The moderating Role of Extraversion and Age on two Dynamic Norm Messages encouraging a Plant-Based Dietary Transition

Jana Melander

S3910059

Department of Psychology, University of Groningen

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Group number 2122_2a_30

Supervisor: Maddie Judge, PhD

Second evaluator: T.J. Downer, MSc

In collaboration with: Fellow students Insa Oßenbrügge, Lisa Ziegler and Annick Dikkerboom

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Abstract

Animal agriculture is a large contributor to greenhouse gas emissions. To slow down climate change, a transition to a more plant-based diet is needed. This experimental study investigated the effect of two dynamic norm messages; group behavior and political measures, on participants' intentions to reduce their animal product consumption. Further, the impact of two moderating variables, age, and extraversion, on the relationship between the conditions and the intentions was analyzed. Our sample consisted of 159 participants, varying in age and nationality, who currently consume animal products. Participants were randomly assigned to one of three conditions, two dynamic norm conditions with two different types of norm messages (group behavior and political measures) or the control condition. They answered questions about their dietary intentions before and after the manipulation. The overall results showed no significant effect of dynamic norm messages on intentions to reduce animal product consumption. However, the moderating variable age affected the intentions of the youngest age group for both dynamic norm messages Additionally, the influence of the moderating variable extraversion was non-significant. Conclusively, more research in this field is needed to increase people's awareness of the importance and impact of animal product consumption on the environment. Lastly, it is crucial to investigate people's intentions and following that, their behavior to act more environmentally friendly and thus help decrease global warming.

Keywords: plant-based dietary transition, animal product consumption, dynamic norms, extraversion, age

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The production of livestock contributes to biodiversity loss, soil degradation as well as air and water pollution with 70% of agricultural land across the world being approximately devoted to livestock production (Steinfeld et al., 2006). Animal agriculture contributes to approximately 18% of greenhouse gas emissions worldwide, exceeding the entire transport sector (Steinfeld et al., 2006). Thus, a reduction in meat consumption and an accompanying shift to a more plant-based diet is needed to decrease the human influence on climate change, from here on called 'a plant-based dietary transition' (Hedenus et al., 2014; Marinova & Bogueva, 2019; Reisch et al., 2013).

According to Bahadur et al. (2018) the United Nations' sustainable development goals of zero hunger (SDG 2) as well as the sustainable consumption and production (SDG 12) goals, which consist of decreasing CO2 emissions as well as saving land, can only be achieved if societies around the world start eating more plant-based proteins. Furthermore, Kwasny et al. (2022) found that eating more sustainably, for example by eating more vegetables or reducing red meat consumption could potentially decrease climate change impact by 50% by 2050. Nonetheless, still many consumers fail to make a connection between environmental changes and meat consumption, specifically taking into account that less meat consumption could help to decrease global warming (Campbell-Arvai, 2015; de Boer et al., 2016). Additionally, negative health consequences, as well as environmental effects, can be linked to animal-based diets, e.g., cardiovascular disease, metabolic disease, and CO2 emissions (Cui et al., 2019; Fretts et al., 2015; Pfeiler & Egloff, 2018).

Nevertheless, in the last few decades, there seems to be a slow dietary transition from an animal-based to a more plant-based diet. Researchers found that biological, physiological, psychological, and socio-cultural factors are associated with people's food choices (Cliceri et al., 2018). This knowledge can be used to build up a healthier and more sustainable lifestyle. Furthermore, on account of the increasingly drastic consequences of climate change, research on how individuals can be encouraged to reduce their animal product consumption is essential. The present research aims to provide new insights into the underlying processes of the successful promotion of a plant-based dietary transition. Furthermore, it will be analyzed which dynamic norm is more efficient in promoting it. The overall goal is to reduce the impact of animal product consumption on the environment.

This study will compare two dynamic norm messages regarding a more plant-based dietary transition and test their effectiveness on participants' intentions and behavior. These messages relate to group behavior and political measures. Norms are directives of a group, showing what is considered appropriate and what is not by that group (APA Dictionary of Psychology, 2022). Dynamic norms can be defined as information about people's changing behavior over time (Sparkman & Walton, 2017). The principle behind the group behavior message is to highlight other people's behavioral changes. The precept of the political measures message is to highlight the impact of laws regarding the behavioral change. These messages compare a bottom-up with a top-down approach which has not been researched intensively yet. A bottom-up process in this context could exemplify that people are voluntarily reducing animal products due to a change in group norms, as a result of an increasing number of people changing their behavior. This means that a more sustainable behavior gets encouraged (Ockwell et al., 2009). The message regarding political measures can be interpreted as a top-down process, standing for behavioral change ordered from a higher institution, not by a voluntary process of the individual. Hence, it pressures people into behaving more sustainably through the power of authority (Ockwell et al., 2009).

Theoretical framework

Dynamic Norms

Sparkman and Walton (2017) found that exposure to dynamic norms can lead to attitude and behavior change. Additionally, a dynamic norm appeal to reduce meat consumption instead of completely restraining it effectively reduced meat consumption and showed lasting effects over a five-month period (Sparkman et al., 2021). On the contrary, Aldoh et al. (2021), as well as Çoker et al. (2022) found no attitude or behavior intention change after exposure to dynamic norms regarding meat consumption. Cialdini & Jacobson (2021) reviewed 58 articles examining the impact of social norms on climate-change-related behaviors. Their overall results show that social norms influence climate-change-related behaviors, but that future research should differentiate between norms. Thus, we will focus on dynamic norms in this study despite the mixed results and therefore examine if dynamic norms can influence people's intentions.

