Towards Sustainability by Changing the Moral Standing of Animals:

The Influence of Raising Awareness About Animal Cognition and Emotion on Animal Product Consumption Habits and Meat-Eating Justifications

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Abstract

Animal product consumption has wide-ranging negative effects on the environment and animal welfare. To resolve these issues, the general amount of consumed animal products needs to be decreased. While aiming to change these consumption patterns, it is crucial to understand which psychological mechanisms are involved. This research investigated the effect of an intervention on participants' behavioural intentions regarding animal product consumption and actual consumption behaviour, as well as their meat-eating justifications. In the two-part study (*N* = 590 and *N* = 546), participants either received a video intervention educating about animals' cognitive and emotional abilities or received no intervention. Following the results, participants who received the intervention intended to reduce their animal product consumption more strongly than the control group (Part 1). For the pre- and post-measurement, the statistical tests displayed a discrepancy regarding the effect of the intervention on animal product consumption (Parts 1 and 2). Additionally, the intervention did not influence participants' meat-eating justifications. However, participants in the intervention group tended to agree less to religious statements justifying meat consumption. This indicates that appealing to religious beliefs and values might provide an opportunity to accomplish a dietary shift towards consuming fewer animal products. Participants who consumed more meat also tended to agree to different justifications more strongly to justify their meat consumption (Part 2). Based on this, this research provides a potentially valuable step towards understanding how to change the application of mechanisms underlying animal product consumption, which is crucial towards developing more sustainability and animal welfare.

Introduction

Animal product consumption has a wide-ranging negative impact on the environment and animal welfare (Atkinson et al..2013; Xu et al., 2021). Because of these problems, global animal product consumption needs to be reduced (Gonzalez et al., 2020; Mandel et al., 2023). To achieve this necessary change, it is essential to understand human perception of animal sentience and the motives underlying consumption patterns. One significant aspect relates to common misconceptions about animals' cognitive and emotional capabilities, which are often unknown or underestimated by meat eaters (Leach et al., 2023). Without understanding animals' capabilities to feel and suffer, many people consider consuming animal products not as a moral issue and do not intend to change their consumption behaviour (Loughnan et al., 2010). This research aims to explore the effect of a video intervention to resolve the question *"Will raising awareness about animals' cognitive and emotional abilities influence people's justifications for meat-eating, their intentions, and their actual behaviour regarding animal product consumption?"* By investigating this effect, this research could provide meaningful insight into how psychological mechanisms are involved in animal product consumption, which could constitute a valuable step towards sustainability and animal welfare.

Environmental Implications

The first negative consequence of our current animal product production and consumption is an increasingly detrimental environmental effect. Livestock farming has been increasing since the 1960s, and, following this increase, can be defined as a major driver of climate change and global warming. Today, the livestock industry is responsible for around 35% of global greenhouse gas emissions (GHGE) (Xu et al., 2021). According to Gonzalez et al., (2020), a shift towards a vegetarian diet would make it possible to reduce up to 50% of GHGE, as omnivorous diets have the highest environmental impact (1.83 t CO_2eq/person/year). At the same time, vegan or vegetarian diets are responsible for lower emissions (0.89 and 1.37 t CO_2eq /person/year) (Gonzalez et al., 2020). Additionally, livestock farming covers over 40% of the EU state surface and therefore significantly destroys natural habitat, leading to a disastrous loss of biodiversity (Geiger et al., 2010). Bonnet (2020) emphasises its negative global impact on deforestation, and the pollution of water, soil, and air. Based on this, the serious negative impact of today's food industry needs to be put into focus of public concern (Gonzalez et al., 2020).

Animal Welfare

In addition to the mentioned environmental effects, industrial livestock farming causes problems concerning animal welfare (Buller, 2018). The concept of animal welfare is composed of the interrelated factors of the state of the animal body (e.g., physical health), its affective states (e.g., pleasure, pain, and suffering), and its freedom to perform natural, species-typical behaviours (Fraser, 2008). Furthermore, animal welfare concerns also include the ways animals are "farmed, transported, and slaughtered" (Buller, 2018, p.12).

The extent to which animal welfare violations occur throughout the life of animals in the livestock industry can be highlighted based on the example of cattle, which occurs right after the birth of a calf. To use cow's milk for human consumption, separating mother and calf right after birth is a widespread practice. Marino and Allen (2017) highlight the strong bond between mother and calf, which is immediately built up after birth, and results in significant levels of distress experienced by mother cows after separation from their calves (Marion & Allen, 2017). In the following, the calves are held in social isolation, putting them at risk of developing negative cognitive, social, and behavioural impairments (Mandel et al., 2022). Next, cattle kept in conventional husbandry are subject to an increased risk of developing physical health issues. Standing on hard surfaces and limited space puts cattle at risk to develop lameness and claw problems. High stocking densities and poor hygiene enable the spread of diseases, such as mastitis or metritis, and bacterial infections (Mandel et al., 2022). After being exposed to these issues, cattle are at risk of experiencing acute suffering and distress during slaughter. According to Atkinson et al. (2013), EU Law requires animals to be stunned before slaughter, to secure unconsciousness and to avoid suffering before death by bleeding procedures. However, research has found inaccuracies in the stunning process of commercial slaughter, ranging from 6 to 32% of inadequate stunning in cattle, putting the animal at risk of being conscious and experiencing severe pain during the bleeding process (Atkison et al., 2013). Based on the issues above, reducing animal product consumption substantially is recommended to contribute to a decrease in GHGE and global warming and reduce animal suffering (Gonzalez et al., 2020; Mandel et al., 2023).

Psychological Mechanisms

According to Leach et al. (2023), understanding human perception of animal sentience is of crucial importance when debating a societal shift towards a more plant-based diet. Related to animal product consumption, the *meat paradox* derives from the fact that people care, and do not want to hurt animals, but still exploit them in the food industry by eating meat and other animal products (Caviola et al., 2019).

The Cognitive Dissonance Theory offers insight into the psychological processes underlying this paradox. The theory illustrates how people try to resolve an unpleasant state of mind that results from a conflict between an attitude towards a certain topic (e.g., not wanting to hurt animals), and their actual behaviour about this topic (e.g., contributing to animal suffering by consuming animal products) (Loughnan et al., 2010). This dissonance can either be adjusted by changing the attitude towards eating meat, or towards the moral concern for animals. For vegetarians, the moral concern is a reason not to eat meat. Others, to avoid the conflict about their enjoyment of eating meat, suppress their moral concern for animals, and perceive them as unworthy and unfeeling, while withdrawing their moral value and their capacity to suffer (Loughnan et al., 2010).

Rothgerber (2014), defines this mechanism as a denial of one's participation in causing harm, carried out by denying the animals' capability to suffer and their cognitive abilities. Without an animal's capability to suffer, killing is not perceived as a moral issue, and eating meat is not considered morally conflicting (Loughnan et al., 2010). This *moral disengagement* leads to a tendency to underestimate or completely deny animals' cognitive abilities, to escape cognitive dissonance and justify the performed behaviour (Leach et al., 2023).

Intervention & Hypothesis

Focusing on these misconceptions and justifications is important as, based on the literature, industrial animal farming has significant negative consequences on the environment and animal welfare. Therefore, a reduction in animal product consumption is necessary. To achieve this, it is crucial to get an understanding of how to prevent people from making use of the psychological mechanisms underlying and justifying meat consumption. Based on the literature, refuting misconceptions by educating people about animals' abilities (e.g., the experience of pleasure, pain, and suffering) is expected to dismantle common justifications for the consumption of animal products, and because of this, change their actual consumption behaviour. Participants who received an intervention informing them about animals' cognitive and emotional abilities are expected to decrease their animal product consumption in the following week compared with participants who did not receive the intervention. Furthermore, this research will investigate if participants, instead of partly or completely changing their behaviour towards a plant-based diet, built up different justifications for their animal product consumption behaviour, after possible misconceptions about animals' minds have been refuted. Considering alternative motivations behind an omnivorous diet, this exploration acknowledges that misconceptions are not the sole factors driving meat consumption behaviours.

Materials & Methods

Part 1

Participants & Design

A one-part questionnaire survey design was used in this part of the study. Participants could sign up for the study via Prolific. For participation in both parts of the survey, they received £4.75. A power analysis has been conducted to determine the required sample size for the intervention and the control condition. A small to medium effect size has been expected ($d = 0.28$). The analysis with $f = 0.14$, 80% power, and $\alpha = .05$ indicated a required sample size of 402 participants.

