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Informational and emotional daily messages to reduce red and processed meat consumption

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ABSTRACT

In the present study we tested a daily messaging intervention aimed at promoting the reduction of red and processed meat consumption (RPMC). We randomly allocated 180 young adults to three different message conditions. Participants in the informational condition read messages on the consequences of excessive RPMC on one's health and the environment. Participants in the emotional condition read messages eliciting anticipated regret for the consequences of excessive RPMC on one's health and the environment. Participants in the control condition read messages on the health and the environment consequences of sugar consumption. We sent messages through a chatbot every morning for two weeks. RPMC, attitude, intention, and anticipated regret regarding RPMC were measured three times: before the two-week messaging intervention (baseline), immediately after the intervention (post intervention) and two months thereafter (follow up). RPMC was also measured through food diaries, completed for two weeks after the intervention. Compared to the control condition, participants exposed to emotional messages reduced RPMC at follow up, while this was not the case for participants exposed to informational messages. In addition, anticipated regret and intention mediated the effects of emotional messages on RPMC. Implications for devising effective messaging interventions to change RPMC are discussed.

1. Introduction

The health risks connected to an excessive red and processed meat consumption (RPMC) have been well known for years, and include an increased likelihood of developing serious conditions such as heart disease (Bouvard et al., 2015) and cancer (e.g., World Health Organization, 2015). In addition to these potential threats to individuals, widespread excessive RPMC has several environmental costs deriving from meat production and processing practices, such as high water consumption, land pollution, and high greenhouse gas emissions (Tilman & Clark, 2014; Westhoek et al., 2014).

Despite the urgency and public relevance of changing consumers' habits regarding RPMC, attempts to promote a reduction in RPMC through messages focused on health and environment outcomes have had limited success so far (e.g., Vainio, Irz, & Hartikainen, 2018). In the present study we explored the persuasiveness of messages aimed at eliciting anticipated regret regarding the health and environmental consequences of RPMC. We compared these emotional messages with messages presenting only information about the health and environmental consequences of RPMC, and with a control condition. To have a reliable assessment of message effectiveness, our design included three features that were not present in previous research: a) presentation of the manipulated messages over a two-week period through a chatbot; b) measuring RPMC-related variables at three time points (before and after exposure to messages, and two months thereafter); c) completion of a food diary for two weeks after the end of the intervention.

1.1. Informational and emotional appeals aimed at reducing RPMC

Previous research has investigated messages promoting change in food choices through either informational or emotional appeals (Dubé & Cantin, 2000; Kotler & Armstrong, 1991; Percy and Rossiter, 1997). An informational appeal focuses on the objective characteristics of food, such as its nutritional value, or its health or environmental consequences. An emotional appeal, instead, focuses on the positive or negative emotions connected to food choice. Several studies have shown the effectiveness of emotional appeals in different domains (e.g., Teichert, Hardeck, Liu, & Trivedi, 2018; Zarantonello, Romani, Grappi, & Bagozzi, 2016; Wei, Rickard, & Brown, 2015), including eating habits (Carfora, Caso, & Conner, 2016; Previte, Russell, Bennett, & Parkinson, 2015) and pro-environmental behaviours (Noble, Pomering, & Johnson, 2014). For example, Noble, Pomering, and W. Johnson (2014) found

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that a negative emotional appeal eliciting guilt is more effective at influencing pro-environmental attitudes and intentions than an informational appeal or a positive emotional appeal.

In the case of RPMC-related communication, research on the effectiveness of emotional appeals has been limited so far. Most research has employed informational appeals - that is, messages focusing on the negative consequences on health and/or the environment of excessive RPMC - and has obtained mixed results (Cordts, Nitzko, & Spiller, 2014; Marette & Millet, 2016; Scrimgeour, 2012; Vainio et al., 2018). A few researchers have instead explored the effectiveness of emotional appeals, moving from the assumption that some negative emotions, such as disgust or fear, are known to influence meat consumption (e.g., Buttlar & Walther, 2018, Tse, Zhang, Doherty, Chappell, & Garnett, 2016; Tybur, Laakasuo, Ruff, & Klauke, 2016). For example, Palomo-Vélez, Tybur, and van Vugt (2018) found that messages eliciting disgust affect attitudes towards meat more strongly than informational messages. In a one-month multicomponent intervention, Amiot, Boutros, Sukhanova, and Karelis (2018) found that fear-based messages had a long-lasting effect on males' meat consumption.

