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Consumer Considerations of Carbon Paw Prints in Evaluations of Dog Food Products

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Abstract

Due to its reliance on meat, the companion animals' food industry significantly contributes to environmental problems. Despite these environmental implications, little is known about the relative importance that caregivers attach to environmental concerns in their evaluation of companion animals' food products. Study 1 ($N = 317$) showed that perceived nutritional value predicted whether caregivers were interested in plant-based dog food products, while pro-environmental identification did not impact the findings. In Studies 2 ($N = 460$) and 3 ($N = 194$), the promoted benefits of a fictitious dog food product were manipulated. Findings revealed that perceived health benefits rather than perceived environmental benefits were the main determinant of product interest. Together, these findings suggest that environmental concerns play a limited role in people's views of companion animals' food products. It is therefore important to address concerns about the health impacts of companion animals' food products with plant-based content.

Keywords

Meat consumption – environmental concern – companion animals – pet food industry

People are increasingly aware of the urgency of climate change (Moser, 2016), and interest in adapting consumption patterns to reduce one's carbon footprint is rising (Schanes et al., 2016). Nevertheless, environmentally conscious consumers often continue to indirectly contribute to environmental issues through their companion animals. Approximately 88 million households have a companion animal in Europe alone (FEDIAF, 2020). Consequently, the companion animals' food industry is thriving, which – due to its reliance on the livestock sector – has serious negative environmental implications (De Silva & Turchini, 2008). For example, Alexander et al. (2020) revealed that the annual production of global dry food accounts for greenhouse gas emissions comparable to the 60th highest-emitting country. It can therefore be questioned whether the current approach to companion animals' diets is sustainable in the long term (Deng & Swanson, 2015; Swanson et al., 2013).

To address the industry's environmental implications, a niche market is developing in which plant-based alternatives are offered (Zafalon et al., 2020). Yet, though research has shown that people care about the wellness benefits that companion animals' food presents (Deng & Swanson, 2015; Dodd et al., 2019), few studies have examined whether sustainability concerns also play a

role in consumers' decisions (Conway & Saker, 2018). Moreover, most studies tended to focus on the impacts of individual motivations and communication strategies to reduce one's personal meat intake (De Vaan et al., 2019; Sparks et al., 1997). In the current research, we examine the relative impact of environmental concerns in comparison to considerations about a companion animal's health in the evaluation of food products. As such, this research can provide insights on which concerns need to be prioritized in the production of and communication about companion animals' food products in order to explore the options to mitigate the industry's negative environmental impacts.

Motives Related to Meat Consumption

Human-induced climate change is causing more frequent and intense extreme weather events, to which people and ecosystems are increasingly less capable to adapt (IPCC, 2022). Greenhouse gas emissions need to be reduced rapidly to limit a global temperature rise to 1.5°C above pre-industrial levels, as the changes to the climate will likely become irreversible if this boundary is exceeded. In 2019, the United Nations called for a change in human diets through a reduction in meat consumption (Schiermeier, 2019). Significant changes in land management and agriculture are required to mitigate climate change effects (IPCC, 2019). These changes can be established by using plant protein to replace animal protein, as fewer limited resources are needed to produce plant protein. Red meat has the strongest negative environmental impact. For example, beef protein requires at least 10 times more water, pesticide, and land than the same amount of protein from kidney beans, and produces 5–6 times more waste than chicken protein (Sabaté et al., 2015).

The most common motivations to follow a vegetarian diet are health-related (e.g., avoiding illness and promoting fitness), environmental concern (e.g., concerns about climate change and scarcity of resources) and concern for animals (e.g., concerns about animal welfare and animal rights; Janssen et al., 2016). Environmental and animal concern are sometimes considered as part of ethical motivation, as these motivations relate more to individual moral values and consequently lead to stronger diet convictions than self-oriented health-related motives (Rosenfeld, 2018). Yet despite the urgency of climate change (IPCC, 2022), perceived health benefits – rather than environmental concern – are often offered as the primary reason to adapt one's diet when examining self-expressed motives (Cheah et al., 2020; De Boer et al., 2017; Neff et al., 2018). For example, Cheah et al. (2020) observed that the intention to avoid meat was driven by perceptions of positive health outcomes – such as

being better able to regulate one's weight and lowering the risk of diseases – while the impact of environmental concern was limited.

Expected health benefits can diverge based on people's current diets and the type of meat that is targeted. Research by De Boer et al. (2017) showed that among people who ate a low or moderate amount of meat, red meat tended to be avoided for health reasons. Similarly, Neff et al. (2018) found that a reduction in the consumption of red and processed meat was most common. Although environmental concern positively impacted this reduction, the decision to avoid these types of meat was mostly driven by perceived health benefits and costs. Among people who did not lower their meat intake, meat was considered as a healthy option. Overall, these studies suggest that though people might sympathize with the environmental cause, it appears to function as a less influential motive to reshape one's diet than perceived health outcomes of meat consumption.