630 people conducted part 1 of the survey, of which 37 have been excluded because they did not complete the survey. Additionally, 3 people were excluded as they did not watch the intervention video attentively (indicated by a score <5 on a 7-point scale asking whether they attentively watched the video). The final sample for part 1 consisted of 590 people (310 male, 273 female, 6 non-binary/third-gender, 1 preferred not to say). The mean age of the participants was 39.8 years (*SD* = 13.3, *Range* = 18-78 years). 433 participants in the sample are Europeans, while 157 come from the rest of the world. Regarding their diet, 521 participants described themselves as omnivore, 19 as pescatarians, 32 vegetarians, 15 vegans, and 3 didn't know or didn't want to share.

The video intervention was the independent variable (1-step vs. no). The dependent variable in part 1 was behavioural intentions.

Procedure & Materials

The first part took around 20 minutes to complete. The respondents could access the survey in Qualtrics via a link. The Informed Consent informs the participant about the goal of the study, the rights to withdraw, and confidential data handling. Furthermore, it was emphasised that watching the video might elicit distress because of the information about how animals are treated. After giving consent, the participants were forwarded to provide demographic information about age, gender, and nationality, as well as to which dietary categories they assign themselves (i.e. omnivore, pescetarian, vegetarian, etc.).

Animal Product Consumption at Time 1. Before the intervention or no intervention, participants were asked to reveal their animal product consumption in the last 7 days. They could indicate how many days in the past 7 days they had meat, dairy, and eggs included in their breakfast, lunch, dinner, and in-between snacks. This part consists of 12 questions which ask about the three consumption categories (meat, dairy, and eggs), for each of the different meals (e.g. "How many days in the past week was meat part of your breakfast?"). The questions are answered on an 8-point Likert scale, ranging from 0 (days) to 7 (days) (adjusted from Vonk & Weiper, 2023).

Intervention Video. A 7-minute video is shown, which educates the participants about the cognitive and emotional abilities of different animal species. During the video, common misconceptions about animals' capabilities to experience pain, their cognitive capabilities regarding memory and problem-solving, as well as their emotional abilities are refuted. Participants were either assigned to the intervention condition or a control condition, in which participants were not exposed to the intervention video.

Behavioural Intentions. Participant's behavioural intentions regarding their consumption of animal products in the future have been assessed. The intentions for animal product consumption, products derived from animal testing, and intentions to visit entertainment facilities like zoos or circuses have been measured. Altogether, the Scale consists of 9 questions about behavioural intentions ($\alpha = .79$), which are answered on a 5-point Likert Scale with the answer options: "…more than I currently do", "…just as much as I currently do", "…less than I currently do", "stop consume all together", and "I did not consume (e.g. eggs) and I would stick to that" (Banach & Stel, 2024). On all items, a stronger intention to reduce harmful behaviours is indicated by a higher mean score.

In the end, participants in the intervention condition answered control questions. They were asked if they watched the video until the end (*yes* vs. *no*), and if they watched the video attentively (1 = *strongly disagree* to 7 = *strongly agree*). Additionally, they could give open remarks about what stood out and what they remembered most from the video. In the end, all participants could give open remarks, before they were debriefed and thanked for participating.

Part 2

Participants & Design

546 people conducted part 2 of the study (285 male, 256 female, 4 non-binary/third-gender, 1 preferred not to say). Compared to part 1, 44 participants have been excluded from the sample as they participated in part 1 of the study but did not come back to answer part 2 of the survey a week later. The mean age of the participants in part 2 was 39.8 years (*SD* = 13.3, *Range* = 18-78 years). 427 participants in the sample are Europeans, while 119 originate from

the rest of the world.

The video intervention displayed in part 1 was the independent variable (1-step vs. no). The dependent variables were animal product consumption in the week after the intervention and meat-eating justifications.

Procedure & Materials

The second part was conducted after 7 days after part 1 and took around 5 minutes to complete. The participant was contacted via email to answer the second part of the survey. At the start, all participants needed to consent to participate in the survey again.

Animal Product Consumption at Time 2. To measure the effect of the intervention on animal product consumption in the 7 days after the intervention, the same scale was used as at time 1, to make a pre-post comparison.

Meat-Eating Justifications. Subsequently, Rothgerber's 27-item Meat-Eating Justifications Scale was used to assess how participants justified their meat consumption (Rothgerber, 2013). The Scale consists of 27 items grouped into 9 subscales, each consisting of three items: Pro-Meat ($\alpha = .86$; e.g. "I enjoy eating meat too much to ever give it up."), Denial ($\alpha = .72$; e.g. "Animals don't really suffer when being raised and killed for meat."), Hierarchical Justification ($\alpha = .82$; e.g. "It's acceptable to eat certain animals because they're bred for that purpose."), Dichotomy ($\alpha = .51$; e.g. "To me, there is a real difference between animals we keep as pets and animals we eat as Food."), Dissociation ($\alpha = .84$; e.g. "When I look at meat, I try hard not to connect it with an animal."), Religious Justification ($\alpha = .90$; e.g. "God intended for us to eat animals."), Avoidance ($\alpha = .66$; e.g. "I try not to think about what goes on in slaughterhouses."), Health Justification ($\alpha = .93$; e.g. "Meat is essential for strong muscles."), and Fate Justification ($\alpha = 72$; e.g. "It wouldn't surprise me to learn that scientists believe the human body (e.g., our teeth) has evolved to eat meat."). The items are scored using a 9-point Likert Scale (1 = *strongly disagree*; 9 = *strongly agree*), in which the participants indicate how much they agree or disagree with the items. Overall, the 27 items displayed solid reliability ($\alpha = .92$). A higher mean score on one of the subscales indicates that these justifications are more commonly used to justify meat consumption than subscales with a lower score.

Finally, the correlation between the amount of meat consumed in the week before and after the intervention and meat-eating justifications was measured, to assess if a higher meat consumption would lead to a higher agreement with different justifications. As the Meat-Eating Justification only measured justifications regarding meat consumption, only meat has been considered, instead of measuring the effect of the total animal product consumption on the different justifications.

Again, in the end, all participants could give open remarks, before they were debriefed and thanked for participating.

Results

Part 1

Behavioural Intentions

First, the Behavioural Intentions Scale has been analysed. A higher mean score indicates a stronger intention to reduce the consumption of animal products. After calculating the descriptive statistics, the parametric assumptions have been checked. To assess the Homogeneity of Variance, Levene's Test has been conducted to measure the equality of variances between the intervention and control groups. Based on Levene's Test, the assumption of homogeneity of variances was met; F (1.588) = 1.56, $p = 0.22$. To assess the assumption of normality, the Shapiro-Wilk Test has been used. The test results indicated a violation of the normality (Intervention group: $W = 0.99$, $p = 0.01$, control group: $W = 0.99$, $p = 0.01$). Based on the large sample size, an independent t-test has been used, despite a violation of the normality assumption. The t-test measured the effect of the condition (intervention vs control group) as an independent variable on the behavioural intentions as the dependent variable. In line with the main hypothesis, the analysis shows that participants in the intervention condition more strongly intended to reduce the hurting of animals ($M = 3.19$, $SD = 0.70$, $n = 283$) compared with the control group ($M = 3.05$, $SD = 0.65$, $n = 307$), t (574) = -2.61, $p = 0.01$, Cohen's $d = -0.21$.

Part 2

After this analysis, the data from the second part has been added. A further exclusion criterion was the exclusion of participants who participated in part 1 of the study but did not come back to answer the second survey a week later.

Animal Product Consumption

To analyse the effect of the intervention on animal product consumption, a Mann-Whitney U test and a Wilcoxon Signed Rank Test have been conducted. Therefore, the associated questions have been added to three different scores for each pre-and post-test. The total meat consumption was calculated based on how many meals participants consumed meat for breakfast, lunch, dinner, and snacks in the last 7 days. The same procedure has been applied to dairy and egg consumption. Additionally, one total animal product consumption score has been calculated. The descriptive statistics for each category are displayed in Table 1 (see Supplementary Materials). Levene's Test (Table 2) and Shapiro-Wilk's Test (Table 3) have been calculated to check the assumptions of homogeneity and normality (see Supplementary Materials). Based on the violated assumption of normality, a non-parametric Mann-Whitney U test has been chosen to analyse the potential effect of the intervention on the participant's animal product consumption. A *p*-value <0.05 indicates a significant effect regarding animal product consumption between the intervention and control groups. The test showed no significant differences between the intervention and control group for meat consumption (pre: $W = 38474$, $p = 0.14$; post: $W = 36261$, $p = 0.60$), dairy consumption (pre: $W = 38474$, $p = 0.32$; post: $W = 39904$, $p = 0.14$), or egg consumption (pre: $W = 37900$, $p = 0.40$; post: $W = 40138$, $p = 0.11$). Furthermore, no significant differences in total consumption have been found (pre: $W = 35211$, $p = 0.81$; post: $W = 39600$, $p = 0.20$). Based on these results, the intervention did not significantly affect the participant's animal product consumption between groups. However, assessing the effectiveness within groups for the total consumption, the Wilcoxon Signed Rank Test showed a significant decrease within both the intervention ($V = 22011$, $p < 0.001$) and the control group ($V = 23336$, $p < 0.001$), and for all participants combined ($V = 90583$, $p < 0.001$). This indicates that, regardless of the assigned group, participants substantially changed their consumption of animal products.