There are multiple reasons why people do not adapt to a more plant-based diet, for example, lack of awareness, information, or perceived responsibility as well as the liking of eating meat (Corrin & Papadopoulos, 2017; Graça et al., 2019; Hoek et al., 2017; Lea et al., 2006; Macdiarmid et al., 2016; Onwezen & van der Weele, 2016; Schösler et al., 2015; Zur & A. Klöckner, 2014). Therefore, more research regarding how people can be influenced to act more sustainable is needed (Sparkman & Walton, 2017). The best predictor of behavior is an intention. Therefore, examining intentions can be essential in influencing behavior. Dorce et al. (2021) found that intentions showed the strongest influence on sustainable behavior. Due to its influential impact, we will focus on intentions in this study.

Political and Group Behavior Conditions

Regarding the group behavior message, it has been found that sustainability decisions are influenced by the perceptions of social norms (Constantino et al., 2021). Dynamic norms can prompt people to perceive an increase in importance regarding a specific societal norm. Due to the importance shift, people anticipate a changing future (Sparkman & Walton, 2017) and can be more willing to change their behavior as well. Thus, dynamic norms show that perceiving the change of other people can lead to reconsideration of one's values and barriers (Sparkman & Walton, 2017). This demonstrates the influence of the group on the individual. Additionally, Khamzina et al. (2021) showed that the group norm in combination with attitudes influenced the intention to act more sustainably.

Graça et al. (2020) illustrated that the communication of legal aspects can increase policy support for more plant-based diets in societies. This is in accordance with the study by Constantino et al. (2021). Their results suggest that institutional signals, e.g., messages showing the impact of climate change while stating a commitment for the public can shift participants' attitudes regarding a more climate-friendly behavior. Nevertheless, this does not change their actual behavior but only their intentions. Examples of policy measures are a price reduction for plant-based products, higher taxes on animal products, labels to show the sustainability of the product, and regulations for more vegan and vegetarian meals in, e.g., company and school cafeterias as well as animal welfare campaigns and regulations (Active State, 2021.; Mathur et al., 2021). The study by Huber et al. (2018) compared two types of social norm messages, group information and institutional information regarding a new government policy. There was little effect on behavioral change of the group behavior intervention. However, the institutional message showed two different effects. There was an increase in pro-environmental behavior when the personal costs were not too high for the individual, whereas there was a negative effect when the costs increased, e.g., voluntarily paying for CO2 offsetting of the society was not paid by most participants. Therefore, there seems to be an effect of political measures on people's intentions.

To explain this effect, cognitive dissonance is essential. Cognitive dissonance is a mental discomfort due to conflicting beliefs or values (*APA Dictionary of Psychology*, 2022). It is important in leading to behavioral and intention change (Séré de Lanauze & Siadou-

Martin, 2019). Cognitive dissonance related to meat consumption can occur when the person recognizes themself as a meat-eater and is aware of the negative consequences this behavior entails, for example, harm to animals or one's health (Rothgerber & Rosenfeld, 2021). People that like to eat meat are unlikely to search for information regarding the negative consequences of meat consumption (Bryant et al., 2022). This phenomenon is called confirmation bias. This stands for the tendency to look for or remember information that confirms one's original beliefs (*APA Dictionary of Psychology*, 2022). Furthermore, people tend to not see their own impact as an individual on the environment (Bryant et al., 2022). Therefore, they will not have the discomfort of cognitive dissonance and no change will occur. Consequently, political measures can be useful tools in bringing people to act more sustainably because they would not act more sustainably on their own.

Moderators Age and Extraversion

We are interested if the effect of the two dynamic norm messages could depend on the age of the participants. As exemplified by a study by Pfeiler and Egloff (2018), it was shown that younger age was significantly and positively related to the consumption of meat. Additionally, people over 40 tend to know the health benefits of a plant-based diet and as a result eat fewer animal products than the younger generation, aged under 20 (Xie et al., 2020). This could lead to the assumption, that younger people would consume more animal products and might not be as willing to increase their intentions in eating less. In contrast, other research has found that younger people are more open to experience and as a result may be more willing to change and potentially adjust their eating habits to more sustainable ones (Schwaba et al., 2018). Furthermore, younger people tend to perceive climate change as more threatening than older generations (McDonald-Harker et al., 2022). This would lead to a different assumption, of younger people being more willing to increase their intentions to eat fewer animal products. Nevertheless, Aldoh et al. (2021) found that age did not influence the

effect of positivity towards less meat consumption. We argue that overall, the older generations tend to be less willing to reduce animal products in comparison to the younger generations (Schwaba et al., 2018). Older people show fully developed identities and many life experiences that could lead them to be more set in their ways, more resistant to change, and therefore less open to intention shifts (Spini & Jopp, 2012). Additionally, there could be potential habituation to messages portraying dynamic norms throughout one's life, leading to less impact of these messages. Thus, we aim to analyze the potential negative effect of age groups on the relationship between the two dynamic norm messages and intentions.

Personality traits can be linked to eating habits. Nonetheless, results regarding which traits are related to healthy and unhealthy eating vary (Pfeiler & Egloff, 2020). This is especially due to looking at different food items as well as different statistical methods. In this study, the focus lies on extraversion. Extraversion can be defined as a broad personality trait that entails outward and socially directed behaviors and interests, showing overall characteristics like sociability, assertiveness, heightened activity, and positive emotions (APA Dictionary of Psychology, 2022.; Extraversion - an Overview / ScienceDirect Topics, 2001). In the study by Pfeiler and Egloff (2020) extraversion was positively associated with meat consumption. Moreover, Keller and Siegrist (2015) found that extraversion influenced eating styles directly and had a significant impact on people's food choices. Extraverted people preferred sweet and savory foods, e.g., meat and soft drink consumption. This behavior might have been influenced by their preference for eating out. Besides, extroverts were found to comply less with social norms (Gudjonsson et al., 2004; Sharma & Malhotra, 2003). Thus, extraversion could be a moderating factor because extraverted people seem to be less attentive to what someone else is doing, being less influenced by the group behavior, and therefore, could be less affected by the dynamic norm conditions. Consequently, extroverts' general preference for savory food, eating out and together with others combined with less

compliance to social norms could lead to a decreased intention to reduce animal product consumption. Therefore, we will examine the impact extraversion has on the relationship between the two dynamic norm messages and intentions.