The Connection Between Humans and Companion Animals

Studies show that environmental concern can promote a higher interest in purchasing sustainable products (Ansal & Atalar, 2016; Cerri et al., 2018; Jeseviciute-Ufartiene, 2019). Yet health considerations tend to be more important than environmental concern in meat consumption (Cheah et al., 2020; De Boer et al., 2017; Neff et al., 2018) despite the associated detrimental environmental impact (IPCC, 2022). The question thus arises: Which considerations determine caregivers' decisions regarding the purchasing of plant-based food products for their companion animals? We argue that health concerns will function as a stronger determinant of such decisions than environmental concerns due to the bond that caregivers experience with their companion animals. Companion animals are often perceived as part of the family and tend to be treated as humanlike companions due to the social connection they provide (Sevillano & Fiske, 2016). For example, interacting with a companion animal has been associated with feelings of relaxation, lower stress, depression, and anxiety, improved cardiovascular reactivity, and more physical activity (Allen et al., 2002; Aydin et al., 2012; Schreiner, 2016; Young et al., 2020). Moreover, companion animals can offer an independent source of social support that complements the social support received from humans (McConnell et al., 2011).

In line with human food trends, there is an increased attention for how food impacts companion animals' health (Deng & Swanson, 2015). However, while consumers increasingly associate a reduced intake of (some types of) meat with health benefits in human food (Cheah et al., 2020; De Boer et al.,

2017; Neff et al., 2018), a reverse trend can be observed for companion animals. Consumers perceive plant-based protein sources as less suitable for companion animals than animal-based protein, and they are concerned about the extent to which plant-based food provides adequate nutritional value (Acuff et al., 2021; Dodd et al., 2019). Some studies have indeed indicated that companion animals' foods that consist entirely of plant-based ingredients often do not reach the recommended levels of nutrients (Kanakubo et al., 2015; Zafalon et al., 2020). However, in contrast to cats, dogs are well-equipped to process a diet that, in part, relies on plant-based protein due to their omnivorous nature if a proper balance of nutrients is established (Acuff et al., 2021; Buff et al., 2014; Dodd et al., 2019).

Therefore, there is a demand for low-carbohydrate food products which have a high quality (e.g., best cuts of meat) and quantity of animal-based protein (Okin, 2017). In addition, raw diets – which are based on muscle and organ meats, bones, fruits, and vegetables, and have a relatively high meat content – are gaining popularity among some caregivers (Winter, 2019). Research has indicated that companion animals' food products often contain protein levels that exceed their nutritional requirements (Deng & Swanson, 2015). In contrast to protein deficiencies, most companion animals can adapt to an excess in protein levels (Kanakubo et al., 2015; Zafalon et al., 2020). However, the health benefits that diets with excessive protein offer are debatable, yet the carbon paw print is enhanced by opting for this type of diet (Acuff et al., 2021; Deng & Swanson, 2015).

Thus, although both health and environmental benefits can promote consumers' interest in adapting human diets, people seem to attribute negative health impacts to the use of plant-based companion animals' food (Acuff et al., 2021; Dodd et al., 2019). As such, the reduced greenhouse gas emissions associated with companion animals' diets that rely on plant-based protein are likely to be negated by the lack of confidence that caregivers have in their nutritional value. In consideration of the close bond that many people form with their companion animals, we would expect that health considerations will outweigh negative environmental impacts in caregivers' interest in companion animals' food products. Moreover, we predict that products will be more positively evaluated when health benefits rather than environmental benefits are emphasized.

Overview of the Current Research

Three studies were conducted to examine our central hypothesis, in which we focused on fully plant-based products (Studies 1 and 3), or a product based

on animal-protein (Study 2). Given that more diversity in dietary choices is possible for dogs than for cats, which thereby provides more opportunities to explore the inclusion of environmentally friendly food choices, all studies focused on dog food products only.

In Study 1, a survey was used to examine how interest in plant-based dog food products is affected by the caregiver's pro-environmental identity and the perceived nutritional value of the products. In Study 2, the description of a fictitious dog food product was manipulated to emphasize the benefits for the dog's health or the environmental benefits. These descriptions were compared to a neutral condition to examine which type of message would promote more positive product evaluations among caregivers. An experimental design was also employed in Study 3, in which a fictitious, plant-based dog food product was again introduced to caregivers. In contrast to Study 2 – in which the source of animal-based protein was not specified – the dog food product was explicitly introduced as a vegan option with plant-based ingredients only. Furthermore, the experimental design was expanded by also including a condition in which animal welfare benefits were promoted, and a condition in which all benefits were described.

Study 1: The Role of Pro-Environmental Identity in Perceptions of Plant-Based Dog Food

The aim of Study 1 was to examine the relative impact of caregivers' pro-environmental identity and their perceptions of nutritional value on the interest in plant-based dog food products. Self-identity captures the characteristics of people's self-perceptions that are considered enduring (Van der Werff et al., 2014). A pro-environmental identity thus indicates whether an individual considers their relation to the environment as a key facet of who they are (Carfora et al., 2017). The extent to which an individual has a pro-environmental identity has been shown to be an important determinant of pro-environmental behaviors, as engaging in behaviors that are consistent with the identity can help to validate the self-concept (Whitmarsh & O'Neill, 2010). Given that plant-based dog food products have a lower environmental impact than animal-based protein, it can be argued that a pro-environmental identity could promote more positive responses to plant-based dog food. However, we expected that perceptions of nutritional value would function as a stronger determinant of caregivers' interest in plant-based dog food. Effects of the caregiver's diet were also assessed, as people's current diets relate to their perceptions of the health benefits associated with meat consumption (De Boer et al., 2017; Neff et al., 2018).