Meat Eating Justifications

Finally, Rothgerber's 27-item Meat-Eating Justification Scale has been analysed. Means, standard deviations and *d*-values for both the video and the control group are presented in Table 4 (see Supplementary Materials). After assessing the descriptive statistics, Levene's test and the Shapiro-Wilk test have been calculated. For all subscales, the *p*-value is > 0.05, which indicates no significant variances between the groups across all scales. Therefore, the assumption of homogeneity of variances is met (see Supplementary Materials, Table 5). Based on the Shapiro-Wilk Test, the normality assumption has been violated for all subscales (see Supplementary Materials, Table 6). Because of this, the non-parametric Wilcoxon rank sum test has been applied. The Wilcoxon rank sum test compares the subscales between the video and control groups. A *p*-value < 0.05 indicates a significant difference between the groups, while a *p*-value > 0.05 suggests no significant difference. Despite religious justification ($p = 0.049$), all *p*-values are > 0.18, indicating no significant difference between the groups (see Supplementary Materials, Table 7). Therefore, the intervention did not affect the meat-eating justifications between the intervention and control groups, *Ws* < 39946, *ps* > 0.18. For the subscale religious justifications, the shown effect indicates that after watching the video, participants agreed less to statements justifying meat consumption based on religious arguments (*M* = 3.7, *SD* = 2.06), compared with the control condition (*M* = 4.07, *SD* = 2.06), *W* = 39946, *p* = 0.04898.

Correlation between Meat Consumption and Meat-Eating Justifications

To assess a potential correlation between meat consumption in the week before and after the intervention and the application of meat-eating justifications, Spearman's *rho* has been calculated, indicating the strength and direction of a correlation. A score of -1 displays a perfect negative, while a score of 1 displays a perfect positive correlation, and a *p*-value <0.05 expresses a statistically significant correlation. Across the subscales, significant positive correlations have been found, revealing a tendency for participants with higher meat consumption in the past two weeks to agree to a higher number of meat-eating justifications, *ps* < 0.001 (see Supplementary Materials, Table 8). Notably strong correlations have been found for pro-meat (ρ = .56, *p* < 0.001), hierarchical justifications (ρ = .41, *p* < 0.001), and health justification (ρ = .42, *p* < 0.001), while avoidance displays the weakest correlation (ρ = .07, *p* < 0.001).

Discussion

The two-part study aimed to explore the effect of a video intervention educating about animals' emotional and cognitive abilities on participants' animal product consumption, intentions about future consumption and justifications for meat consumption. The main findings displayed that, in line with the main hypothesis, the intervention significantly strengthened participants' behavioural intentions to reduce animal product consumption (Part 1). For the pre- and post-measurement, the statistical tests displayed a discrepancy regarding the effect of the intervention on animal product consumption (Parts 1 and 2). No effect on the application of meat-eating justifications has been found. Finally, the study showed that participants across both conditions with higher meat consumption in the week before and after the intervention agreed more strongly with different strategies justifying meat consumption (Part 2).

The results on the behavioural intentions have found that after the intervention participants intended to decrease their animal product consumption. However, the small effect size indicates only a very subtle change. Despite being subtle, the mean score of the intervention group also indicates that most participants intend to reduce their animal product intake. This is underlined by comments made by the participants in the open remarks section. Comments highlighted the intervention as “eye-opening”, “thought-provoking” and an incentive to reconsider their dietary choices. Based on this effect on participants' intentions, and their remarks on emotions and conceptions, the intervention can be seen as a foundation for a process, which has the potential for a longer-term impact on future behaviour.

The effectiveness of the intervention regarding animal product consumption has been assessed using two different statistical tests. The within-group measurement has shown a decrease in animal product consumption in the post-test for both the intervention and the control group. Based on the between groups measurement, however, these changes did not differ between the two groups. Advocating for an effect of the intervention, only participating in the study, and answering questions about one’s dietary habits might have raised awareness among all participants, even on those who did not watch the video. This might have led to a decrease in consumption. Contrarily, this effect could also be explained by external factors and influences, as no differences between the groups have been found. Additionally, participants’ behavioural intentions were assessed right after the intervention, which had a potentially stronger influence on their decision-making, while the actual animal product consumption during the week after the intervention was exposed to different potential moderating variables. Media, advertisements, and the specific social environment can influence dietary choices daily, impacting the intervention's effect. This is consistent with Rees et al. (2018), who emphasised the difficulty of changing animal product consumption patterns based on a strong habituation of these behaviours. The discrepancy in the results of the two tests highlights the complexity underlying animal product consumption patterns. Because of this, one intervention, despite influencing participants' behavioural intentions, is not strong enough to break the strongly habituated consumption habits. Actual changes in participants' consumer behaviour could be manifested through future interventions over a longer period. For example, people motivated to change their dietary choices could be supported with meal planning applications, to support this development. Yet, it is important to mention that even small reductions in animal product consumption positively affect the environment and animal welfare.

Across almost all subscales, the intervention did not change the meat-eating justifications. The only subscale showing a significant impact of the intervention was religious justifications. The origin of the participants could be an explanation for the stronger effect on this subscale. Most participants are European, where Christianity is the dominant religion. Religious beliefs are important in shaping ethical standards and values which influence dietary attitudes and behaviours. One potential explanation about how the intervention activated these religious beliefs could be given with the concepts of empathy and compassion, which are core values in Christianity (Lupu, 2018). The insight that animals are capable of showing empathy towards one another and in a way similar to us humans might be a reason to reconsider the moral standing of animals, and in turn, dietary choices. This is further underlined by comments made in the open remarks section, in which multiple participants showed themselves surprised after learning about animals' abilities to show compassion towards one another. Additionally, based on Christian ethics, consuming animal products derived from factory farming contradicts the principle of respecting the well-being of creatures of God (Clough, 2017). Therefore, the effect found on the subscale of this research could indicate that understanding the influence of religious beliefs on dietary choices might offer further insights into the mechanisms underlying animal product consumption. Appealing to these religious values in culturally targeted interventions might yield the potential to achieve a stronger effect in reducing animal product consumption. That no significant effect has been found on the other subscales can be explained by the timely execution of the study. Part 2 has been conducted 7 days after the intervention, in which a potential effect might have already decreased. Furthermore, participants are at risk of displaying a self-report bias to appear more socially favourably regarding their meat consumption.

Finally, participants who consumed more meat in the week before and after the intervention period agreed more strongly with different meat-eating justifications. These findings are aligned with the Cognitive Dissonance Theory (Loughnan et al., 2010), and the Meat Paradox (Caviola et al., 2019). The attitude of caring for animals is conflicting with the enjoyment of eating meat, creating a state of distress. Based on these theories, people who consume more meat need to build up more justifications to align their attitudes and behaviour, to decrease stress arising from this dissonance. For further research, understanding the role of the level of experienced guilt might be of interest. People who care strongly for animals might experience a higher level of guilt and discomfort when eating meat, which could result in a higher agreement for different justifications. Investigating this hypothesis might provide a deeper understanding of how the application of these mechanisms regarding animal product consumption can be prevented. Additionally, a long-term assessment of the applied justifications is required to do justice to the psychological complexity of cognitive dissonance and to be able to design effective interventions towards more sustainability.

Conclusion

Despite not finding a direct effect of the intervention on animal product consumption and meat-eating justifications, the study can be seen as partly effective. The research has found promising results regarding behavioural intentions and the correlation of meat consumption with meat-eating justifications, which display a potentially valuable step towards understanding how to change the application of mechanisms underlying animal product consumption, which is crucial towards developing more sustainability and animal welfare.