Another negative emotion that might be employed to drive change in RPMC is anticipated regret, which is the negative feeling arising from the anticipation of future events and outcomes (Richard, Van Der Pligt, & De Vries, 1996; Zeelenberg, 2012). Consumers often experience this emotion when they anticipate the possible negative consequences of their food choices (e.g., Bagozzi, Belanche, Casaló, & Flavián, 2016; Caso, Carfora, & Conner, 2016; Lagerkvist, Okello, & Karanja, 2015; Rotman, Lee, & Perkins, 2017), including excessive meat consumption (Asbjarnarson, 2017; Carfora, Caso, & Conner, 2017b; Nordgren, Van Der Pligt, & Van Harreveld, 2007).

Anticipated regret has a profound effect on the way people process information (Brewer, DeFrank, & Gilkey, 2016). For example, previous research has shown that making anticipated regret salient by associating it to a specific behaviour influences both health-related and environmental intentions and behaviours (Boeri & Longo, 2017; Lipkus, Johnson, Amarasekara, Pan, & Updegraff, 2019; Sheeran, Harris, & Epton, 2014). Research on how communication eliciting anticipated regret can stimulate changes in food choices has been however limited (Carfora, Caso, Palumbo, & Conner, 2018; Martinez, 2014), and only one study has investigated the effect of eliciting anticipated regret on RPMC (Carfora et al., 2017b).

1.2. The present study

In the present study, we aimed to address some critical issues left open by previous research on the effects of emotional appeals on RPMC reduction. Unlike previous research, we investigated emotional appeals evoking anticipated regret for *both* health and environmental outcomes of excessive RPMC. We compared the effects of emotional appeals with the effects of purely informational appeals describing the same consequences, and compared both with a control condition. In addition, we investigated the effects of the appeals not only on emotions, attitudes, and intentions, but also on the actual behaviour of participants, measured with the daily food diary method (Palomo-Vélez et al., 2018). Finally, we assessed the stability of these effects over time. To do this, we adopted a ten week long panel design, testing whether psychological changes triggered by our intervention predicted later changes in RPMC.

2. Method

2.1. Sample and procedure

The present study received formal approval by the research ethics committee of the Catholic University of the Sacred Heart in Milan. We first ran a statistical power analysis to determine sample size. Using GPower 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007), we estimated the required sample size for detecting a medium-sized effect (ES = 0.25) with an alpha = .05, power = .90, and 3 experimental conditions. The estimated sample size was $N = 132$ for the between-group comparison. Therefore, we planned a sample size of 250, in order to achieve more than sufficient power to detect the main effect and additional mediation effects, after accounting for expected attrition across three-time.

Data collection took place from March to May 2018. 250 undergraduates of the Catholic University of Milan were invited to take part in a study on persuasive communication in exchange for course credits. To participate, undergraduates were required to be in possession of a personal smartphone with an Internet connection, and to follow no specific diet (e.g., veganism or vegetarianism). Participants provided their written consent, personal email address, and a personal code to allow the subsequent matching of questionnaires and food diaries. In week 1, undergraduates were asked to fill out an online questionnaire and register themselves into a chatbot on Facebook Messenger. The last page of the questionnaire randomly allocated students to one of the three experimental conditions (informational messages, emotional messages, control). 180 undergraduates (age: $M = 20$, $SD = 2$; sex: F = 136; M = 44) completed the first questionnaire. Over two weeks (intervention phase), participants received daily persuasive messages. At post-intervention (at the end of week 2), all participants filled out a second questionnaire. Then, each evening of the following two weeks (week 3–4) participants completed an online food diary. Two months after the intervention (week 10), participants completed the follow-up by filling out a third questionnaire. At the end of the study, the final sample was composed of 92% of the initial sample ($N = 166$; control condition $n = 68$; informational message condition $n = 58$; emotional message condition $n = 40$). After completing the final follow-up questionnaire, participants were fully debriefed, made aware of the study purpose and procedures, and received an email explaining the health and environmental impact of an excessive RPMC. This ensured that all students received useful information on the topic of the intervention.