Furthermore, we controlled for the extent to which caregivers anthropomorphized (i.e., attributed human characteristics to) dogs.

Method

Participants and Procedure

The study was completed by 317 dog caregivers (83.9% female, 11.7% male, 4.4% other or not indicated; $M_{\text{age}} = 40.29$, $SD_{\text{age}} = 13.12$, age range: 19–80 years). A link to the online, English questionnaire was shared in various international social media groups (e.g., Facebook, Instagram) that focused on dog caregivers or enthusiasts. At the start of the questionnaire, informed consent was obtained, after which participants were asked if they currently had a dog. Additionally, the environmental concern measure was introduced. We then provided a brief description of sustainable dog food: “Sustainable dog food contains no meat or fish. Instead, sustainable dog food products use plant-based proteins to meet a dog’s nutritional needs.” Thus, the sustainable characteristic of such products focused only on protein source. Perceived nutritional value, product interest, anthropomorphism, and personal diet measures were then assessed.

Materials

All measures were assessed on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), unless indicated otherwise.

Pro-Environmental Identity. Five items (adapted from Smith et al., 2007; and Sparks & Shepherd, 1992) were used to measure participants’ pro-environmental identity, $\alpha = .87$: “I think of myself as someone who is very concerned with environmental issues,” “I would be proud to be seen as having an environmentally-friendly lifestyle,” “I think of myself as an environmentally-friendly consumer,” “I see myself as pro-environmentalist,” and “I feel strong ties with pro-environmentalist people.”

Perceived Nutritional Value. Perceived nutritional value of sustainable dog food products was assessed with three items: “I believe that sustainable dog food could provide sufficient nutritional value for a dog,” “I think that sustainable dog food is just as healthy as conventional dog food that contains meat or fish,” and “Sustainable dog food can improve the health of a dog,” $\alpha = .93$.

Product Interest. Interest in purchasing sustainable dog food products was measured with four items, $\alpha = .98$: “I would be interested in sustainable dog food,” “I would be willing to give my dog sustainable dog food,” “It’s likely that I’ll buy sustainable dog food,” and “I would consider purchasing sustainable dog food.”

Control Variables. Three items (Epley et al., 2008) assessed the tendency of participants to attribute human-like features to dogs, $\alpha = .87$: “I believe that dogs can be [considerate, thoughtful, sympathetic].” Furthermore, two items were used to assess the caregiver’s meat and fish consumption patterns: “How often do you consume meat?” and “How often do you consume fish?” Answer options ranged from 1 (never) to 7 (always).

Results

A regression analysis was conducted in which pro-environmental identity and perceived nutritional value were entered as determinants of product interest. The analysis controlled for potential effects of gender, age, anthropomorphism, and the caregiver’s meat and fish consumption. Results revealed that only perceived nutritional value significantly predicted caregivers’ product interest: Higher levels of perceived nutritional value promoted higher interest in sustainable dog food products, $\beta = .86, p < .001$, partial $r^2 = .60$. None of the other partial effects were significant, all p ’s $> .08$.

Discussion

Study 1 provided initial support for our prediction that perceived health benefits outweigh environmental concerns in caregivers’ interest in dog food products. Findings showed that interest in plant-based products only increased when caregivers had positive perceptions of the products’ nutritional value. Even though pro-environmental identity can spillover to other pro-environmental behaviors (Whitmarsh & O’Neill, 2010), the need for identity-congruent behavior did not influence interest in plant-based dog food products.

Study 2: Sustainability vs. Health Messages in Dog Food Advertising

Study 2 focused on replicating and expanding the findings of Study 1 by examining the impact of information provision on people’s evaluations of traditional dog food products (i.e., using animal-based protein). An experimental design was employed to compare the relative persuasiveness of product messages that focused on the health or the environmental benefits that the dog food product offered. A fictitious traditional dog food brand was introduced that was said to contain 23% protein (based on AAFCO recommendations,

2014). The promotional message did not specify the ingredients to avoid the influence of taste perceptions based on meat type, and to provide a more conservative test of the impact of stated health benefits. As such, Study 2 offers a first step to test the impacts of health or environmental promotional messages for traditional dog food products.

Method

Participants, Design and Procedure

The sample consisted of 460 participants (74.1% female, 21.1% male, 4.8% other or not indicated; $M_{\text{age}} = 36.49$, $SD_{\text{age}} = 13.47$, age range: 18–74 years). The majority indicated that they currently live in Western Europe (81.5%). All participants were dog caregivers. A minority (21.3%) reported that their dog had dietary restrictions. Like Study 1, a link to the online, English questionnaire was distributed on social media. After obtaining informed consent, an advertisement of a dog food brand was presented to participants. This advertisement contained the experimental manipulation, which had a unifactorial between-subjects design with three conditions (health, sustainable, neutral). Participants were randomly assigned to one of the conditions. The manipulation checks, product attitude and interest measures, dietary restrictions of the dog, and background items were then introduced.