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Supplementary Materials

Results

Animal Product Consumption Scale

Table 1. *Pre and post animal product consumption in the week before and after the intervention for meat, dairy and eggs.*

		Meat		**Dairy**		**Eggs**		**Total**	
Condition	**Time**	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Intervention	Pre	9.63	5.94	11.44	6.46	3.47	3.58	24.5	11.6
	Post	8.32	5.44	10.38	6.44	3.16	3.13	21.9	10.8
Control	Pre	8.91	5.63	11.86	6.37	3.9	4.17	24.7	10.9
	Post	8.06	5.24	11.18	6.49	3.87	4.07	23.1	10.8

Table 2. *Levene's Test to check the homogeneity assumption of the animal product consumption scale.*

	Meat		**Dairy**		**Eggs**		**Total**	
Time	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Pre	(1.54) = 0.49	0.48	(1.54) = 0.003	0.96	(1.54) = 1.46	0.23	(1.53) = 1.18	0.28
Post	(1.54) = 0.78	0.38	(1.54) = 0.02	0.9	(1.54) = 6.29	0.01	(1.54) = 0.44	0.51

Table 3. *Shapiro-Wilk Test to check the normality assumption of the Animal Product Consumption Scale.*

	Meat		**Dairy**		**Eggs**		**Total**	
Time	*W*	*p*	*W*	*p*	*W*	*p*	*W*	*p*
Pre	0.98	<0.001	0.98	<0.001	0.82	<0.001	0.98	<0.001
Post	0.97	<0.001	0.98	<0.001	0.83	<0.001	0.98	<0.001

Table 4. *Group differences in meat-eating justifications.*

	Intervention		**Control**		
	M	*SD*	*M*	*SD*	Cohen's *d*
Promeat	4.89	2.17	4.69	2.15	0.09
Denial	3.07	1.46	3.25	1.56	-0.16
Hierarchal Justification	4.31	1.92	4.32	1.94	<-0.01
Dichotomy	5.75	1.68	5.73	1.71	0.01
Dissociation	5.24	2.04	5.19	2.04	0.03
Religious Justification	3.7	2.06	4.07	2.06	-0.18
Avoidance	5.8	1.76	5.77	1.73	0.02
Health Justification	5.04	2.22	5.16	2.15	-0.06
Fate Justification	4.86	1.7	4.96	1.7	-0.06
Total Justification	4.74	1.29	4.79	1.27	-0.04

Table 5. *Levene's Test to check the homogeneity assumption of the Meat-Eating Justification Scale.*

Subscale	*F*	*p*
Pro-Meat	(1.56) = 0.05	2.26
Denial	(1.54) = 2.62	0.11
Hierarchal Justification	(1.54) = 0.29	0.59
Dichotomy	(1.54) = <0.01	0.89
Dissociation	(1.54) = 0.01	0.92
Religious Justification	(1.54) = 0.13	0.72
Avoidance	(1.54) = 0.23	0.63
Health Justification	(1.54) = 0.91	0.34
Fate Justification	(1.54) = 0.01	0.95
Total Justification	(1.51) = 0.05	0.82

Table 6. *Shapiro-Wilk Test to check normality assumption of the Meat-Eating Justification Scale.*

Subscale	*W*	*p*
Pro-Meat	0.95	<0.001
Denial	0.96	<0.001
Hierarchal Justification	0.97	<0.001
Dichotomy	0.91	<0.001
Dissociation	0.95	<0.001
Religious Justification	0.96	<0.001
Avoidance	0.91	<0.001
Health Justification	0.96	<0.001
Fate Justification	0.96	<0.001
Total Justification	0.97	<0.001

Table 7. *Results of the Wilcoxon Rank Sum Test for the Meat-Eating Justifications Scale.*

	Wilcoxon's *W*	*p*
Pro-Meat	34013	0.26
Denial	38999	0.18
Hierarchal Justification	36308	0.89
Dichotomy	36004	0.83
Dissociation	35193	0.54
Religious Justification	39946	0.04898
Avoidance	35515	0.67
Health Justification	37419	0.57
Fate Justification	38488	0.32
Total Justification	34032	0.65

Table 8. *Results of Spearman's Rank Correlation Coefficient to assess the correlation between meat consumption and meat-eating justifications.*

	Spearman's '*ρ*' *(rho)*	*p*
Pro-Meat	0.56	<0.001
Denial	0.35	<0.001
Hierarchal Justification	0.41	<0.001
Dichotomy	0.29	<0.001
Dissociation	0.21	<0.001
Religious Justification	0.32	<0.001
Avoidance	0.07	<0.001
Health Justification	0.42	<0.001
Fate Justification	0.38	<0.001
Total Justification	0.47	<0.001