2.2. Messaging intervention

During the 2-week intervention, participants in all conditions received daily messages from a chatbot on Facebook Messenger. A chatbot is an artificial intelligence program that simulates interactive human conversation by using pre-set phrases and text-based signals. Experimenters programmed the chatbot to send different persuasive messages to each participant, depending on the respective experimental condition. The chatbot was programmed to send the messages every morning (7.30 a.m.).

In the *informational message* condition, participants received every day a message informing them about the health and environmental impact of excessive RPMC (e.g., "If you eat an excessive amount of red and processed meat, you will not protect your health from colon cancer, and at the same time you will not protect the environment from the release of harmful greenhouse gases"). The messages described the negative consequences of RPMC on both health (e.g., stomach cancer, obesity, heart disease, diabetes, joint problems, bowel disease, liver disease) and the environment (e.g., deforestation, water waste, water pollution, excessive fertilizer use, biodiversity loss, air pollution, climate change).

In the *emotional message* condition, participants received messages that cited the same health/environmental outcomes of RPMC presented in the informational messages, but evoking the anticipated regret related to them (e.g., "If you eat an excessive amount of red/processed meat, *you could feel regret for not protecting* your health from cancer and the environment from the release of harmful greenhouse gases").

Participants in the *control condition* received messages describing the health and environmental consequences of eating sugar (e.g. "If you eat an excessive amount of high sugar food, you will not protect your health from type-2 diabetes, and at the same time you will not protect the environment from the release of harmful greenhouse gases").

2.3. Measures

At baseline (the beginning of week 1), post-intervention (the end of week 2) and follow-up stages (the end of week 10) participants were asked to fill out the same questionnaire, assessing the variables reported below. The measures were adapted from previous research investigating attitudes, intentions and emotions related to RPMC (Carfora, Caso, & Conner, 2017a). At the beginning of the questionnaire, participants were provided with a definition of red and processed meat ("Red/processed meat is defined as mammalian meat, that is red when it is raw and dark in colour when cooked. This includes beef, lamb, pork, venison and goat and processed meat, like beef burgers, bacon, sausages etc. One serving is roughly the same size as a deck of cards").

Self-reported RPMC. Participants answered the question "How many servings of red and processed meat have you eaten last week?". Answers were given on a 15-point response scale ranging from "0" to "14 or more".

Intention to reduce RPMC. The intention to eat less red/processed meat was measured with three items using a Likert scale ranging from 1 ("definitely do not)" to 7 ("definitely do") (e.g., "I intend to eat less than two portions of red/processed meat a week"). Higher scores indicated greater intention to follow the recommended quantity of RPMC per week. Cronbach's alpha was .96 at baseline; 0.95 post-intervention; 0.96 at follow-up.

Attitude towards RPMC reduction. Attitude was assessed through eight items on a semantic differential scale ranging from 1 to 7 ("Eating less than two portions of red/processed meat a week is … bad - good; inconvenient - convenient; unnatural - natural; immoral - moral; expensive - affordable; unsafe - safe; not important to me - important to me; unhealthy - healthy; not environmentally friendly - environmentally friendly"). Higher scores indicated a more positive attitude towards reduced RMPC reduction. Cronbach's alpha was .82 at baseline, 0.87 post-intervention, and 0.88 at follow-up.

Anticipated regret for excessive RPMC. Participants' anticipated regret for not following recommendations regarding RPMC was assessed with three items using a Likert scale ranging from "completely disagree" (1) to "completely agree" (7) (e.g., "If I eat more than two portions a week of red/processed meat, this will bother me"). Higher scores indicated a greater level of anticipated regret. Cronbach's alpha was .87 at baseline, 0.92 at post-intervention, at 0.91 at follow-up.

Food diary. After the end of the messaging intervention phase (week 2), participants were asked to fill in an online food diary for two weeks (weeks 3–4). They were asked to report all food eaten during the day (breakfast, lunch, dinner, and snacks), choosing from a list of foods presented with photographs of three different serving sizes (small-, medium- and large-sized portions; see Turconi et al., 2005). For the purpose of the present study, we selected only answers related to RPMC. Small-, medium- or large-sized portions were scored 0.5, 1, and 1.5 respectively. Resulting scores were summed across the two weeks, and then halved to obtain the average weekly number of red/processed meat portions.