Materials

Experimental Manipulation. Participants were asked to carefully look at an advertisement for a fictitious dog food brand named “Anybelly.” The advertisement showed a dog eating from a bowl, the product packaging, and a message about the product which was manipulated (Figure 1).

In all conditions, the product was described to have a “delicious taste.” In the neutral condition, no other information about the product was included. In the sustainable message condition, the message also specified that the product had scientifically proven environmental benefits: It would reduce the ecological paw print, and it was good for the planet. In the health message condition, the message said the product had scientifically proven health benefits: It would support a strong immune system, and it would help to maintain a healthy digestion.

Manipulation Checks. Two manipulation checks were introduced to examine whether participants interpreted the conditions as intended. One item was used to check the health message manipulation: “The advertisement of Anybelly states that it will improve the health of a dog.” The sustainable message



FIGURE 1 Advertisement sustainable message condition study 2

manipulation was tested with the item: “The advertisement of Anybelly states that it will reduce a dog’s ecological paw print” (for both items, 1 = *strongly disagree*, 7 = *strongly agree*).

Product Attitude. Product attitude was assessed with four items (based on Ajzen & Madden, 1986) that were measured on a 7-point semantic differential scale: “Giving food from Anybelly to my dog would be ...” [very bad – very good, very foolish – very wise, very harmful – very beneficial, very unattractive – very attractive], $\alpha = .91$.

Product Interest. The product interest measure was similar to the measure used in Study 1, $\alpha = .94$.

Control Variables. The caregivers’ meat and fish consumption was assessed using the same items as in Study 1. Furthermore, Study 2 controlled for the potential influence of dietary restrictions of the dog. One item was used to assess dietary restrictions: “Does your dog(s) have any dietary restrictions?” (yes/no).

Results

Manipulation Checks

A one-way ANOVA showed that the manipulation significantly influenced the sustainable message manipulation check, $F(2, 457) = 71.22, p < .001$. A

Games-Howell post-hoc test demonstrated that the statement that ecological paw prints would be reduced was more likely to be noticed in the sustainable message condition ($M = 5.07$, $SD = 1.66$) than in the health message condition ($M = 3.29$, $SD = 1.38$), $p < .001$, or in the neutral message condition ($M = 3.32$, $SD = 1.40$), $p < .001$, while no difference was found between the health and the neutral message conditions, $p = .98$.

Another one-way ANOVA revealed an effect of the manipulation on the health message manipulation check, $F(2, 457) = 34.31$, $p < .001$. A Games-Howell post-hoc test showed that participants were more likely to observe that the packaging described beneficial health effects in the health message condition ($M = 4.84$, $SD = 1.36$) than in the sustainable message condition ($M = 3.54$, $SD = 1.65$), $p < .001$, or the neutral message condition ($M = 3.71$, $SD = 1.46$), $p < .001$. The sustainable and neutral message conditions did not differ, $p = .63$. Hence, the experimental manipulation was successful.

Main Analyses

An ANOVA was used to test the effects of the experimental manipulation on product attitude and product interest. The analyses controlled for the effects of the dog's potential dietary restrictions, and the participant's gender, age, meat consumption, and fish consumption.

Product Attitude

The analysis yielded a significant effect of the manipulation on product attitude, $F(2, 426) = 3.88$, $p = .02$, partial $\eta^2 = .02$. Contrasts showed that participants in the health message condition held more positive product attitudes ($M = 4.22$, $SD = 0.87$) than participants in the neutral message condition ($M = 3.95$, $SD = 0.97$), $p = .01$, while no difference was found between the sustainable ($M = 3.98$, $SD = 1.04$) and the neutral message, $p = .84$. Additionally, participants' age had a negative partial effect on product attitude, $F(1, 426) = 8.08$, $p = .005$, partial $\eta^2 = .02$. The caregiver's meat consumption had a positive partial effect on product attitude, $F(1, 426) = 6.96$, $p = .009$, partial $\eta^2 = .02$. Dietary restrictions had a marginal partial effect, $F(1, 426) = 3.35$, $p = .07$, partial $\eta^2 = .01$. No significant partial effects were found for gender, $p = .18$, or caregivers' fish consumption, $p = .23$.

Product Interest

The manipulation had a marginally significant partial effect on product interest, $F(2, 426) = 2.86$, $p = .06$, partial $\eta^2 = .01$. Participants were more interested in the product when they were given a health message ($M = 3.27$, $SD = 1.48$) rather

than a neutral message ($M = 2.89$, $SD = 1.32$), $p = .02$. No difference between the sustainable ($M = 2.98$, $SD = 1.53$) and the neutral message was observed, $p = .61$. Furthermore, older age was associated with lower product interest, $F(1, 426) = 11.60$, $p < .001$, partial $\eta^2 = .03$. None of the other variables were significant, all p 's $> .19$.

Discussion

Study 2 offered support for the notion that traditional dog food product messages that emphasize different benefits can impact caregivers' product evaluations. In comparison to a neutral message that focused on product taste only, adding a statement about environmental benefits did not promote more positive responses to a traditional dog food product, whereas adding information about health benefits resulted in more positive attitudes and product interest. As such, Study 2 corroborated the findings of Study 1.