R Script

```
#data analysis bachelor thesis - Lukas Hehn
install.packages("tidyverse")
library("tidyverse")
install.packages("foreign")
library("foreign")
install.packages("psych")
library("psych")
install.packages("haven")
library("haven")
install.packages("dplyr")
library("dplyr")
install.packages("janitor")
library("janitor")
install.packages("CTT")
library("CTT")
install.packages("Lambda4")
library("Lambda4")
install.packages("carData")
library("carData")
library("car")
install.packages("lme4")
library("lme4")
install.packages("ggplot2")
library("ggplot2")
```

```
install.packages("gridExtra")

library("gridExtra")

install.packages("readxl")

library("readxl")


rm(list = ls())

dataBIG <- read_excel(file.choose())


#delete participants who did not complete

dataBIG$Progress <- as.numeric(dataBIG$Progress)


dataBIG <- dataBIG %>%

  filter(Progress == 100)


dataBIG <- dataBIG %>%

  filter(is.na(Q3.1) | Q3.1 >= 5)


dataBIG <- select(dataBIG, -StartDate, -EndDate, -Status, -RecordedDate, -UserLanguage, -
DistributionChannel, -StartDate2, -EndDate2, -Status2, -RecordedDate2, -
DistributionChannel2, -UserLanguage2)

dataBIG <- select(dataBIG, -IPAddress, -Duration__in_seconds_, IPAddress2, -
Duration__in_seconds_2)


#convert numbers to values in gender variable

dataBIG$Gender1 <- factor(dataBIG$Gender1,

                    levels = c(1, 2, 3, 4),
```

```
                    labels = c ("male", "female", "thirdgender", "prefer not to say"))
levels(dataBIG$Gender1)


#convert number into values in nationality variable
dataBIG$Nationality1 <- factor(dataBIG$Nationality1,
                  levels = c(1, 2, 3),
                  labels = c ("Dutch", "German", "Other"))
levels(dataBIG$Nationality1)


#convert number into variables animal product consumption scale (which category applies to
you)
dataBIG$Q1.0 <- factor(dataBIG$Q1.0,
                    levels = c(1, 2, 3, 4, 5, 6),
                    labels = c ("Ominvore", "Pescetarian", "Vegetarian", "Vegan", "I don't know", "I
don't want to share"))


#combine variables to Behavioural Intentions SCale
dataBIG <- dataBIG %>%
  mutate(across(c(Q2.1, Q3.0, Q4.0, Q5, Q6, Q7, Q8, Q9, Q10),
                ~ as.numeric(as.character(.))))
dataBIG <- dataBIG %>%
  mutate(behavioural_intentions = rowSums(select(., Q2.1, Q3.0, Q4.0, Q5, Q6, Q7, Q8, Q9,
Q10), na.rm = TRUE))


#POWER ANALYSIS
# Install and load the pwr package
```

```
install.packages("pwr")

library(pwr)


#Ppower analysis

power_analysis <- pwr.t.test(d = 0.28, sig.level = 0.05, power = 0.80, type = "two.sample",
alternative = "two.sided")


print(power_analysis)


#BIS MEANS


likert_responsesBIS <- dataBIG[, c("Q2.1", "Q3.0", "Q4.0", "Q5", "Q6", "Q7", "Q8", "Q9",
"Q10")]


# Calculate the mean score for each respondent

mean_scores <- rowMeans(likert_responsesBIS, na.rm = TRUE)


# Add the mean scores to your data frame

dataBIG$BIS_MEAN <- mean_scores


#ANALYSIS DATA1


#create datasets for the intervention and control group

control_group1 <- dataBIG %>%

  filter(is.na(Q2.2) | is.na(Q3.1) | is.na(Q5.0) | is.na(6.0))
```

```
video_group1 <- dataBIG %>%
  filter(!(is.na(Q2.2) | is.na(Q3.1) | is.na(Q5.0) | is.na(6.0)))

nrow(control_group1)
nrow(video_group1)

control_group1$group_membership <- "control"
video_group1$group_membership <- "video"

#descriptive statistics for demographic information
#gender
gender_counts <- table(dataBIG$Gender1)
gender_proportions <- prop.table(gender_counts)
print(gender_counts)
print(gender_proportions)

#nationality
nationality_counts <- table(dataBIG$Nationality1)
nationality_proportions <- prop.table(nationality_counts)

print(nationality_counts)
print(nationality_proportions)

nationality_counts1 <- table(dataBIG$Q3_3_TEXT_1)
```

```
nationality_proportions1 <- prop.table(nationality_counts1)


print(nationality_counts1)

print(nationality_proportions1)


#age

dataBIG$Age1 <- as.numeric(as.character(dataBIG$Age1))


age_stats <- dataBIG %>%

  summarize(

    mean_age = mean(Age1, na.rm = TRUE),

    median_age = median(Age1, na.rm = TRUE),

    sd_age = sd(Age1, na.rm = TRUE),

    min_age = min(Age1, na.rm = TRUE),

    max_age = max(Age1, na.rm = TRUE))

print(age_stats)


#descriptive statistics animal product consumptions scale (video vs control)

video_group1 <- video_group1 %>%

  mutate(across(c(Q2_1, Q2_4, Q2_7, Q2_10,

                  Q2_2, Q2_5, Q2_8, Q2_11,

                  Q2_3, Q2_6, Q2_9, Q2_12),

                ~ as.numeric(as.character(.))))


video_group1 <- video_group1 %>%
```

```
  mutate(meat_consumption = Q2_1 + Q2_4 + Q2_7 + Q2_10,
         dairy_consumption = Q2_2 + Q2_5 + Q2_8 + Q2_11,
         eggs_consumption = Q2_3 + Q2_6 + Q2_9 + Q2_12)

#descriptive statistics for meat (video)
meat_stats <- video_group1 %>%
  summarize(
    mean_meat = mean(meat_consumption, na.rm = TRUE),
    median_meat = median(meat_consumption, na.rm = TRUE),
    sd_meat = sd(meat_consumption, na.rm = TRUE),
    min_meat = min(meat_consumption, na.rm = TRUE),
    max_meat = max(meat_consumption, na.rm = TRUE)
  )

#descriptive statistics for dairy (video)
dairy_stats <- video_group1 %>%
  summarize(
    mean_dairy = mean(dairy_consumption, na.rm = TRUE),
    median_dairy = median(dairy_consumption, na.rm = TRUE),
    sd_dairy = sd(dairy_consumption, na.rm = TRUE),
    min_dairy = min(dairy_consumption, na.rm = TRUE),
    max_dairy = max(dairy_consumption, na.rm = TRUE)
  )

#descriptive statistics for eggs (video)
```

```
eggs_stats <- video_group1 %>%
  summarize(
    mean_eggs = mean(eggs_consumption, na.rm = TRUE),
    median_eggs = median(eggs_consumption, na.rm = TRUE),
    sd_eggs = sd(eggs_consumption, na.rm = TRUE),
    min_eggs = min(eggs_consumption, na.rm = TRUE),
    max_eggs = max(eggs_consumption, na.rm = TRUE)
  )
#results descriptive statistics video
print(meat_stats)
print(dairy_stats)
print(eggs_stats)


#descriptive statistics animal product consumptions scale (video vs control)
control_group1 <- control_group1 %>%
  mutate(across(c(Q2_1, Q2_4, Q2_7, Q2_10,
                  Q2_2, Q2_5, Q2_8, Q2_11,
                  Q2_3, Q2_6, Q2_9, Q2_12),
                ~ as.numeric(as.character(.))))


control_group1 <- control_group1 %>%
  mutate(meat_consumption = Q2_1 + Q2_4 + Q2_7 + Q2_10,
         dairy_consumption = Q2_2 + Q2_5 + Q2_8 + Q2_11,
         eggs_consumption = Q2_3 + Q2_6 + Q2_9 + Q2_12)
```

```
#descriptive statistics for meat (control)
meat_statsC <- control_group1 %>%
  summarize(
    mean_meatC = mean(meat_consumptionC, na.rm = TRUE),
    median_meatC = median(meat_consumptionC, na.rm = TRUE),
    sd_meatC = sd(meat_consumptionC, na.rm = TRUE),
    min_meatC = min(meat_consumptionC, na.rm = TRUE),
    max_meatC = max(meat_consumptionC, na.rm = TRUE)
  )

#descriptive statistics for dairy (control)
dairy_statsC <- control_group1 %>%
  summarize(
    mean_dairyC = mean(dairy_consumptionC, na.rm = TRUE),
    median_dairyC = median(dairy_consumptionC, na.rm = TRUE),
    sd_dairyC = sd(dairy_consumptionC, na.rm = TRUE),
    min_dairyC = min(dairy_consumptionC, na.rm = TRUE),
    max_dairyC = max(dairy_consumptionC, na.rm = TRUE)
  )

#descriptive statistics for eggs (control)
eggs_statsC <- control_group1 %>%
  summarize(
    mean_eggsC = mean(eggs_consumptionC, na.rm = TRUE),
    median_eggsC = median(eggs_consumptionC, na.rm = TRUE),
```

```
    sd_eggsC = sd(eggs_consumptionC, na.rm = TRUE),
    min_eggsC = min(eggs_consumptionC, na.rm = TRUE),
    max_eggsC = max(eggs_consumptionC, na.rm = TRUE)
  )
#results descriptive statistics control
print(meat_statsC)
print(dairy_statsC)
print(eggs_statsC)

#statstics diet video
video_diet_counts <- table(video_group1$Q1.0)