Research Questions

Our first research question is "To what extent do the dynamic norms of group behavior and political measures differ in promoting a plant-based dietary transition?" It has been shown that both norms can be effective in shifting intentions (Cialdini & Jacobson, 2021; Constantino et al., 2021; Graça et al., 2019; Khamzina et al., 2021; Sparkman et al., 2021; Sparkman & Walton, 2017) but there was only one study comparing the two norms (Huber et al., 2018). Thus, it is interesting to examine the potential difference to understand people's intentions and what can change them better. Our second research question is "Does age moderate the effects of the two messages?" Researchers found that age can have an influence the consumption of animal products (McDonald-Harker et al., 2022; Schwaba et al., 2018; Spini & Jopp, 2012; Xie et al., 2020) and that either the younger generations or older generations are more willing to reduce their animal product consumption. Therefore, this research question contributes to analyzing the connection between age and a plant-based dietary transition. Our third research question is "Does the personality trait extraversion moderate the effects of the two messages?" Extraversion has been shown to be influential in eating preferences as well as compliance with social norms (Gudjonsson et al., 2004; Keller & Siegrist, 2015; Pfeiler & Egloff, 2018; Sharma & Malhotra, 2003) and is thus interesting to examine as a potential moderator.

Hypotheses

Our first hypothesis (H1) is that both dynamic norm conditions affect intentions, leading to a higher intention to reduce animal products than a control condition. This is

hypothesized because dynamic norms have been shown to be effective in leading to attitude and behavior change in former research (Sparkman et al., 2021; Sparkman & Walton, 2017).

The second hypothesis (H2) states that the political measure condition will lead to a higher intention to reduce animal products than the group behavior condition. This is hypothesized due to former research findings highlighting the effectiveness of institutional signals in comparison to the group norm (Constantino et al., 2021; Graça et al., 2019; Huber et al., 2018) as well as the influential factors, cognitive dissonance, and confirmation bias, leading the individual to be less open to change or new information. Thus, political measures can be a good starting point in motivating people to act more sustainable in explaining the consequences for the environment and the benefits while implementing measures that are not too cost-intensive (Huber et al., 2018). This is an exploratory hypothesis because there is a lack of research on the effect of political measures on norm perception, especially in the environmental context (Constantino et al., 2021). This lack highlights the importance of our hypothesis to gather more information on the topic.

Our third hypothesis (H3) states that intentions to eat fewer animal products as a function of dynamic norms decrease with increasing age. Therefore, dynamic norms and age presumably interact and the differences between the messages should be smaller for older people. This moderation is illustrated in Figure 1. This was hypothesized because of the fully developed identities and life experiences of older people, leading to more resistance to change (Spini & Jopp, 2012) as well as potential habituation to norm messages.

The fourth hypothesis (H4) is formulated regarding the moderating effect of extraversion, hypothesizing that extraversion will decrease the influence of the relationship between the dynamic norm messages and intentions. The intentions as a function of dynamic norms should decrease with an increasing level of extraversion. This moderation can be seen in Figure 2. This was hypothesized because extroverts seem to pay less attention to the behavior of others and therefore it can be assumed that the dynamic norm messages will not lead to intention changes (Keller & Siegrist, 2015; Pfeiler & Egloff, 2018).¹

Figure 1

Moderation Model of Age



Note. Own representation. Age as a moderator between the two conditions (group behavior message and political measure message) and intentions.

Figure 2

Moderation Model of Extraversion



Note. Own representation. Extraversion as a moderator between the two conditions (group

behavior message and political measure message) and intentions.

¹ We planned on measuring behavior change asking about animal product consumption in the original and in a follow-up survey. Therefore, behavior was included as an exploratory analysis. We could not analyze the potential behavior change due to insufficient responses to our follow-up questionnaire (35 responses). We did not state specific hypothesis but that there should be a change in behavior after being exposed to the manipulation messages.

Method

Participants

An a priori power analysis (using the G*Power application) based on a One-way Analysis of Covariance (ANCOVA) test showed that 179 participants were required to achieve a medium effect size (f = .25) and power of 0.80. In this study, 253 participants participated. We excluded 13 participants who are vegan, because they already have limited their animal product consumption to eating no animal products at all. Furthermore, we excluded 81 participants with incomplete datasets, including participants who did not read the manipulation part of the study (as shown by a timer on the page recording less than one second of viewing). After excluding these participants, the final sample consisted of 159 participants. All the participants were 18 years or older. Of all participants, 60.4% were in the age group of 18-35 years old, 19.5% were in the group of 36-50 years old, 15.7% were in the group of 51-64 years old and 4.4% of the participants were 65 years and older. The sample consisted of 42 men (26.4%) 116 women (73.0%) and one non-binary person (0.6%). Of all participants 40 identified themselves as vegetarian (25.2%), 86 as meat reducers (54.1%), thirty as meat eaters (18.9%) and three participants answered 'other' (1.9%). There were 47 Dutch (29.6%), 99 German (62.3%), and 13 international/other participants (8.2%). The participants were recruited through snowball sampling to try to achieve a broader range of age groups. The participants took part in the study voluntarily and did not receive any compensation for their participation.

