that the total effect (-1.33; 95% CI = -1.61 to -1.03) and the total indirect effect (-.36; 95% CI = -.58 to -.15) were significant. The path between conditions and RMC at T2 was reduced by controlling for the mediators but remained significant (-.97; 95% CI = -1.27 to -.65) showing any mediation was partial. Examination of the mediated paths showed that the highest mediated effects were for the simple mediation path from conditions to RMC via intention (-.12; 95% CI = -.22 to -.02) and via healthy-eating identity (-.11; 95% CI = -.22 to -.02). The simple mediation path via meat-eating identity was not significant (-.00; 95% CI = -.11 to .11).

The strongest sequential mediation chain was for the path from conditions to RMC via healthy-eating identity and then meat-eating identity (-.08; 95% CI = -.15 to -.03), followed by the sequential mediation chain from conditions to RMC via healthy eating identity and then intention (-.03; 95% CI = -.07 to -.01). An important significant sequential mediation chain, although smaller in magnitude, was for the path from conditions to RMC via healthy-eating identity, then meat-eating identity and then intention (-.02; 95% CI = -.05 to -.01). The sequential mediation chain path from conditions to RMC via meat-eating identity and then intention was not significant (.00; 95% CI = -.03 to .03). Therefore, the daily promotion of RMC to self-monitor reduced RMC partially via an increase in participants' healthy-eating identity, which seemed to be the factor that drives the effects of message condition, producing a consequent change in meat-eating identity and intentions.

<INSERT FIGURE 2 ABOUT HERE>

Discussion

Study 2 described the effects of a brief SMS-based intervention designed to reduce RMC in young adults over a seven-day period. A total of 62.3% of participants at the baseline ate above the recommended value of at most two portions per week. Those in the message condition group, compared with control, increased their intention to eat at most two portions of red meat per week

and reduced their consumption, reporting adequate intake of red meat over the last week. Following initiation of the intervention, 56.6 % of the participants in the control group ate above the recommended value of RMC compared with 23.3% of participants in the message condition group. Therefore, a brief SMS intervention was effective in changing RMC. Furthermore, sequential mediation analysis showed that the increase in the participants' healthy-eating identity reduced their meat-eating identity, increasing intentions and consequentially reducing RMC at T2 in the experimental condition.

General discussion

Considering Study 1, the greater impact of PBC and attitude on intention is in line with previous research, which indicated that these constructs are the most important predictors of healthy eating (e.g., Canova & Manganelli, 2016) and specifically of meat consumption (Povey et al., 2001; Richetin et al., 2011). More recently, Graça et al., (2015) found that positive attitude towards meat decreased intentions to reduce meat consumption, while a perception of behavioural control concerning changing meat consumption increased intentions to reduce meat consumption. The finding that affective attitude was more predictive than instrumental attitude was consistent with various studies, which found that the first was more effective in predicting various health behaviours (e.g., Conner, Godin, Sheeran, & Germain, 2013; Conner et al., 2015), and with evidence that meat consumption is related more strongly with affective attitude than a cognitive attitude (Aikman, Crites, & Fabrigar, 2006; Berndsen & Van der Pligt, 2004). The finding that subjective norm was not a significant predictor of intention is in accordance with previous studies, which found that subjective norm has a low or nonsignificant relationship to healthy eating (Blanchard et al., 2009; Louis, Chan, & Greenbaum, 2009) and particularly to a vegetarian diet (Povey et al., 2001), to the intention of substituting meat with a more plant-based diet (Graça, et al., 2015) or of reducing meat consumption (Zur & Klöckner, 2014; Zur, 2012). Importantly, the present study found that past behaviour was not a significant predictor of intention, responding to the issue noted by Richetin et al. (2011) about the likely useful addition of past behaviour.

Self-identity as healthy eater did not explain additional variance in intention to reduce consumption of red meat, consistent with Povey et al., (2001), although it has been shown to be significant for other healthy-eating behaviours (e.g., Brouwer & Mosack, 2015; Carfora, et al., 2016a). Moreover, the finding that meat-eating identity explained intentions about RMC was in line with findings of Allen and Ng (2003), which demonstrated that red meat identification had a positive correlation with RMC. In fact, their research showed that RMC was higher when nutritional importance was low and identification as a meat eater was high.

The present findings contribute to the literature on RMC, demonstrating how those who perceived themselves as meat eaters tend not to intend to reduce their RMC. This is consistent with the theoretical explanation of the relevance of self-identity in predicting intention (e.g., Charng, et al., 1988), as the more significant the meat-eating identity the lower is the intention to reduce RMC.