video_diet_proportions <- prop.table(video_diet_counts)

video_diet_stats <- data.frame(
  Category = names(video_diet_counts),
  Count = as.vector(video_diet_counts),
  proportion = as.vector(video_diet_proportions)
)
print(video_diet_stats)

#statistics diet control
control_diet_counts <- table(control_group1$Q1.0)
control_diet_proportions <- prop.table(control_diet_counts)

control_diet_stats <- data.frame(
```

```
  Category = names(control_diet_counts),
  Count = as.vector(control_diet_counts),
  proportion = as.vector(control_diet_proportions)
)
print(control_diet_stats)


#descriptive statistics video beahvioural intentions
behavioural_intnetions_video1 <- video_group1 %>%
  summarize(
    mean_intentions_video1 = mean(behavioural_intentions, na.rm = TRUE),
    median_intentions_video1 = median(behavioural_intentions, na.rm = TRUE),
    sd_inentions_video1 = sd(behavioural_intentions, na.rm = TRUE),
    min_intnetions_video1 = min(behavioural_intentions, na.rm = TRUE),
    max_intentions_video1 = max(behavioural_intentions, na.rm = TRUE)
  )
print(behavioural_intnetions_video1)


BIS_MEANvideo1 <- video_group1 %>%
  summarize(
    BIS_means_video1 = mean(BIS_MEAN, na.rm = TRUE),
    BIS_SD_video1 = sd(BIS_MEAN, na.rm = TRUE)
  )


print(BIS_MEANvideo1)
```

```
#descriptive statistics control beahvioural intentions
behavioural_intnetions_control1 <- control_group1 %>%
  summarize(
    mean_intentions_control1 = mean(behavioural_intentions, na.rm = TRUE),
    median_intentions_control1 = median(behavioural_intentions, na.rm = TRUE),
    sd_inentions_control1 = sd(behavioural_intentions, na.rm = TRUE),
    min_intnetions_cnotrol1 = min(behavioural_intentions, na.rm = TRUE),
    max_intentions_control1 = max(behavioural_intentions, na.rm = TRUE)
  )
print(behavioural_intnetions_control1)

BIS_MEANcontrol1 <- control_group1 %>%
  summarize(
    BIS_means_control1 = mean(BIS_MEAN, na.rm = TRUE),
    BIS_SD_control1 = sd(BIS_MEAN, na.rm = TRUE)
  )

print(BIS_MEANcontrol1)

#cohen's d BIS

mean_control <- 3.05
  sd_control <- 0.65
  n_control <- 283
```

```
mean_video <- 3.19
  sd_video <- 0.7
  n_video <- 263

# Calculate pooled standard deviation
pooled_sd <- sqrt(((n_control - 1) * sd_control^2 + (n_video - 1) * sd_video^2) / (n_control +
n_video - 2))

# Calculate Cohen's d
cohens_d <- (mean_control - mean_video) / pooled_sd

print(paste (cohens_d))

#parametric assumptions for the BIS
#combine data with control/video variable
combined_dataBIS <- rbind(video_group1, control_group1)

#Cronbach's alpha BIS

bis_items <- combined_dataBIS[, c("Q2.1", "Q3.0", "Q4.0", "Q5", "Q6", "Q7", "Q8", "Q9",
"Q10")]

cronbach_alphaBIS <- alpha(bis_items)
print(cronbach_alphaBIS)
```

```
#levenes test for checking homoscedasticity
leveneTest(behavioural_intentions ~ group_membership, data = combined_dataBIS)

leveneTest(BIS_MEAN ~ group_membership, data = combined_dataBIS)

#shapiro wilk test to test for normality
shapiro.test(combined_dataBIS$behavioural_intentions[combined_dataBIS$group_membership == "video"])
shapiro.test(combined_dataBIS$behavioural_intentions[combined_dataBIS$group_membership == "control"])

shapiro.test(combined_dataBIS$BIS_MEAN[combined_dataBIS$group_membership == "video"])
shapiro.test(combined_dataBIS$BIS_MEAN[combined_dataBIS$group_membership == "control"])

#analysis behavioural intentions scale
#independent t-test
t_test_results <- t.test(behavioural_intentions ~ group_membership, data = combined_dataBIS)
print(t_test_results)

t_test_results <- t.test(BIS_MEAN ~ group_membership, data = combined_dataBIS)
print(t_test_results)
```

```
#PART 1+2 pre post
combined_dataPP <- rbind(video_group1, control_group1)

#exclude participants who did not participate in part2
combined_dataPP <- combined_dataPP[!is.na(combined_dataPP$prolific2), ]

#descriptive statistics for demographic information PART1+2
#convert numbers to values in gender variable
combined_dataPP$Gender2 <- factor(combined_dataPP$Gender2,
                    levels = c(1, 2, 3, 4),
                    labels = c ("male", "female", "thirdgender", "prefer not to say"))
levels(dataBIG$Gender1)

#convert number into values in nationality variable
combined_dataPP$Nationality2 <- factor(combined_dataPP$Nationality2,
                      levels = c(1, 2, 3),
                      labels = c ("Dutch", "German", "Other"))
levels(dataBIG$Nationality1)
#gender
gender_counts2 <- table(combined_dataPP$Gender2)
gender_proportions2 <- prop.table(gender_counts2)
print(gender_counts2)
print(gender_proportions2)
```

```
#nationality
nationality_counts2 <- table(combined_dataPP$Nationality2)
nationality_proportions2 <- prop.table(nationality_counts2)

print(nationality_counts2)
print(nationality_proportions2)

#Nationalities 2
nationality_counts2 <- table(combined_dataPP$Q3_3_TEXT2)
nationality_proportions2 <- prop.table(nationality_counts2)

print(nationality_counts2)
print(nationality_proportions2)

#age
combined_dataPP$Age2 <- as.numeric(as.character(combined_dataPP$Age2))

age_stats2 <- combined_dataPP %>%
  summarize(
    mean_age = mean(Age1, na.rm = TRUE),
    median_age = median(Age1, na.rm = TRUE),
    sd_age = sd(Age1, na.rm = TRUE),
    min_age = min(Age1, na.rm = TRUE),
    max_age = max(Age1, na.rm = TRUE))
print(age_stats)
```

```
#ANIMAL PRODUCT CONSUMPTION SCALE
#combine questions to new variable
combined_dataPP <- combined_dataPP %>%
  mutate(meat_consumption2 = rowSums(select(., B1_2, B4_2, B7_2, B10_2), na.rm =
TRUE))


combined_dataPP <- combined_dataPP %>%
  mutate(dairy_consumption2 = rowSums(select(., B2_2, B5_2, B8_2, B11_2), na.rm =
TRUE))


combined_dataPP <- combined_dataPP %>%
  mutate(eggs_consumption2 = rowSums(select(., B3_2, B6_2, B9_2, B12_2), na.rm =
TRUE))


#group wise descriptive statistics
#Group-wise descriptive statistics meat consumption PRE AND POST
#PRE
meat_stats1 <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    mean_meat_consumption1 = mean(meat_consumption1, na.rm = TRUE),
    sd_meat_consumption1 = sd(meat_consumption1, na.rm = TRUE),
    min_meat_consumption1 = min(meat_consumption1, na.rm = TRUE),
    max_meat_consumption1 = max(meat_consumption1, na.rm = TRUE)
  )
```

```
#POST
meat_stats2 <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    mean_meat_consumption2 = mean(meat_consumption2, na.rm = TRUE),
    sd_meat_consumption2 = sd(meat_consumption2, na.rm = TRUE),
    min_meat_consumption2 = min(meat_consumption2, na.rm = TRUE),
    max_meat_consumption2 = max(meat_consumption2, na.rm = TRUE)
  )

# Group-wise descriptive statistics dairy consumption
#PRE
dairy_stats1 <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    mean_dairy_consumption1 = mean(dairy_consumption, na.rm = TRUE),
    sd_dairy_consumption1 = sd(dairy_consumption, na.rm = TRUE),
    min_dairy_consumption1 = min(dairy_consumption, na.rm = TRUE),
    max_dairy_consumption1 = max(dairy_consumption, na.rm = TRUE)
  )

#POST
dairy_stats2 <- combined_dataPP %>%
  group_by(group_membership) %>%
```

```
  summarise(
    mean_dairy_consumption2 = mean(dairy_consumption2, na.rm = TRUE),
    sd_dairy_consumption2 = sd(dairy_consumption2, na.rm = TRUE),
    min_dairy_consumption2 = min(dairy_consumption2, na.rm = TRUE),
    max_dairy_consumption2 = max(dairy_consumption2, na.rm = TRUE)
  )

# Group-wise descriptive statistics eggs consumption
#PRE
eggs_stats1 <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    mean_eggs_consumption1 = mean(eggs_consumption, na.rm = TRUE),
    sd_eggs_consumption1 = sd(eggs_consumption, na.rm = TRUE),
    min_eggs_consumption1 = min(eggs_consumption, na.rm = TRUE),
    max_eggs_consumption1 = max(eggs_consumption, na.rm = TRUE)
  )

#POST