Design and Procedure

The present study is a between-subjects randomized experiment, containing two dependent variables, namely intentions for reducing animal products and actual animal product consumption. Furthermore, we manipulated the source of the dynamic norm messages as an independent variable. Prior to the start of the data collection, the study was approved by the Ethics Committee of the Faculty of Behavioral and Social Sciences (EC-BSS) of the University of Groningen. The data was anonymized, the participants' identities protected, and their data treated with confidentiality. Before the start of the study, every participant received an informed consent form, and they received a debriefing form at the end of the first questionnaire. The debriefing form included the purpose of the study, the manipulations they were exposed to, as well as the deception that has been involved. The deception concerned the information added to the newspaper articles of the two experimental conditions, which we specified and changed a bit from the truth to make them more influential as well as generalized them to all EU-citizens.

Researchers sent the online questionnaire to members of their social networks using a Qualtrics link shared either via email, WhatsApp, or via other social media. The data collection took place for 17 days and the survey lasted about 10 minutes. The participants were randomly assigned to one of the three experimental conditions. We asked participants for demographic data (age, gender, nationality, dietary identity) and email addresses² first, before continuing to the scales measuring our variables. We continued by assessing the amount of animal products consumed by the participants on a weekly basis, their interest, and intent to eat less animal products. This was followed by some personality measurements. Then, our experimental part began, where the participants were asked to read through a newspaper article, with randomized conditions. While the participants in the control group merely received basic information on how the consumption of animal products the environment, those in the individual behavior condition received some extra information about how many people are currently changing their behavior, while those in the law condition learned about new political measures that were to be introduced. Finally, we

 $^{^{2}}$ We asked for the email addresses of participants to be able to connect the answers of the original survey to the intended follow-up survey.

assessed intention and interest in reducing animal product consumption again, followed by one question assessing the perceived likelihood of a social norm change.

Introductory content. The following text was shown to every participant, making sure that everyone has the same level of information regarding the environmental impact of animal products. The control condition received this text without the manipulation sentences afterwards, see manipulation below. "Research has found that, by 2050, the impact of climate change could be halved by switching to more sustainable eating choices including a vast reduction in red meat consumption. Currently, 70% of the agricultural land is used for the production of animal products. Consequences of this extensive animal agriculture are increased carbon emissions, deforestation, loss of biodiversity, as well as soil degradation. Furthermore, the industry causes environmental and groundwater pollution due to insufficient waste management. The greenhouse gas emissions of the livestock industry appear to be responsible for up to 18% of the greenhouse effect, which exceeds the contribution of the complete transportation sector. Thus, livestock industries can be considered as unsustainable. Consequently, a transfer to a more plant-based diet seems to be essential to scale down climate change."

Manipulation. Moreover, we used a dynamic-norm message for both our experimental conditions, communicating either a potential norm change in individual behavior, a political adjustment, or a control condition. The message for the group behavior condition was phrased like the following: "Fortunately, recent research has shown that within the last 5 years, EU citizens have now started to make an effort to limit their animal product consumption. In recent years, already 20-30% of EU citizens have changed their behavior and begun to eat less animal products than they otherwise would.". This message was inspired by Sparkman & Walton (2017), highlighting that people can be prompted to change to eating less animal products through dynamic norm messages. For the political condition, the norm

message was formulated in the following way: "Currently, the EU parliament is discussing the application of laws implementing heightened taxes on animal products based on their individual environmental impact. Consequently, prices of animal products such as eggs, dairy and meat would increase by at least 30% as stated by EU spokesman Jaume Duch Guillot." The control group did not receive any dynamic norm message.

Materials

The word "meat" was changed to "animal products" to adapt the original questions to our research question. All the scales and questions used were translated into German and Dutch. We did this to broaden our sample group. The English surveys can be found in Appendix B. The scales were included in the survey in the following order.³

Animal product consumption. We adapted one question from Carfora et al. (2019) to measure animal product consumption. The question states "How many servings of animal products have you eaten in the previous week?" The answer can be given on a scale from 0-21, which stands for three meals a day for one week. Carfora et al. (2019) described one serving as being the same size as a deck of cards.⁴

Intention. We measured the participant's intention to reduce their consumption of animal products before introducing our manipulation as well as after it and in the follow-up questionnaire with four items. These items were adapted from Sparkman and Walton (2017) and from Judge et al. (2022). They asked, "How interested are you in eating less animal products?", "I intend to eat less animal products", "In the upcoming month, I will eat less animal products", "In the foreseeable future, to what extent do you think you will make an

³ We also measured collective efficacy, self-efficacy as well as intrinsic and extrinsic motivation as mediators in our thesis project. I focused on extraversion and age as my moderators while the other group members focused on the mentioned mediators.

⁴ This measure was included because our aim was to measure the participant's animal product consumption after one week and examine a potential change in behavior. This could not be conducted due to insufficient follow-up answers.

effort to eat less animal products?". A five-point Likert scale was used (1 = Not at all, 5 = Extremely). The items showed an internal reliability of $\alpha = .93$

Extraversion. To measure the personality trait extraversion, we used the extraversion subscale of The Big Five Inventory-2 (BFI-2), which is a revision of the Big Five Inventory (BFI) (Soto & John, 2017). It shows a more robust hierarchical structure, an improved control for individual differences in responses as well as greater predictive power than the BFI. We used five questions from the personality trait extraversion subscale out of the 12 questions offered by the BFI-2 (Soto & John, 2017). We decided not to use all the questions for extraversion to avoid making the questionnaire uncomfortably long for the participants. We included the questions with the highest internal reliability, choosing three reversed and two regular phrased questions, $\alpha = .88$. The answers could be given on a Likert scale (1= *Strongly agree*).

Manipulation check. To check whether the texts successfully manipulated perceived future social norms, we asked participants about their perceived future social norm by asking one question "In the foreseeable future, to what extent do you think that many people will make an effort to eat less animal products?" (Sparkman & Walton, 2017). It could be answered with a Likert scale ranging from (1 = Not at all to 5 = Extremely).