However, it is possible that adding an environmental statement to a dog food product that contains meat is considered to represent an incongruence between the product features and the message. Furthermore, by not listing specific ingredients, it is more challenging for people to form an impression of the product's qualities. Study 3 addressed these issues by focusing on the promotional message of a plant-based dog food product.

Study 3: Attitudes Toward Plant-Based Dog Food

Study 3 focused on whether the effects of information provision about a traditional dog food product of Study 2 also translate to a dog food product that only contains plant-based protein. Due to the lack of animal-based protein in the product, it is possible that communicating the environmental benefits of the product is more aligned with the product's perceived qualities. This, in turn, could lead to more positive responses to environmental messages about plant-based dog food.

In Study 3, we added two experimental conditions. First, we included a message in which the benefits of the product for animal welfare were emphasized. Concerns about animal welfare represent an important driver for some people to reconsider their meat consumption (Cornish et al., 2019; Janssen et al., 2016). Second, we compared the effects of a neutral, health, environmental, or animal welfare message to a message in which all three benefits were jointly introduced.

Method

Participants, Design, and Procedure

An online Dutch questionnaire was completed by 194 participants (86.1% female, 12.4% male, 1.5% other or not indicated; $M_{\text{age}} = 40.88$, $SD_{\text{age}} = 12.94$, age range: 19–70 years). All participants were dog caregivers who lived in the Netherlands. The majority considered themselves to be an omnivore (45.4%), followed by vegan (26.8%), flexitarian (21.1%), vegetarian (4.6%), and pescatarian (2.1%). A minority (15%) indicated that their dog had medical diet restrictions. Most participants (61.9%) regularly purchased dog food that contained meat. Like Studies 1 and 2, a link to the questionnaire was shared on social media sites that focused on dog enthusiasts. Furthermore, to have diversity in personal diets, a link to the questionnaire was also distributed on social media groups that focused on a vegan lifestyle.

A unifactorial, between-subjects design with five randomly assigned conditions (health, sustainable, cruelty-free, combination, neutral) was used. After providing informed consent, participants were introduced to questions regarding their own and their dog's diet. We then showed a fictitious advertisement of a plant-based dog food product to participants which contained the experimental manipulation. The manipulation checks, product attitude and interest measures, and demographic variables were then presented. All measures were assessed using a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). Finally, participants were debriefed about the dog food product.

Materials

Experimental Manipulation. A fictitious advertisement of “Vegdog” was shown to all participants (Figure 2). The advertisement included a green package with the brand name, a wagging tail, and a bowl of kibble in front of the package. A small textbox was displayed on the package which specified that the food was 100% vegan and based on potatoes and legumes.

In the neutral message condition, no other information was displayed on the package. In the sustainable message condition, the package included the phrases “eco+,” “sustainable food,” and “good for the planet.” The phrases “love+,” “cruelty-free food,” and “with love for all animals” were displayed on the package in the cruelty-free message condition. In the healthy message condition, the phrases presented on the package were “vital+,” “healthy food,” and “for strong bones and muscles, supports the immune system.” Finally, in the mixed message condition, the package included “total+,” “healthy, cruelty-free, and sustainable food,” and “with care for your dog, for other animals, and for the planet.”



FIGURE 2
Advertisement sustainable message
condition study 3

Manipulation Checks. Three single items were used to examine how the manipulation influenced perceptions of the dog food brand: “I believe that Vegdog dog food is a healthy option for my dog,” “I believe that Vegdog dog food is a sustainable product,” and “I believe that Vegdog dog food was produced without animal cruelty.”

Product Attitude. Participants indicated their agreement or disagreement with four items to assess product attitude (based on Ajzen & Madden, 1986): “I find this product ...[attractive, good, a wise choice, a useful purchase],” $\alpha = .94$.

Product Interest. Three items assessed whether caregivers were interested in the dog food brand: “I think that I would want to buy Vegdog food,” “It is likely that I would give Vegdog to my dog,” “I would have the intention to purchase Vegdog in the nearby future,” $\alpha = .97$.

Control Variables. One item was introduced to assess personal diet: “Which role do animal products have in your diet? I am an ...[omnivore, flexitarian, pescatarian, vegetarian, vegan, other].” For the analyses, answers were recoded to distinguish people who included meat and/or fish in their diets from people who were vegan or vegetarian. We also assessed whether the dog had medical restrictions.

Results

Manipulation Checks

A one-way ANOVA revealed a significant effect of the manipulation on sustainable product perception, $F(4, 189) = 2.75, p = .03$. However, a Games-Howell post-hoc test showed that a difference in perceived sustainability only emerged between the mixed message condition ($M = 5.34, SD = 1.53$) and the health message condition ($M = 4.48, SD = 1.21$), $p = .05$.

A significant effect of the manipulation was found on perceived animal suffering, $F(4, 189) = 2.92, p = .02$. The dog food was more likely to be perceived as being produced without animal suffering in the mixed message condition ($M = 6.03, SD = 1.26$) than in the health message condition ($M = 5.05, SD = 1.54$), $p = .02$. However, like the previous manipulation check, perceptions of animal cruelty did not differ between the other conditions.