3. Results

3.1. Preliminary analysis on self-reported variables at baseline

Table 1 reports the means and standard deviations of all measured variables in the three conditions at each time point. In a preliminary analysis, we checked whether randomization was adequate. Multivariate analysis (MANOVA) did not yield any significant differences) in the baseline variables (attitudes, anticipated regret, intentions, self-reported RPMC, and age) among the three conditions ($ps > .19$). A chi-square test showed similar sex distributions in the three groups ($p = .14$). Thus, preliminary results showed that the automatic randomisation of participants was adequate and the three conditions were matched on baseline variables.

3.2. Main analyses

3.2.1. Multivariate effects of messaging intervention on self-reported variables at post-intervention and follow-up

To test the effects of the intervention across the different dependent variables (attitude, anticipated regret, intention, self-reported RPMC), we conducted a mixed MANCOVA with the experimental condition (informational, emotional, and control condition) as a between-subject factor and time (post-intervention and follow-up) as a within-subject factor. The baseline scores for each variable were entered as covariates (Table 2). Significant multivariate effects emerged for the condition ($p = .01$) and the covariates ($p < .001$). The interaction between time and condition was not significant ($p = .67$), indicating that the intervention effect remained consistent across post-intervention and follow-up. Where significant multivariate effects were found, we ran ANCOVAs to compare the three conditions to one another on each dependent variable (attitude, anticipated regret, intention and self-reported RPMC) at post-intervention (Table 3) and follow-up (Table 5). In these ANCOVAs we controlled for baseline RPMC, given that this covariate had a significant interaction with time ($p = .05$). To compare conditions, we used post-hoc tests with Bonferroni correction to account for the multiple comparisons.

3.2.1.1. Effect of messaging intervention on attitude, regret, intention and self-reported RPMC at post-intervention. We ran ANCOVAs, controlling for baseline self-reported RPMC, to test the differences of the three conditions on attitude, regret, intention and self-reported RPMC at post-intervention (Table 3). Results showed significant effects for condition in each ANCOVA, whereas significant or near-significant effects were found on attitude and intention to reduce RPMC. Post-hoc tests (Table 6) showed that participants in the emotional condition had stronger anticipated regret and higher intention to reduce RPMC, as compared to participants in the control condition. Participants in the informational condition reported a stronger attitude towards reduced RPMC than participants in the control condition. Furthermore, participants in both emotional and informational conditions showed lower self-reported RPMC as compared to control.

3.2.1.2. Effect of messaging intervention on RPMC measured with food diary. To compare the differences of the three conditions on RPMC measured with food diary (weeks 3–4), we ran an ANCOVA (Table 4), again including self-reported RPMC at baseline as a covariate. Results showed significant effects for condition and for the covariate. Both participants exposed to emotional messages and participants exposed to informational messages reported lower RPMC as compared with participants in the control condition (Table 6).

3.2.1.3. Effect of messaging intervention on attitude, regret, intention and self-reported RPMC at follow-up. To test the differences of the three conditions on attitude, regret, intention and self-reported RPMC at follow-up, we ran ANCOVAs controlling for baseline self-reported RPMC. Results showed significant effects for condition in all four ANCOVAs, whereas significant effects for the covariate were found only on self-reported RPMC and attitude (Table 5). Post hoc comparisons showed that at follow-up participants in the emotional message condition reported higher values of anticipated regret as compared to participants in the informational message condition and participants in the control condition (Table 6). Participants in the emotional condition had also higher intention towards reducing RPMC, and reported lower RPMC as compared to control. Furthermore, participants in the informational condition differed from participants in the control condition only for a stronger attitude towards reducing RPMC. No other significant differences were found.

Table 1
Means and standard deviations of the study variables in each condition at baseline, post-intervention, and follow-up.