Results

Assumption Check

Assumption tests were conducted to check whether the data met the assumptions of the statistical tests. Despite some minor violations, the assumption of normality is met (see appendix A Figure 3, and Figure 4). The residuals are normally distributed (see appendix A

Figure 5) and thus a linear relationship can be assumed. Figure 5 shows that the homoscedasticity assumption holds as well. ^{5 6}

Manipulation Check

We used an Analysis of Variance (ANOVA) to check for the effectiveness of our manipulation. We expected an increase in perceived changes in social norms from our participants. For this analysis, SPSS Statistics 26 was used. The ANOVA was conducted using the three conditions (group behavior, political measures, and control) and the manipulation item as the dependent variable. No significant differences between the two manipulation conditions and the control condition were found (p = .15) with a small effect size ($\eta p^2 = .02$).

ANCOVA

For this analysis SPSS Statistics 26 was used. A one-way Analysis of Covariance (ANCOVA) was conducted to compare the effectiveness of the three conditions (group behavior, M = 3.77, SD = 0.88, n = 50, political measures, M = 3.63, SD = 0.98; n = 61, and control, M = 3.71, SD = 0.90, n = 48) whilst controlling for baseline intentions. An ANCOVA was chosen because it entails a better power analysis as well as an improved capacity to detect interactions and measurement errors in the covariates (Little et al., 2000). A covariate was needed to include baseline intentions in our analysis. There was no significant difference in intentions [F(2, 155) = .17, p = .84] between the conditions with a small effect size ($\eta p^2 = .03$). Thus, we fail to support H1 and H2.

Two-way ANCOVA and Simple Main Effects

A moderation analysis for age was conducted via SPSS. For this, a two-way ANCOVA for three age groups (18-35, 36-50, 51-64) and the three conditions was used. We

⁵ We checked for outliers and run the analysis again. There were no significant differences found.

⁶ We planned on measuring behavior change using a follow-up questionnaire. This follow-up could not be analyzed due to insufficient answers (35 responses).

originally had four age group options, but due to insufficient participants for the last age group category, 65 and older (n = 6), we decided to omit this age group from the analysis. The two-way ANCOVA was conducted to examine whether the effects of the two messages depended on the age group of the participants in comparison to the control condition. The independent variables were the three conditions and the age group variable. The dependent variable was post intentions. The baseline intentions variable was included as a covariate The interaction age*condition*baseline intentions showed F(9, 134) = 97.61, p < .001, with a large effect size ($np^2 = .86$). Consequently, we conducted a simple effects analysis using SPSS. For this, we conducted the estimated marginal means analysis for the interaction between age and conditions and asking for the Confidence interval adjustment of Fisher's Least Significant Differences because we did not have any preferences regarding probabilities. There was a significant interaction between the two manipulation conditions and the age group 18-35 (p = .047). Law (p = .047, 95% CI of the difference = .002 to .347). Group behavior (p = .047, 95% CI of the difference = -.347 to -.002). Thus, there is not enough information to support H3 but there is a significant intention change for the youngest age group in the two manipulation conditions in contrast to the control condition.

Moderation Analysis

A moderation analysis for extraversion was conducted, looking at the effect of the level of extraversion on the two manipulation conditions. For this, PROCESS v4.1 by Andrew F. Hayes was used. The hypothesized moderation model was tested in a single model (model 1) using a bootstrapping approach, bootstrapped samples (5,000) to assess the significance of the effects of the manipulation at differing levels of the moderator (Hayes, 2013). A dummy coded variable for the two manipulation conditions was the predictor variable. Here, the political measure condition was coded with 1 and the group behavior condition was coded with 0. The outcome variable was post intentions and extraversion was the proposed moderator. This moderation analysis tests the effect of a moderating variable (extraversion) on the relationship between a predictor (group behavior dynamic norm condition vs. political measure dynamic norm condition) and an outcome variable (post intentions). The results show a non-significant effect (SE = .28, p = .99, 95% CI = [- .55, 55]). Therefore, we cannot support H4.

Discussion

Changing one's animal product consumption can be crucial in reducing one's carbon footprint and mitigating the effects of climate change. Dynamic norm messages have been found to have a positive influence on participants' intentions to eat a more sustainable diet (Sparkman & Walton, 2017). In this research, we explored the potential impact of dynamic norm messages on the intention of participants to consume fewer animal products. This was tested by using two different norm messages, group behavior, and political measures. Furthermore, we analyzed if two moderating variables, age, and extraversion, would change the relationship between the norm messages and intentions.

Our first hypothesis (H1) was that both dynamic norm conditions will have an effect, leading to a higher intention to reduce animal products compared to the control condition. This hypothesis was not supported by our data analysis. H2 assumed that the political measure condition will lead to a higher intention to reduce animal products than the group behavior condition. This hypothesis could also not be supported by our data. The third hypothesis (H3) stated that the intention to eat fewer animal products as a function of dynamic norms decreases with increasing age. This hypothesis could not be entirely supported. We found a significant difference regarding an impact of the dynamic norm messages for the youngest age group. Nevertheless, there was no change for the older age groups. However, this supports the notion that younger people are more willing to change or get influenced by dynamic norm norms should decrease with an increasing level of extraversion. This hypothesis was not supported by our data output.

Theoretical Implications

Some research has found that dynamic norms can lead to attitude and behavior change as well as a longer-lasting reduction in meat consumption (Sparkman et al., 2021; Sparkman & Walton, 2017). Moreover, it was found that dynamic norms can prompt people to perceive an increase in importance regarding a specific societal norm and thus anticipate a changing future (Sparkman & Walton, 2017). Constantino et al. (2021) and Graça et al. (2020) demonstrated that information about policy measures like Meat Curtailment Policies can increase the support for a more plant-based diet on a societal level as well as change people's intentions to behave more environmentally friendly. Our results are consistent with existing research that has found no effect of dynamic norms on intentions (Aldoh et al., 2021; Çoker et al., 2022). Thus, our research suggests that there might be no significant differences between two types of dynamic norm messages, group behavior and political measures, on intentions to reduce animal product consumption.