eggs_stats2 <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    mean_eggs_consumption2 = mean(eggs_consumption2, na.rm = TRUE),
    sd_eggs_consumption2 = sd(eggs_consumption2, na.rm = TRUE),
    min_eggs_consumption2 = min(eggs_consumption2, na.rm = TRUE),
```

```
  max_eggs_consumption2 = max(eggs_consumption2, na.rm = TRUE)
 )


# Combine the results into one dataframe
combined_stats <- bind_rows(meat_stats1, meat_stats2, dairy_stats1, dairy_stats2,
eggs_stats1, eggs_stats2)


# Print the combined statistics
print(combined_stats)


#test assumptions
#shapiro wilk test and levene's test
#pre
shapiro.test(combined_dataPP$meat_consumption)
shapiro.test(combined_dataPP$dairy_consumption)
shapiro.test(combined_dataPP$eggs_consumption)


#post
shapiro.test(combined_dataPP$meat_consumption2)
shapiro.test(combined_dataPP$dairy_consumption2)
shapiro.test(combined_dataPP$eggs_consumption2)


#levene
#pre
leveneTest(meat_consumption ~ group_membership, data = combined_dataPP)
```

```
leveneTest(dairy_consumption ~ group_membership, data = combined_dataPP)

leveneTest(eggs_consumption ~ group_membership, data = combined_dataPP)

#post

leveneTest(meat_consumption2 ~ group_membership, data = combined_dataPP)

leveneTest(dairy_consumption2 ~ group_membership, data = combined_dataPP)

leveneTest(eggs_consumption2 ~ group_membership, data = combined_dataPP)


#pre post comparison

wilcox.test(combined_dataPP$meat_consumption, combined_dataPP$meat_consumption2,
paired = TRUE)

wilcox.test(combined_dataPP$dairy_consumption, combined_dataPP$dairy_consumption2,
paired = TRUE)

wilcox.test(combined_dataPP$eggs_consumption, combined_dataPP$eggs_consumption2,
paired = TRUE)


#groups pre

wilcox.test(meat_consumption ~ group_membership, data = combined_dataPP)

wilcox.test(dairy_consumption ~ group_membership, data = combined_dataPP)

wilcox.test(eggs_consumption ~ group_membership, data = combined_dataPP)


#groups post

wilcox.test(meat_consumption2 ~ group_membership, data = combined_dataPP)

wilcox.test(dairy_consumption2 ~ group_membership, data = combined_dataPP)

wilcox.test(eggs_consumption2 ~ group_membership, data = combined_dataPP)


#total animal product consumptions score
```

```
# Compute total animal product consumption scores
combined_dataPP$total_pre <- combined_dataPP$meat_consumption +
combined_dataPP$dairy_consumption + combined_dataPP$eggs_consumption
combined_dataPP$total_post <- combined_dataPP$meat_consumption2 +
combined_dataPP$dairy_consumption2 + combined_dataPP$eggs_consumption2


# Aggregate by group and test time
total_scores <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    total_pre = sum(total_pre, na.rm = TRUE),
    total_post = sum(total_post, na.rm = TRUE)
  )
print(total_scores)


total_pre<- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    mean_TOTALpre = mean(total_pre, na.rm = TRUE),
    sd_TOTALpre = sd(total_pre, na.rm = TRUE),
    min_TOTALpre= min(total_pre, na.rm = TRUE),
    max_TOTALpre = max(total_pre, na.rm = TRUE)
  )
print(total_pre)
```

```
total_post<- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(
    mean_TOTALpost = mean(total_post, na.rm = TRUE),
    sd_TOTALpost = sd(total_post, na.rm = TRUE),
    min_TOTALpost = min(total_post, na.rm = TRUE),
    max_TOTALpost = max(total_post, na.rm = TRUE)
  )
print(total_post)


#assumptions
#pre
shapiro.test(combined_dataPP$total_pre)
#post
shapiro.test(combined_dataPP$total_post)


#levene
#pre
leveneTest(total_pre ~ group_membership, data = combined_dataPP)
#post
leveneTest(total_post ~ group_membership, data = combined_dataPP)


wilcox.test(total_pre ~ group_membership, data = combined_dataPP)
wilcox.test(total_post ~ group_membership, data = combined_dataPP)
```

```
#wilcoxon signed test

intervention_groupW <- combined_dataPP[combined_dataPP$group_membership ==
"video", ]

control_groupW <- combined_dataPP[combined_dataPP$group_membership == "control", ]


wilcox_test_intervention <- wilcox.test(intervention_groupW$total_pre,
intervention_groupW$total_post, paired = TRUE)

print(wilcox_test_intervention)


wilcox_test_control <- wilcox.test(control_groupW$total_pre, control_groupW$total_post,
paired = TRUE)

print(wilcox_test_control)


# Perform Wilcoxon signed-rank test for the total consumption score (all participants)

wilcox_test_total <- wilcox.test(combined_dataPP$total_pre, combined_dataPP$total_post,
paired = TRUE)

print(wilcox_test_total)


#ANALYSIS MEAT JUSTIFICATION

# Create subscale scores

combined_dataPP$PROMEATm <- rowMeans(combined_dataPP[, c("Q1_1_2", "Q1_10_2",
"Q1_19_2")])

combined_dataPP$DENIALm <- rowMeans(combined_dataPP[, c("Q1_2_2", "Q1_11_2",
"Q1_20_2")])

combined_dataPP$HIER_JUSTm <- rowMeans(combined_dataPP[, c("Q1_3_2", "Q1_12_2",
"Q1_21_2")])
```

```
combined_dataPP$DICHOTOMYm <- rowMeans(combined_dataPP[, c("Q1_4_2",
"Q1_13_2", "Q1_22_2")])

combined_dataPP$DISSOCIATIONm <- rowMeans(combined_dataPP[, c("Q1_5_2",
"Q1_14_2", "Q1_23_2")])

combined_dataPP$REL_JUSTm <- rowMeans(combined_dataPP[, c("Q1_6_2", "Q1_15_2",
"Q1_24_2")])

combined_dataPP$AVOIDANCEm <- rowMeans(combined_dataPP[, c("Q1_7_2",
"Q1_16_2", "Q1_25_2")])

combined_dataPP$HEALTH_JUSTm <- rowMeans(combined_dataPP[, c("Q1_8_2",
"Q1_17_2", "Q1_26_2")])

combined_dataPP$FATE_JUSTm <- rowMeans(combined_dataPP[, c("Q1_9_2", "Q1_18_2",
"Q1_27_2")])


# Calculate the overall justification score

combined_dataPP <- combined_dataPP %>%

  mutate(TOTAL_JUSTIFICATION = PROMEAT + DENIAL + HIER_JUST +
DICHOTOMY + DISSOCIATION + REL_JUST + AVOIDANCE + HEALTH_JUST +
FATE_JUST

  )


combined_dataPP$TOTAL_JUSTm <- rowMeans(combined_dataPP[, c("PROMEATm",
"DENIALm", "HIER_JUSTm", "DICHOTOMYm", "DISSOCIATIONm", "REL_JUSTm",
"AVOIDANCEm", "HEALTH_JUSTm", "FATE_JUSTm")])


# Calculate descriptive statistics by group

descriptive_stats <- combined_dataPP %>%

  group_by(group_membership) %>%

  summarize(
```

```
    mean_PROMEAT = mean(PROMEAT, na.rm = TRUE),
    sd_PROMEAT = sd(PROMEAT, na.rm = TRUE),
    mean_DENIAL = mean(DENIAL, na.rm = TRUE),
    sd_DENIAL = sd(DENIAL, na.rm = TRUE),
    mean_HIER_JUST = mean(HIER_JUST, na.rm = TRUE),
    sd_HIER_JUST = sd(HIER_JUST, na.rm = TRUE),
    mean_DICHOTOMY = mean(DICHOTOMY, na.rm = TRUE),
    sd_DICHOTOMY = sd(DICHOTOMY, na.rm = TRUE),
    mean_DISSOCIATION = mean(DISSOCIATION, na.rm = TRUE),
    sd_DISSOCIATION = sd(DISSOCIATION, na.rm = TRUE),
    mean_REL_JUST = mean(REL_JUST, na.rm = TRUE),
    sd_REL_JUST = sd(REL_JUST, na.rm = TRUE),
    mean_AVOIDANCE = mean(AVOIDANCE, na.rm = TRUE),
    sd_AVOIDANCE = sd(AVOIDANCE, na.rm = TRUE),
    mean_HEALTH_JUST = mean(HEALTH_JUST, na.rm = TRUE),
    sd_HEALTH_JUST = sd(HEALTH_JUST, na.rm = TRUE),
    mean_FATE_JUST = mean(FATE_JUST, na.rm = TRUE),
    sd_FATE_JUST = sd(FATE_JUST, na.rm = TRUE),
    mean_TOTAL_JUSTIFICATION = mean(TOTAL_JUSTIFICATION, na.rm = TRUE),
    sd_TOTAL_JUSTIFICATION = sd(TOTAL_JUSTIFICATION, na.rm = TRUE)
  )

descriptive_statsTOTAL <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarize(
```

```
  mean_TOTAL_JUSTm = mean(TOTAL_JUSTm, na.rm = TRUE),
  sd_TOTAL_JUSTm = sd(TOTAL_JUSTm, na.rm = TRUE)
 )
# Print the descriptive statistics
print(descriptive_stats)
print(descriptive_statsTOTAL)
#descriptive statistics MEAN


#Cronbach's alpha
subscale_columns <- c("PROMEATm", "DENIALm", "HIER_JUSTm", "DICHOTOMYm",
"DISSOCIATIONm", "REL_JUSTm", "AVOIDANCEm", "HEALTH_JUSTm",
"FATE_JUSTm")
subscales_df <- combined_dataPP[, subscale_columns]


alpha_results <- alpha(subscales_df)


print(alpha_results)


# Creating data frames for each subscale
PROMEAT_df <- combined_dataPP[, c("Q1_1_2", "Q1_10_2", "Q1_19_2")]
DENIAL_df <- combined_dataPP[, c("Q1_2_2", "Q1_11_2", "Q1_20_2")]