The significant outcomes of the SMS intervention are in line with studies that have reported the efficacy of text messages to promote health behaviours (e.g., Siopis, Chey, & Allman-Farinelli, 2015) and a reduction in RMC (Bertolotti, et al., 2016), confirming that the messaging interventions could be a useful strategy to encourage young adults to change their eating behaviour. More specifically, a simple self-monitoring reminder was found to be sufficient to reduce self-reported meat consumption. Furthermore, the effect of the messages was shown to be mediated through changing healthy eating and meat-eating identities and intentions to reduce RMC. This finding is a potentially important contribution to the literature because it underlines that self-identity could be influenced by self-monitoring reminders in young adults. It could be hypothesised that participants integrated the self-monitoring practice of RMC in their self-identity as a healthy eater, as action repetition can lead individuals to integrate a certain behaviour into their self-concept (Charng, et al., 1988), fostering the development of a self-identity as “I am a person that monitors RMC to be healthier.”

The findings that a messaging intervention increases healthy-eating identity and decreases meat-eating identity is coherent with the literature, where the nutritional and related health

outcomes of food appeared as more relevant for meat consumption if meat identification decreases (Allen & Ng, 2003). This consideration could also justify why in Study 1, the healthy-eating identity was not significant predictors of intentions, as participants did not consider health as an important aspect in evaluating their intention about RMC. Therefore, it could be instead concluded that the adoption of a dietary choice, such as monitoring of RMC, would develop a sense of self as a healthy eater, embodying this procedure in a “healthy identity practice,” which decreases the identification as a meat eater.

Limitations and methodological issues

The current research has a number of limitations. First, the findings may not be generalisable to all young people because the sample was restricted to university students from the South of Italy. Second, the behaviour was measured with a food diary in both studies, which although more appropriate compared with a single self-report item, is less valid than an objective measure. Finally, in Study 2, we only measured behaviour over a seven-day period and these seven days corresponded with the intervention days. Therefore, we did not have any evidence about whether the observed effects would be maintained beyond the days on which messages were delivered. Demonstrating that such effects are maintained for significant periods of time would be an important goal for future research, particularly given the fact that the health benefits would only be associated with long term reductions in RMC. Using an objective measure of RMC with a much longer follow-up period, it may be possible to test whether this intervention contributes to positive health consequences.

Future direction and practical implications

From an applied perspective, despite these methodological concerns, the present results could provide useful information for policy recommendations in Italy based on the use of messaging interventions to increase self-monitoring of eating behaviour in young adults. Particularly, the current study emphasised the efficacy of using an SMS intervention that promotes self-monitoring as a means to reduce RMC and increase healthy eating identity. Future interventions

could verify whether this promotional strategy may be effective in other contexts and with other age groups. Moreover, it could be interesting, in future research, to develop an intervention, which integrates the TPB variables with the social cognitive theory (Bandura, 1986) and focuses on the ability to actively direct behaviour through self-observation, self-judgment, and self-reaction in order to provide a better understanding of the processes through which self-monitoring could promote behavioural change.

Furthermore, future research could test the effects of messages through different communication channels, such as the Internet (Caso, 2015); or using different message content, such as affective (which provide information on emotional consequence of healthy eating) versus instrumental messages (which provide information about physical aftermaths of healthy eating; e.g. Carfora, Caso, & Conner, 2016b; Conner et al., 2011; Morris et al., 2015); or emphasising health rather than wellbeing (e.g. Bertolotti et al., 2016). Finally, the use of SMS for promoting self-monitoring could be extended in different areas of research such as the prevention of new emerging clinical entities (Gargiulo et al., 2014).

Conclusion

Overall, our two studies contributed to a better understanding of the cognitions involved in intentions to reduce RMC and indicated that a simple message intervention could promote this behaviour. Future studies could help to confirm these results in other samples with objective measures of behaviour.

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CONSORT 2010. Checklist of information to include when reporting a randomised trial (STUDY “)

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract	1a	Identification as a randomised trial in the title	1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	1
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	2-6
	2b	Specific objectives or hypotheses	6
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	11
Participants	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	n/a
	4a	Eligibility criteria for participants	11
	4b	Settings and locations where the data were collected	11
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	12
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	13
	6b	Any changes to trial outcomes after the trial commenced, with reasons	n/a
Sample size	7a	How sample size was determined	n/a
Randomisation:			

Sequence	8a	Method used to generate the random allocation sequence	11
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	11
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	n/a
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	11
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	n/a
	11b	If relevant, description of the similarity of interventions	n/a
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	12-13
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	13-14
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	In figure file; figure 1
	13b	For each group, losses and exclusions after randomisation, together with reasons	40
Recruitment	14a	Dates defining the periods of recruitment and follow-up	11
	14b	Why the trial ended or was stopped	n/a
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	In table file; table 1

Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	11
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	12
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	n/a
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	13-14
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	n/a
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	17
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	17
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	17-18
Other information			
Registration	23	Registration number and name of trial registry	n/a
Protocol	24	Where the full trial protocol can be accessed, if available	n/a
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	none