Finally, the manipulation did not impact the perception that the product represented a healthy choice for dogs, $F(4, 189) = 0.18, p = .95$. Thus, although the findings suggest that presenting mixed benefits on the packaging can influence perceptions of sustainability and animal cruelty, no evidence was found that these perceptions were different from the situation in which no statements were included. The health and the sustainability message manipulations were comparable to the message manipulations in Study 2. It is therefore likely that the lack of effects on perceptions can be explained by the explicit focus on a vegan dog food product, as people tend to have preconceived ideas about plant-based options (Acuff et al., 2021; Dodd et al., 2019).

Main Analyses

Given that the experimental manipulations did not affect perceptions in the intended way, we focused on both the manipulation effects as well as product perceptions of sustainability, health, and animal suffering as independent variables in our analyses. ANOVAs were conducted to examine product attitude and product interest, which controlled for the impact of personal diet (vegan/vegetarian, meat and/or fish included in diet), dogs' medical restrictions (restrictions, no restrictions), and the participant's age and gender.

Product Attitude

In line with the manipulation check findings, no effect was observed from the manipulation itself, $p = .87$. However, perceived health benefits did promote more positive product attitudes, $F(1, 176) = 239.07, p < .001$, partial $\eta^2 = .58$. The perceived sustainability of the product also had an impact on product attitudes, $F(1, 176) = 18.02, p < .001$, partial $\eta^2 = .09$. Higher sustainability

perceptions were associated with more positive product attitudes. No significant effect was found of animal welfare perceptions, $p = .16$. Additionally, product attitude was significantly predicted by caregivers' personal diet, $F(1, 176) = 9.62$, $p = .002$, partial $\eta^2 = .05$. Caregivers who ate and/or fish were more negative about the product ($M = 3.52$, $SD = 1.37$) than caregivers who did not ($M = 4.73$, $SD = 1.44$). None of the other effects were significant, all $ps > .30$.

Product Interest

The manipulation did not impact product interest, $p = .46$. In line with Studies 1 and 2, product interest was driven by perceptions of health benefits, $F(1, 176) = 162.08$, $p < .001$, partial $\eta^2 = .48$. No effects of perceived environmental benefits, $p = .18$, or animal welfare were found, $p = .40$. Furthermore, caregiver diet influenced product interest, $F(1, 176) = 19.77$, $p < .001$, partial $\eta^2 = .10$. Product interest was higher among caregivers who did not consume meat or fish ($M = 4.24$, $SD = 1.86$) than among caregivers who did ($M = 2.64$, $SD = 1.55$). Other effects were not significant, all $ps > .23$.

Discussion

In contrast to Study 2, Study 3 revealed that including information about the potential benefits of a plant-based dog food product was not effective in changing people's product perceptions. People might thus have preconceived ideas about vegan products that are difficult to alter through brief product statements. However, when examining consumers' perceptions of the health, environmental, and animal welfare benefits of the product – rather than the communicated benefits – Study 3 largely supported the findings of Studies 1 and 2. Health perceptions functioned as the main determinant of product attitudes. However, positive attitudes toward plant-based dog food products were also promoted if participants perceived the product as a sustainable option. Nevertheless, product interest was driven by health perceptions, not sustainability perceptions. Thus, it appeared that caregivers appreciated the lower environmental impacts that a plant-based dog food product would bring, but the motivation to actually adopt such a product depended on whether it promoted positive health outcomes for the dog.

General Discussion

Three studies offered support for our central hypothesis that perceived health outcomes would be a stronger determinant of interest in dog food products

than environmental impact. Study 1 showed that only perceptions of the provided nutrition influenced whether caregivers were interested in plant-based dog food products. Studies 2 and 3 aimed to replicate and expand these findings by examining whether offering information about a food product's benefits could change caregivers' responses. Study 2 revealed that when a "traditional" brand with animal-based protein was presented, only the inclusion of a message about health benefits promoted more positive product evaluations than a neutral message.

While product messages could alter caregivers' responses to a traditional product, Study 3 showed that the inclusion of a message about the benefits of a plant-based product had a limited impact on caregivers' perceived product benefits. However, findings on caregivers' perceptions of product benefits did align with the findings of Studies 1 and 2, as product interest was impacted by health perceptions, and not by perceptions of sustainability or animal welfare. Yet product attitudes were promoted by health perceptions and by sustainability perceptions. Together, these studies consistently showed that despite the negative environmental impact of animal-based protein, health considerations appear to be key in companion animal diet decision-making.

Our findings suggest that people worry about jeopardizing the health of their companion animals by altering the protein sources in their diets. As such, perceptions of the product's offered health benefits appear to represent the main obstacle for caregivers to select plant-based food products. Research on plant-based companion animals' food showed that such concerns are indeed valid to a certain extent, as most foods did not meet the recommended levels for one or more nutrients (Kanakubo et al., 2015; Zafalon et al., 2020). However, diets with very high meat content can also lead to health issues (Deng & Swanson, 2015). Although the reliance on the latter diet can also lead to enhanced environmental harm, our findings indicate that companion animal health is the primary factor that needs addressing for caregivers to re-evaluate their decisions regarding their companion animals' diets.