Variables	Emotional message condition (n = 40)						Informational message condition (n = 58)						Control message condition (n = 68)					
	Baseline		Post-intervention		Follow-up		Baseline		Post-intervention		Follow-up		Baseline		Post-intervention		Follow-up	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Attitude toward RPMC	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
Anticipated regret	3	1	4	1	4	1	3	1	3	1	3	1	3	1	3	1	3	1
Intention to reduce RPMC	4	2	4	2	4	1	4	2	4	1	4	1	4	2	3	2	3	2
Self-reported RPMC	8	3	7	3	6	2	7	5	7	5	7	4	8	4	8	4	7	4
Diary RPMC (2 weeks)	–	–	6.50	5.50	–	–	–	–	6.50	4.50	–	–	–	–	8.50	7.50	–	–

Note. RPMC = Red and Processed Meat Consumption. Diary RPMC refers to the sum of the servings of the red and processed meat in the two weeks after the interventions.

Table 2
Summary of mixed MANCOVA of conditions x time (post-intervention and follow-up) controlling for baseline variables.

Predictor	*df*	*F*	*p*	η_p^2
Between-subjects				
Intercept	4156	8.54	.001	.18
Attitude at Baseline	4156	36.94	.001	.49
Anticipated regret at Baseline	4156	9.41	.001	.19
Intention at Baseline	4156	7.15	.001	.15
Self-reported RPMC at Baseline	4156	63.97	.001	.62
Condition	8314	2.76	.01	.07
Within-subjects				
Time	4156	1.03	.39	.03
Time X Condition	8314	.72	.67	.02
Time X Attitude at Baseline	4156	.24	.92	.01
Time X Anticipated Regret at Baseline	4156	1.29	.27	.03
Time X Intention at Baseline	4156	1.86	.12	.04
Time X Self-reported RPMC at Baseline	4156	2.46	.05	.06

Note. RPMC = Red and Processed Meat Consumption.

Table 3
Effect of messaging intervention on study variables at post-intervention.

Source Variance	*df*	Mean Square	*F*	*p*
Attitude				
Condition	2	2.87	2.79	.05
Baseline RPMC	1	8.20	8.01	.001
Explained	3	4.66	4.56	.01
Residual	162	1.03		
Anticipated regret				
Condition	2	6.83	3.40	.04
Baseline RPMC	1	1.68	.83	.36
Explained	3	5.17	2.57	.05
Residual	162	2.00		
Intention				
Condition	2	7.62	2.84	.05
Baseline RPMC	1	8.90	3.32	.07
Explained	3	7.92	2.95	.03
Residual	162	2.68		
Self-reported RPMC				
Condition	2	18.85	2.80	.05
Baseline RPMC	1	1548.55	230.08	.001
Explained	3	5	78.58	.001
Residual	162	6.73		

3.3. Mediation analyses

To sum up, the results showed that participants in the emotional message condition (but not participants in the informational message condition) differed from control with regard to anticipated regret and intention at post-intervention, and self-reported RPMC at follow-up. We therefore decided to test whether higher scores in anticipated regret and intention of participants exposed to the emotional messages at post-intervention explained lower self-reported RPMC of the same participants at follow-up. To do so, we carried out a sequential mediation analysis, using a bias-corrected bootstrapped mediation approach (Model 6 of the PROCESS macro for SPSS; Hayes & Preacher, 2013). To test the unique effects of the emotional message condition, we created a dummy variable "condition" comparing the emotional message condition with the other two conditions (informational message condition = 0; emotional message condition = 1; control = 0). The indirect effects were evaluated as significant if bootstrapped 95% confidence intervals (CI) did not include zero.

The mediation paths are shown in Fig. 1. Consistent with our expectation, the only significant mediated effect was the sequential mediation chain from condition to self-reported RPMC via anticipated regret and then intention ($B = -0.37$; 95% CI, -0.81; -0.02). The simple mediation paths from condition to RPMC via anticipated regret ($B = 0.37$; 95% CI, -0.22; 1.09) or via intention ($B = -0.16$; 95% CI, -0.67; 0.20) were not significant. Finally, and importantly, the path

Table 4
Effect of messaging intervention on red/processed meat consumption measured with food diary (2 weeks).

Source Variance	*df*	Mean Square	*F*	*p*
Condition	2	62.45	3.03	.05
Baseline RPMC	1	1803.49	87.44	.001
Explained	3	641.97	31.12	.001
Residual	162	20.63		

Table 5
Effect of messaging intervention on study variables at follow-up.