HIER_JUST_df <- combined_dataPP[, c("Q1_3_2", "Q1_12_2", "Q1_21_2")]
DICHOTOMY_df <- combined_dataPP[, c("Q1_4_2", "Q1_13_2", "Q1_22_2")]
DISSOCIATION_df <- combined_dataPP[, c("Q1_5_2", "Q1_14_2", "Q1_23_2")]
REL_JUST_df <- combined_dataPP[, c("Q1_6_2", "Q1_15_2", "Q1_24_2")]
```

```
AVOIDANCE_df <- combined_dataPP[, c("Q1_7_2", "Q1_16_2", "Q1_25_2")]

HEALTH_JUST_df <- combined_dataPP[, c("Q1_8_2", "Q1_17_2", "Q1_26_2")]

FATE_JUST_df <- combined_dataPP[, c("Q1_9_2", "Q1_18_2", "Q1_27_2")]


# Calculating Cronbach's alpha for each subscale

alpha_PROMEAT <- alpha(PROMEAT_df)

alpha_DENIAL <- alpha(DENIAL_df)

alpha_HIER_JUST <- alpha(HIER_JUST_df)

alpha_DICHOTOMY <- alpha(DICHOTOMY_df)

alpha_DISSOCIATION <- alpha(DISSOCIATION_df)

alpha_REL_JUST <- alpha(REL_JUST_df)

alpha_AVOIDANCE <- alpha(AVOIDANCE_df)

alpha_HEALTH_JUST <- alpha(HEALTH_JUST_df)

alpha_FATE_JUST <- alpha(FATE_JUST_df)


print(paste("PROMEAT alpha: ", alpha_PROMEAT$total$raw_alpha))

print(paste("DENIAL alpha: ", alpha_DENIAL$total$raw_alpha))

print(paste("HIER_JUST alpha: ", alpha_HIER_JUST$total$raw_alpha))

print(paste("DICHOTOMY alpha: ", alpha_DICHOTOMY$total$raw_alpha))

print(paste("DISSOCIATION alpha: ", alpha_DISSOCIATION$total$raw_alpha))

print(paste("REL_JUST alpha: ", alpha_REL_JUST$total$raw_alpha))

print(paste("AVOIDANCE alpha: ", alpha_AVOIDANCE$total$raw_alpha))

print(paste("HEALTH_JUST alpha: ", alpha_HEALTH_JUST$total$raw_alpha))

print(paste("FATE_JUST alpha: ", alpha_FATE_JUST$total$raw_alpha))
```

```
all_items <- combined_dataPP[, c("Q1_1_2", "Q1_2_2", "Q1_3_2", "Q1_4_2", "Q1_5_2",
"Q1_6_2", "Q1_7_2", "Q1_8_2", "Q1_9_2",
                      "Q1_10_2", "Q1_11_2", "Q1_12_2", "Q1_13_2", "Q1_14_2",
"Q1_15_2", "Q1_16_2", "Q1_17_2",
                      "Q1_18_2", "Q1_19_2", "Q1_20_2", "Q1_21_2", "Q1_22_2",
"Q1_23_2", "Q1_24_2", "Q1_25_2",
                      "Q1_26_2", "Q1_27_2")]

# Compute Cronbach's alpha for the entire set of 27 items
alpha_all_items <- alpha(all_items)

# Print the result
print(alpha_all_items)

# Define the subscale variables
subscale_vars <- c("PROMEATm", "DENIALm", "HIER_JUSTm", "DICHOTOMYm",
"DISSOCIATIONm", "REL_JUSTm", "AVOIDANCEm", "HEALTH_JUSTm",
"FATE_JUSTm", "TOTAL_JUSTm")

# Calculate mean and standard deviation for each subscale by group
subscales_by_group <- aggregate(. ~ group_membership, data = combined_dataPP[,
c("group_membership", subscale_vars)], FUN = function(x) c(mean = mean(x, na.rm =
TRUE), sd = sd(x, na.rm = TRUE)))

# Print the results
print(subscales_by_group)
```

```
#choens d
sample_sizes <- combined_dataPP %>%
  group_by(group_membership) %>%
  summarise(sample_size = n())

print(sample_sizes)

mean_control <- c(4.694, 3.248, 4.316, 5.725, 5.185, 4.067, 5.767, 5.160, 4.964, 4.792)
sd_control <- c(2.147, 1.563, 1.941, 1.706, 2.038, 2.058, 1.730, 2.145, 1.697, 1.269)

mean_video <- c(4.890, 3.073, 4.312, 5.749, 5.235, 3.700, 5.795, 5.040, 4.857, 4.739)
sd_video <- c(2.169, 1.461, 1.915, 1.680, 2.044, 2.058, 1.763, 2.221, 1.695, 1.291)

mean_diff <- mean_video - mean_control

pooled_sd <- sqrt(((283 - 1) * sd_control^2 + (263 - 1) * sd_video^2) / (283 + 263 - 2))

cohen_d <- mean_diff / pooled_sd

cohen_d

# Check for normality for each subscale and total justification score in each group MEANS
shapiro_test_results <- combined_dataPP %>%
  group_by(group_membership) %>%
```

```
  summarize(
    shapiro_PROMEATm = shapiro.test(PROMEATm)$p.value,
    shapiro_DENIALm = shapiro.test(DENIALm)$p.value,
    shapiro_HIER_JUSTm = shapiro.test(HIER_JUSTm)$p.value,
    shapiro_DICHOTOMYm = shapiro.test(DICHOTOMYm)$p.value,
    shapiro_DISSOCIATIONm = shapiro.test(DISSOCIATIONm)$p.value,
    shapiro_REL_JUSTm = shapiro.test(REL_JUSTm)$p.value,
    shapiro_AVOIDANCEm = shapiro.test(AVOIDANCEm)$p.value,
    shapiro_HEALTH_JUSTm = shapiro.test(HEALTH_JUSTm)$p.value,
    shapiro_FATE_JUSTm = shapiro.test(FATE_JUSTm)$p.value
  )

# Print the Shapiro-Wilk test results
print(shapiro_test_results)

# Shapiro-Wilk test for normality TOTAL SCORE
shapiro_test <- shapiro.test(combined_dataPP$TOTAL_JUSTm)

W_statistic <- shapiro_test$statistic
p_value <- shapiro_test$p.value

cat("Shapiro-Wilk Test for Normality:\n")
cat("W statistic:", W_statistic, "\n")
cat("p-value:", p_value, "\n")
```

```
library(car)

# Levene's test for each subscale and total justification score
levene_test_results <- list(
  PROMEATm = leveneTest(PROMEATm ~ group_membership, data = combined_dataPP),
  DENIALm = leveneTest(DENIALm ~ group_membership, data = combined_dataPP),
  HIER_JUSTm = leveneTest(HIER_JUSTm ~ group_membership, data = combined_dataPP),
  DICHOTOMYm = leveneTest(DICHOTOMYm ~ group_membership, data =
combined_dataPP),
  DISSOCIATIONm = leveneTest(DISSOCIATIONm ~ group_membership, data =
combined_dataPP),
  REL_JUSTm = leveneTest(REL_JUSTm ~ group_membership, data = combined_dataPP),
  AVOIDANCEm = leveneTest(AVOIDANCEm ~ group_membership, data =
combined_dataPP),
  HEALTH_JUSTm = leveneTest(HEALTH_JUSTm ~ group_membership, data =
combined_dataPP),
  FATE_JUSTm = leveneTest(FATE_JUSTm ~ group_membership, data = combined_dataPP),
  TOTAL_JUSTm = leveneTest(TOTAL_JUSTm ~ group_membership, data =
combined_dataPP)
)

# Print the Levene's test results
print(levene_test_results)

# Mann-Whitney U test for PROMEAT subscale
```

```r
wilcox_test_PROMEAT <- wilcox.test(PROMEAT ~ group_membership, data =
combined_dataPP, exact = FALSE)

# Print the results
print(wilcox_test_PROMEAT)

#List of subscales
subscales <- c("PROMEATm", "DENIALm", "HIER_JUSTm", "DICHOTOMYm",
"DISSOCIATIONm", "REL_JUSTm", "AVOIDANCEm", "HEALTH_JUSTm",
"FATE_JUSTm", "TOTAL_JUSTm")



# Perform Mann-Whitney U test for each subscale
mann_whitney_results <- lapply(subscales, function(scale) {
  test_result <- wilcox.test(as.formula(paste(scale, "~ group_membership")), data =
combined_dataPP, exact = FALSE)
  return(test_result)
})

# Print results
names(mann_whitney_results) <- subscales
mann_whitney_results

#correlation meat eating justifications with meat consumption
combined_dataPP$meat_consumption_combined <- combined_dataPP$meat_consumption +
combined_dataPP$meat_consumption2
```

```
#spearmans correlation between meat consumption combined and each subscale

cor_results_combined <- list()

cor_results_combined$PROMEATm <-
cor.test(combined_dataPP$meat_consumption_combined, combined_dataPP$PROMEATm,
method = "spearman")

cor_results_combined$DENIALm <-
cor.test(combined_dataPP$meat_consumption_combined, combined_dataPP$DENIALm,
method = "spearman")

cor_results_combined$HIER_JUSTm <-
cor.test(combined_dataPP$meat_consumption_combined, combined_dataPP$HIER_JUSTm,
method = "spearman")

cor_results_combined$DICHOTOMYm <-
cor.test(combined_dataPP$meat_consumption_combined,
combined_dataPP$DICHOTOMYm, method = "spearman")

cor_results_combined$DISSOCIATIONm <-
cor.test(combined_dataPP$meat_consumption_combined,
combined_dataPP$DISSOCIATIONm, method = "spearman")

cor_results_combined$REL_JUSTm <-
cor.test(combined_dataPP$meat_consumption_combined, combined_dataPP$REL_JUSTm,
method = "spearman")

cor_results_combined$AVOIDANCEm <-
cor.test(combined_dataPP$meat_consumption_combined,
combined_dataPP$AVOIDANCEm, method = "spearman")

cor_results_combined$HEALTH_JUSTm <-
cor.test(combined_dataPP$meat_consumption_combined,
combined_dataPP$HEALTH_JUSTm, method = "spearman")
```

```
cor_results_combined$FATE_JUSTm <-
cor.test(combined_dataPP$meat_consumption_combined, combined_dataPP$FATE_JUSTm,
method = "spearman")

cor_results_combined$TOTAL_JUSTm <-
cor.test(combined_dataPP$meat_consumption_combined,
combined_dataPP$TOTAL_JUSTIFICATIONm, method = "spearman")


cor_results_combined
```