Limitations and Future Directions

Several limitations of this research need to be acknowledged. In Studies 2 and 3, we examined the effects of brand messages. While our research offers insights into caregivers' motivations and obstacles in considering sustainable food options for companion animals, our findings are mostly directly applicable to marketing efforts. It should be noted that consumers can be skeptical of product claims that companies communicate, as providing optimistic information about product benefits contributes to the self-interest of companies (Yoon et al., 2006). It would be valuable to examine whether an independent source providing general information about environmental and health

outcomes of products could lead to different results. Furthermore, in all three studies, female participants were overrepresented in our samples.

No direct comparisons were made in the ratio between animal and plant protein in food products. It is possible that people might be open to try products that contain lower levels of animal protein to offer a well-balanced diet to their dogs, rather than selecting a product that contains no animal protein. Such a shift could already contribute to a reduction in greenhouse gas emissions. The effects of the stated product benefits could also differ based on the ratio between animal and plant protein. Given that high levels of meat are associated with enhanced health in companion animals' diets (Okin, 2017; Winter, 2019), promoting health benefits for a plant-based product might be perceived as incongruent. Finally, we found no effect of caregivers' anthropomorphizing tendencies on our findings. It is possible that the effect of anthropomorphism on caregivers' dietary decisions depends also on the motivations underlying those decisions, which were not assessed. For example, caregivers who aim to avoid meat consumption for environmental reasons might be more interested in a plant-based dog food product than caregivers who avoid meat for health reasons.

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References

- AAFCO (2014). *AAFCO methods for substantiating nutritional adequacy of dog and cat foods*. https://www.aafco.org/Portals/0/SiteContent/Regulatory/Committees/Pet-Food/Reports/Pet_Food_Report_2013_Midyear-Proposed_Revisions_to_AAFCO_Nutrient_Profiles.pdf.
- Acuff, H. L., Dainton, A. N., Dhakal, J., Kiprotich, S., & Aldrich, G. (2021). Sustainability and pet food: Is there a role for veterinarians? *Veterinary Clinics: Small Animal Practice*, 51(3), 563–581. <https://doi.org/10.1016/j.cvsm.2021.01.010>.
- Arisal, I., & Atalar, T. (2016). The exploring relationships between environmental concern, collectivism and ecological purchase intention. *Procedia-Social and Behavioral Sciences*, 235, 514–521. <https://doi.org/10.1016/j.sbspro.2016.11.063>.

- Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology*, 22(5), 453–474. [https://doi.org/10.1016/0022-1031\(86\)90045-4](https://doi.org/10.1016/0022-1031(86)90045-4).
- Alexander, P., Berri, A., Moran, D., Reay, D., & Rounsevell, M. D. A. (2020). The global environmental paw print of pet food. *Global Environmental Change*, 65, 102153. <https://doi.org/10.1016/j.gloenvcha.2020.102153>.
- Allen, K., Blascovich, J., & Mendes, W. B. (2002). Cardiovascular reactivity and the presence of pets, friends, and spouses: The truth about cats and dogs. *Psychosomatic Medicine*, 64(5), 727–739. <https://doi.org/10.1097/01.psy.0000024236.11538.41>.
- Aydin, N., Krueger, J. I., Fischer, J., Hahn, D., Kastenmüller, A., Frey, D., & Fischer, P. (2012). “Man’s best friend”: How the presence of a dog reduces mental distress after social exclusion. *Journal of Experimental Social Psychology*, 48(1), 446–449. <https://doi.org/10.1016/j.jesp.2011.09.011>.
- Buff, P. R., Carter, R. A., Bauer, J. E., & Kersey, J. H. (2014). Natural pet food: A review of natural diets and their impact on canine and feline physiology. *Journal of Animal Science*, 92(9), 3781–3791. <https://doi.org/10.2527/jas.2014-7789>.
- Carfora, V., Caso, D., Sparks, P., & Conner, M. (2017). Moderating effects of pro-environmental self-identity on pro-environmental intentions and behaviours: A multi-behaviour study. *Journal of Environmental Psychology*, 53, 92–99. <https://doi.org/10.1016/j.jenvp.2017.07.001>.
- Cerri, J., Testa, F., & Rizzi, F. (2018). The more I care, the less I will listen to you: How information, environmental concern and ethical production influence consumers’ attitudes and the purchasing of sustainable products. *Journal of Cleaner Production*, 175, 343–353. <https://doi.org/10.1016/j.jclepro.2017.12.054>.
- Cheah, I., Shimul, A. S., Liang, J., & Phau, I. (2020). Drivers and barriers toward reducing meat consumption. *Appetite*, 149, 104636. <https://doi.org/10.1016/j.appet.2020.104636>.
- Conway, D. M. P., & Saker, K. E. (2018). Consumer attitude toward the environmental sustainability of grain-free pet foods. *Frontiers in Veterinary Science*, 5, 170. <https://doi.org/10.3389/fvets.2018.00170>.
- Cornish, A. R., Ashton, B., Raubenheimer, D., & McGreevy, P. D. (2019). Australian consumers’ knowledge and concern for animal welfare in food production: Influences on purchasing intentions. *Society & Animals*, 30(1), 23–50. <https://doi.org/10.1163/15685306-12341601>.
- De Boer, J., Schösler, H., & Aiking, H. (2017). Towards a reduced meat diet: Mindset and motivation of young vegetarians, low, medium and high meat-eaters. *Appetite*, 113, 387–397. <https://doi.org/10.1016/j.appet.2017.03.007>.
- Deng, P., & Swanson, K. S. (2015). Companion animals symposium: Future aspects and perceptions of companion animal nutrition and sustainability. *Journal of Animal Science*, 93(3), 823–834. <https://doi.org/10.2527/jas.2014-8520>.