Source Variance	*df*	Mean Square	*F*	*p*
Attitude				
Condition	2	4.02	3.33	.04
Baseline RPMC	1	5.57	4.62	.03
Explained	3	4.58	3.80	.01
Residual	162	1.21		
Anticipated regret				
Condition	2	4.56	2.81	.05
Baseline RPMC	1	8.30	.00	.99
Explained	3	5.18	2.57	.05
Residual	162	2.09		
Intention				
Condition	2	7.39	2.64	.05
Baseline RPMC	1	.001	.00	.96
Explained	3	6.04	3.01	.05
Residual	162			
Self-reported RPMC				
Condition	2	24.72	4.38	.01
Baseline RPMC	1	1210.39	214.62	.001
Explained	3	417.98	74.11	.001
Residual	162			

Table 6
Mean difference scores among conditions at post-intervention and follow-up, controlling for red and processed meat consumption self-reported at baseline.

	Emotional Message – Control	Informational Message – Control	Emotional Message – Informational Message
	p	*p*	*p*
Post-intervention			
Attitude	.10	.03	.72
Anticipated Regret	.01	.32	.32
Intention	.02	.29	.17
Self-reported RPMC	.05	.04	.89
Diary RPMC (2 weeks)	.03	.05	.73
Follow-up			
Attitude	.15	.01	.41
Anticipated Regret	.08	.72	.05
Intention	.02	.40	.40
Self-reported RPMC	.001	.10	.16

Note. RPMC = Red and Processed Meat Consumption. Diary RPMC refers to the sum of the servings of red and processed meat in the two weeks after the intervention.

between condition and RPMC was not significant ($B = -1.09$; 95% CI, −2.51; 0.32), indicating the presence of a total mediation.

In sum, our findings showed that, compared to informational messages and to control messages, emotional messages were more likely to enhance anticipated regret for exceeding the weekly-recommended RPMC. This led to a stronger intention to reduce RPMC and, in turn, to reduced self-reported RPMC at follow-up.

4. Discussion and Conclusion

The results of the present study advance our knowledge on how to reduce RPMC through message interventions in several ways. First of all, our study introduced several methodological features that were lacking in previous research investigating change in RPMC (e.g., Carfora et al., 2017b): we directly compared the effectiveness of an emotional appeal leveraging on anticipated regret with the effectiveness of an informational appeal, and a control condition; we investigated the impact of a prolonged exposure to persuasive appeals, by sending messages to participants every day for a period of two weeks, and assessing the effects of our intervention at two time points; furthermore, we tested the pathway through which earlier changes in participants' attitudes, emotions, and intentions led to later changes in RPMC.

The findings of our study indicate that emotional messages evoking anticipated regret for not protecting one's health and the environment do elicit an emotional reaction, but also promote consistent intention and behaviour immediately after the intervention. In addition, and perhaps more importantly, emotional messages produce a longer-lasting reduction in RPMC (i.e., still significant several weeks after the initial intervention) than informational messages.

Therefore, our study contributes to a better understanding of which causal model explains behavioral change over time. The prolonged decrease in RPMC among participants exposed to emotional messages can be attributed to increased anticipated regret and intention to reduce RPMC in the previous two months. These results suggest that higher levels of anticipated regret and intention are associated with a stronger impact of intention on subsequent behaviour. This mediating role of anticipated regret in response to a messaging intervention is consistent with the results of past studies on behavioural change interventions in different domains (e.g., Abraham & Sheeran, 2004; Caso & Carfora, 2017; Carfora et al., 2017b; Carfora et al., 2018).

Moreover, our study showed that although informational messages also had an early effect on participants' attitude and behaviour in relation to RPMC, such behavioural change was short-lived and disappeared after two months. Emotional messages, on the other hand, had a more persistent and long-lasting effect on participants exposed to them. Past research has shown that the attitude-intention-behaviour link in food choice is rather complex (Vermeir & Verbeke, 2004) and this complexity may be partly due to the attitudinal ambivalence that often characterizes the health and environmental attitudes (e.g., van Harreveld, Nohlen, & Schneider, 2015). In our emotional message condition the elicitation of the anticipated regret may have provided an additional motivation to overcome such attitudinal ambivalence, and overcome the intention-behaviour gap (see Itzchakov & Van Harreveld, 2018).