Moreover, we investigated two moderation models. First, we analyzed whether age influences the relationship between the two condition manipulations and intentions to reduce animal products consumption. We hypothesized that older people are less willing to eat fewer animal products in comparison to younger people. This was based on the assumptions that life experiences and having a fully developed identity have a negative effect on a person's intentions to change (Spini & Jopp, 2012). Individuals might be less influenced by either dynamic norm message if one has already been exposed to messages like this during the process of one's life due to decreasing sensitivity or an adaptation effect. In conclusion, the effects of aging could lead to a decrease in intentions to eat fewer animal products in both dynamic norm conditions. This effect cannot entirely be found in our data. Nevertheless, we

found that both dynamic norm messages influenced the intentions of the youngest age group, suggesting that younger people are more willing to change their intentions to consume fewer animal products when confronted with dynamic norms.

Second, we examined the relationship between the group behavior and the political measures condition on intentions while evaluating if the degree of extraversion changes this relationship. Pfeiler and Egloff (2020) as well as Keller and Siegrist (2015) found that a higher degree of extraversion seems to be related to a heightened consumption of meat. Additionally, extroverted people seem to comply less with social norms (Gudjonsson et al., 2004; Sharma & Malhotra, 2003) and could therefore be less influenced by dynamic norm messages. Both factors together could lead to hampered intentions to eat fewer animal products and show an effect of the personality trait extraversion on intentions, suggesting that the differences between the dynamic norm messages and intentions could depend on the level of extraversion. These findings were not supported by our data analysis which showed a non-significant effect of extraversion on the relationship between the two conditions and intentions.

Limitations

Our study shows some limitations. First, one limitation is the little variation in the age of the participants. This is therefore not a representative sample of the population and hence, our results cannot be generalized to other populations of different ages, ethnicities, etc. Second, we measured the consumption of animal products as an overarching concept instead of researching meat consumption alone, which could have influenced people's accuracy in answering the survey. Third, the manipulation could have been too weak. This could lead to a rather unclear norm message due to too little text (two sentences regarding the norm conditions) relative to the introductory text. We expected an increase in perceived changes in social norms from our participants if the manipulation of the dynamic norm messages would have worked. Thus, we asked for participants' perceived changes in the future as a manipulation check. Participants reported that they expect no differences, thus leading to the conclusion that our manipulation was indeed too weak. Furthermore, we added an invisible timing variable to the general information and the manipulation and found that 25% of participants read the text for less than or a maximum of ten seconds, also highlighting that the manipulation might not have worked due to insufficient engagement with it. Another limitation is that participants might not have read or understood the text completely and thus not been properly exposed to the manipulation. Furthermore, the control condition also received an informative text and could have been influenced by their intentions, leading to a reduced comparable effect between the three conditions. It could also be that the personal costs were too high for the individuals to show any increase in intentions. Huber et al. (2018) showed that this reduces the willingness of participants. For example, our political measures condition could have elicited this effect by raising too high taxes on animal products. The fifth limitation consists of the cultural and historical context. Nowadays it becomes increasingly common to be confronted with diverse norm messages about reducing meat consumption, and thus the effect might be reduced due to constant exposure. Other generations were not exposed to the same messages and the positive impact of a plant-based diet was less known. Sixth, another influencing factor could be that the intentions of participants were already high and thus a significant increase would have been implausible, e.g., 17.8% of participants were already vegetarian. The seventh limitation could be that participants felt the need to let us know that they have lower consumption of animal products than they do due to social desirability. Eighth, a combination of both messages, the group behavior, and the political measures dynamic norm condition, could have been the most effective in increasing intentions to eat fewer animal products, similar to what has been found in previous research (Huber et al., 2018), but we did not study the combination of both

conditions. Ninth, our study was underpowered due to too few participants. Lastly, we used snowball sampling to obtain participants' data. Another sampling method could increase the variability and generalizability of data.

Strength

Our study also has some strengths. We examined a relatively new area of studying an intervention to reduce animal product consumption (rather than just meat consumption) and thus leading to inspiring exploratory research options. Additionally, the study is of high practical relevance, and it is important to examine the relationships further to be able to understand people's intentions better to reduce carbon dioxide emissions and foster a plant-based dietary transition. Furthermore, we used multiple questions from well-established questionnaires to measure our constructs and these showed good internal reliability (Carfora et al., 2019; Judge et al., 2022; Soto & John, 2017; Sparkman & Walton, 2017). Lastly, we used an experimental and randomized design, ensuring the outcomes were comparable and valid.

Future directions

For future research, we would recommend using a neutral text for the control condition instead of also offering them the general information text. Moreover, recruiting a larger sample to increase power is essential. This should be achieved with a different sampling method than snowball sampling. This is important to increase variability in, for example, age groups and as a result increase generalizability. Furthermore, it is important to control for social desirability and thus to not ask for personal information in the survey, e.g., the email address or test for social desirability using specific questionnaire items. Additionally, a stronger manipulation, e.g., a real newspaper article statement, should be essential. It is recommendable that the manipulation is tested by a pilot study before conducting the actual study. To strengthen the manipulation, a longer text could be used. Additionally, one could also check for the timing variable again and be stricter in excluding participants who did not spend enough time, e.g., at least 20 seconds, on the manipulation page. As a result, a bigger sample is crucial to achieve these aims.

Conclusion

This study aimed to examine the influence of dynamic norm messages on intentions to reduce one's animal product consumption. People of all age groups who were eating animal products were targeted. Our results found that dynamic norms do not influence intentions on the group or the political level. This effect was not changed by extraversion. But the moderator age showed a significant effect for the youngest age group after exposure to both dynamic norm messages. This suggests that the intentions of the youngest age group can be influenced by group behavior and political measures dynamic norm messages. This was one of the first studies examining animal product consumption instead of solely meat consumption, showing the importance of the need to broaden the notion of a plant-based dietary transition. This transition can be crucial in decreasing human influence on climate change (Hedenus et al., 2014; Marinova & Bogueva, 2019; Reisch et al., 2013; Steinfeld et al., 2006). Moreover, Cialdini & Jacobson (2021) highlighted the importance of differentiating between norms regarding sustainability. More research examining the effect of norms on intentions regarding plant-based dietary transitioning is needed. Examining dynamic norms was a first step because they have been shown to affect attitude and behavior (Sparkman et al., 2021; Sparkman & Walton, 2017). It is crucial to find out more about how to influence intentions to act more sustainable and as a result, have an increase in proenvironmental behavior and consequently, be able to scale down climate change. This can be achieved by examining other norms, refined studies on dynamic norms as well as other research focusing on a plant-based dietary transition and its successful promotion.

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Appendix A

Figure 3 *Residuals vs. Predicted*





Standardized Residuals Histogram



Figure 5 *Residuals vs. Predicted*



Appendix B

Misperceptions in the dietary transition Questionnaire

Start of Block

INFORMATION ABOUT THE RESEARCH

Version for participants

"Perceptions of sustainable dietary behaviors" EC code: PSY-2122-S-0330

Why do I receive this information?

You are cordially invited to participate in the following research study because you are over the age of 18 and an EU citizen. This study investigates your perceptions of sustainable dietary behaviors. The research will start in April 2022 and will end in June 2022. The research plan was evaluated by the Ethics Committee of Psychology (ECP) of the University of Groningen. The principal investigator of this research is Dr Madeline Judge, a researcher at the University of Groningen. Four bachelor students are also involved (Insa Oßenbrügge, Lisa Ziegler, Annick Dikkerboom and Jana Melander).

Do I have to participate in this research?

Participation in the research is voluntary. However, your consent is needed. Therefore, please read this information carefully. Ask all the questions you might have, for example, because you do not understand something. Only afterward you decide if you want to participate. If you decide not to participate, you do not need to explain why, and there will be no negative consequences for you. You have this right at all times, including after you have consented to participate in the research.

Why this research?

this research aims to examine people's perceptions of sustainable dietary behaviors.

What do we ask of you during the research?

Before taking this survey, you will be asked to consent to participate. The first step of this research is for you to answer some demographic, dietary behavior, and personality questions. After that, you will read a short general information newspaper article about sustainable dietary behaviors. Then, you will be asked to fill in a short survey about your perceptions. This will not take longer than 10 minutes. The study includes a follow-up questionnaire, so we will ask you to provide your email (this will not be used for any other purposes). The follow-up questionnaire will not take longer than 2 minutes and will be sent to you via email one week after the original study.

What are the consequences of participation?

With your participation, you are contributing to research on the psychology of sustainable behavior. The time investment is relatively low and there are no known risks of participation. There is no monetary compensation for participating in this survey.

How will we treat your data?

You are able to withdraw from this study at any point, without negative consequences. The collected survey data is mostly quantitative (with one qualitative item) and will be analyzed by a team of researchers. Within one month of sending out the follow-up surveys, all email addresses will be deleted from the datasets. You will be able to request a summary of the overall findings of the study; however, we cannot provide your individual responses after this

point, since we do not collect other identifying information. Anonymized survey data may be stored on the Open Science Framework by the primary researcher after any publications of journal articles if requested by the journal. The principal investigator is responsible for processing and correctly storing the data. It will be stored on a password-protected drive for at least five years following any publications.

What else do you need to know?

You may always ask questions about the research: now, during the research, and after the end of the research. You can do so by emailing j.melander@student.rug.nl.

Do you have questions/concerns about your rights as a research participant or about the conduct of the research?

You may also contact the Ethics Committee of the Faculty of Behavioral and Social Sciences of the University of Groningen: ec-bss@rug.nl.

Do you have questions or concerns regarding the handling of your personal data? You may also contact the University of Groningen Data Protection Officer: privacy@rug.nl. As a research participant, you have the right to a copy of this research information.

Page Break

INFORMED CONSENT

"Perceptions of sustainable dietary behaviors"

I have read the information about the research. I have had enough opportunities to ask questions about it. I understand what the research is about, what is being asked of me, which consequences participation can have, how my data will be handled, and what my rights as a participant are. I understand that participation in the research is voluntary. I myself choose to participate. I can stop participating at any moment. If I stop, I do not need to explain why. Stopping will have no negative consequences for me. Below I indicate what I am consenting to.

Consent to participate in the research:

 \bigcirc Yes, I consent to participate; this consent is valid until 27-06-2022 (1)

 \bigcirc No, I do not consent to participate (2)

Skip To: End of Survey If Consent to participate in the research: = No, I do not consent to participate

Consent to processing my personal data:

• Yes, I consent to the processing of my personal data as mentioned in the research information. I know that until 27-06-2022 I can ask to have my data withdrawn and erased. I can also ask for this if I decide to stop participating in the research. (1)

 \bigcirc No, I do not consent to the processing of my personal data. (2)

Skip To: End of Survey If Consent to processing my personal data: = No, I do not consent to the processing of my personal data.

What gender do you identify with?

 \bigcirc Male (1)

 \bigcirc Female (2)

 \bigcirc Non-binary (3)

 \bigcirc Prefer not to say (4)

Please indicate your age group

○ 18-35 (1)

○ 36-50 (2)

○ 51-64 (3)

 \bigcirc 65 and older (4)

Please state your nationality

Please state your email address for our short follow-up questionnaire

Which of the following best describes your diet?
Meat eater (1)
Meat reducer (2)
Vegetarian (3)
Vegan (4)
Other (5)

Page Break

Most of the questions in this questionnaire will ask you about your consumption and attitudes towards the consumption of animal products. This includes meat, fish, eggs, and dairy products (cheese, milk, yogurt, butter etc.).