Our research has several limitations. First of all, the two messaging conditions we compared were very similar (differing only in the presence or absence of a short sentence evoking anticipated regret) and therefore led to similar psychological and behavioral responses, which somewhat limited the size of the effects detected by our analyses.

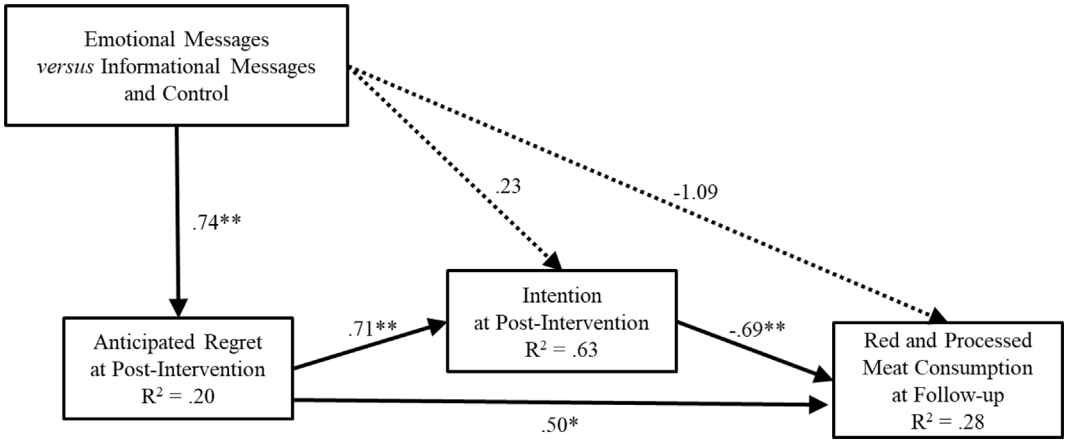

Fig. 1. Mediation model showing paths between variables. Note: All values are unstandardized coefficients; *$p < .05$, **$p < .001$.

Future research might explore the differences among a larger variety of interventions, for example combining messaging with other strategies such as self-monitoring or goal-setting. Another limitation was that our sample was restricted to Italian young adults, thus the data may not generalize to adults or less educated people. FoIn addition, in the present study we did not consider the possible influence of several external factors that are present in the digital space (e.g., the presence of ads of other public company or the presence of online posts about the topic in question). As we adopted a fully controlled experimental design, we could not thoroughly replicate the digital reality. Trying to find a balance between internal and ecological validity, we decided to use a chatbot that sends private messages through Facebook Messenger. In this way users could receive and read the messages on a familiar platform, but without interacting with the Facebook application and its contents. Future studies could investigate how some characteristics of the digital space can moderate the effects of a messaging intervention of the type employed here. Future studies could also deepen our understanding of the effects of informational and emotional appeals, considering their fit with individual characteristics, such as the utilitarian and hedonic approach towards food purchasing (Lombardi et al., 2017) or consumers' trust towards the health/environment recommendation provided by public authorities (Carfora et al., 2019Cembalo et al., 2019).

The results of our research can have some useful implications about how scholars, institutions, and social marketing can ameliorate their communication strategies to reduce RPMC. In our research, all messages were formulated in prefactual (i.e. "If … then") terms, in line with previous findings showing the high persuasiveness of this type of messages (Bertolotti, Carfora, & Catellani, 2019; Bertolotti, Chirchiglia, & Catellani, 2016). Consumers are often exposed to information about the negative health and environmental consequences of certain food choices via different media (e.g., print and broadcast media, food labelling, and community outreach) and nonetheless they often discard these messages, as they sound somewhat distant and inconsequential, or conversely scary and threatening. Institutional and social marketing communication might explore the effectiveness of prefactuals in presenting such information in a more relatable and compelling way, as something that individuals can actively control by adopting the recommended behaviour (e.g., if they reduce RPMC).

More generally, our results open a debate on the possibility of using emotional messages to promote changes also in other healthy and/or pro-environmental behaviours, such as water and energy conservation, organic food consumption, waste management, sustainable transport, and tourism. Both the persuasiveness of prefactually-framed recommendations and the elicitation of anticipated regret may be applied by practitioners who wish to promote sustainable actions in several fields, such as agriculture, education, energy, finance, food, industry, land use, and transport.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2019.104331.

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