How many servings of animal products have you eaten in the previous week?

0 2 4 6 8 11 13 15 17 19 21



How interested are you in eating less animal products?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

To what extent do you agree with this statement: "I intend to eat less animal products"?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

To what extent do you agree with this statement: "In the upcoming months, I will eat less animal products"?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

In the foreseeable future, to what extent do you think you will make an effort to eat less animal products?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

Page Break

Please answer the following questions about your personality.

I am someone who has an assertive personality

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

I am someone who rarely feels excited or eager

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

I am someone who finds it hard to influence people

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

I am someone who is full of energy

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

I am someone who prefers to have others take charge

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

Page Break

General information text

We would like you to read this information carefully

Research has found that, by 2050, the impact of climate change could be halved by switching to more sustainable eating choices including a vast reduction in red meat consumption. Currently, 70% of the agricultural land is used for the production of animal products. Consequences of this extensive animal agriculture are increased carbon emissions, deforestation, loss of biodiversity, as well as soil degradation. Furthermore, the industry causes environmental and groundwater pollution due to insufficient waste management. The greenhouse gas emissions of the livestock industry appear to be responsible for up to 18% of the greenhouse effect, which exceeds the contribution of the complete transportation sector.

Thus, livestock industries can be considered as unsustainable. Consequently, a transfer to a more plant-based diet seems to be essential to scale down climate change.

Political measures condition manipulation text following the general information text Currently, the EU parliament is discussing the application of laws implementing heightened taxes on animal products based on their individual environmental impact. Consequently, prices of animal products such as eggs, dairy and meat would increase by at least 30% as stated by EU spokesman Jaume Duch Guillot.

Group behavior condition manipulation text following the general information text Fortunately, recent research has shown that within the last 5 years, EU citizens have now started to make an effort to limit their animal product consumption. In recent years, already 20-30% of EU citizens have changed their behavior and begun to eat less animal products than they otherwise would.

Timing

First Click (1) Last Click (2) Page Submit (3)

Click Count (4)

Page Break

I believe that I have the ability to take action to mitigate global warming and prevent climate change, by eating less animal products.

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

Although it may cause me inconvenience, I can eat less animal products to mitigate global warming.

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

○ 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

If I tried to quit eating animal products, I believe I would be likely to succeed.

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

Following a diet that includes little to no animal products will be hard for me.

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

I believe that, if we collectively change our diet to a more plant-based and sustainable one, we, as a group, can collectively act to make a positive difference in mitigating climate change.

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\bigcirc 1 Strongly disagree (1)
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 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

I believe that people changing their diets to more plant-based and sustainable ones, together, can make a positive difference in mitigating climate change.

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

We would like to know more about your response to the previous question (optional).

Please explain in 1-3 sentences why you do (or do not) believe that adopting a more plantbased diet collectively would have a positive impact.

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Please rate the following statements about your motivation to eat fewer animal products. If you do not have any interest in eating fewer animal products, imagine what your motivation could result from, if you were interested.

Why would you engage in eating less animal products? Because I would feel good when doing this activity

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

Because I would feel that I have to do it

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

Because I think that this activity would be interesting

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

○ 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

Because I wouldn't have any choice

 \bigcirc 1 Strongly disagree (1)

 \bigcirc 2 Disagree (2)

 \bigcirc 3 Neither agree or disagree (3)

 \bigcirc 4 Agree (4)

 \bigcirc 5 Strongly agree (5)

Page Break

How interested are you in eating less animal products?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

To what extent do you agree with this statement: "I intend to eat less animal products"?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

To what extent do you agree with this statement: "In the upcoming months, I will eat less animal products"?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

In the foreseeable future, to what extent do you think you will make an effort to eat less animal products?

 \bigcirc 1 Not at all (1)

 \bigcirc 2 Slightly (2)

 \bigcirc 3 Somewhat (3)

 \bigcirc 4 Moderately (4)

 \bigcirc 5 Extremely (5)

In the foreseeable future, to what extent do you think that many people will make an effort to eat less animal products?

1 Not at all (1)
2 Slightly (2)
3 Somewhat (3)
4 Moderately (4)

 \bigcirc 5 Extremely (5)

Page Break

Debriefing

Thank you for participating in our study.

The main aim of this study was to examine if different messages can influence people's intention to reduce their animal product consumption. We first presented the information about the health and environmental consequences of animal products, and then presented three different messages to groups of participants

1) a message about the government considering policy to reduce the consumption of animal products,

2) a message about how many other people have started to reduce their consumption of animal products, and

3) a control group with no message.

We also investigated if there were different effects of these messages in different age groups

and for people with different levels of extraversion. Furthermore, we investigated what psychological mechanisms explained differences in how people responded to the messages. It is important to let you know that we included a small amount of deception in the messages, to make them sound more relevant to the participants that we were recruiting.

Firstly, we said the EU parliament is currently trying to implement a law about the introduction of higher taxes on animal products. This statement does not reflect reality. A similar law is, however, currently being considered in the Netherlands. Secondly, we said that a specific number of EU citizens have started to change their behavior, which is also not true. This message was based on statistics that reflect consumer behavior in the Netherlands, specifically. However, to allow for including participants from different countries in the EU, we generalized the statistical findings to all EU citizens.

We expect that the two conditions with specific messages about changes in the law or society will result in higher intentions to reduce animal product consumption, in contrast to the control group. We also expect that the two norm conditions will significantly differ from each other and that there will be higher intentions to reduce animal product consumption in younger age groups.

If there are any further questions about the study, please don't hesitate to contact us via j.melander@student.rug.nl.

Thank you for your time and cooperation.

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