- De Silva, S. S., & Turchini, G. M. (2008). Towards understanding the impacts of the pet food industry on world fish and seafood supplies. *Journal of Agricultural and Environmental Ethics*, 21(5), 459–467. <https://doi.org/10.1007/s10806-008-9109-6>.
- De Vaan, J. M., Van Steen, T., & Müller, B. C. N. (2019). Meat on the menu? How the menu structure can stimulate vegetarian choices in restaurants. *Journal of Applied Social Psychology*, 49(12), 755–766. <https://doi.org/10.1111/jasp.12632>.
- Dodd, S. A. S., Cave, N. J., Adolphe, J. L., Shoveller, A. K., & Verbrugghe, A. (2019). Plant-based (vegan) diets for pets: A survey of pet owner attitudes and feeding practices. *PLoS ONE*, 14, e0210806. <https://doi.org/10.1371/journal.pone.0210806>.
- Epley, N., Akalis, S., Waytz, A., & Cacioppo, J. T. (2008). Creating social connection through inferential reproduction: Loneliness and perceived agency in gadgets, gods, and greyhounds. *Psychological Science*, 19(2), 114–120. <https://doi.org/10.1111/j.1467-9280.2008.02056.x>.
- FEDIAF. (2020). *Facts & figures 2020: European overview*. https://fediaf.org/images/FEDIAF_Facts_and_Figures_2020.pdf.
- IPCC. (2019). *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Cambridge University Press.
- IPCC. (2022). *Climate change 2022: Impacts, adaptation, and vulnerability*. Cambridge University Press.
- Janssen, M., Busch, C., Rödiger, M., & Hamm, U. (2016). Motives of consumers following a vegan diet and their attitudes towards animal agriculture. *Appetite*, 105, 643–651. <https://doi.org/10.1016/j.appet.2016.06.039>.
- Jeseviciute-Ufartiene, L. (2019). Consumer involvement in the purchasing process: Consciousness of the choice. *Economics and Culture*, 16(1), 126–135. <https://doi.org/10.2478/jec-2019-0014>.
- Kanakubo, K., Fascetti, A. J., & Larsen, J. A. (2015). Assessment of protein and amino acid concentrations and labeling adequacy of commercial vegetarian diets formulated for dogs and cats. *Journal of the American Veterinary Medical Association*, 247(4), 385–392. <https://doi.org/10.2460/javma.247.4.385>.
- McConnell, A. R., Brown, C. M., Shoda, T. M., Stayton, L. E., & Martin, C. E. (2011). Friends with benefits: On the positive consequences of pet ownership. *Journal of Personality and Social Psychology*, 101, 1239–1252. <https://doi.org/10.1037/a0024506>.
- Moser, S. C. (2016). Reflections on climate change communication research and practice in the second decade of the 21st century: What more is there to say? *Wiley Interdisciplinary Reviews: Climate Change*, 7, 345–369. <https://doi.org/10.1002/wcc.403>.
- Neff, R. A., Edwards, D., Palmer, A., Ramsing, R., Righter, A., & Wolfson, J. (2018). Reducing meat consumption in the USA: A nationally representative survey of attitudes and behaviours. *Public Health Nutrition*, 21, 1835–1844. <https://doi.org/10.1017/S1368980017004190>.

- Okin, G. S. (2017). Environmental impacts of food consumption by dogs and cats. *PloS ONE*, 12, e0181301. <https://doi.org/10.1371/journal.pone.0181301>.
- Rosenfeld, D. L. (2018). The psychology of vegetarianism: Recent advances and future directions. *Appetite*, 131, 125–138. <https://doi.org/10.1016/j.appet.2018.09.011>.
- Sabaté, J., Sranacharoenpong, K., Harwatt, H., Wien, M., & Soret, S. (2015). The environmental cost of protein food choices. *Public Health Nutrition*, 18, 2067–2073. <https://doi.org/10.1017/S1368980014002377>.
- Schanes, K., Giljum, S., & Hertwich, E. (2016). Low carbon lifestyles: A framework to structure consumption strategies and options to reduce carbon footprints. *Journal of Cleaner Production*, 139, 1033–1043. <https://doi.org/10.1016/j.jclepro.2016.08.154>.
- Schiermeier, Q. (2019). Eat less meat: UN climate-change report calls for change to human diet. *Nature*, 572, 291–292. <https://doi.org/10.1038/d41586-019-02409-7>.
- Schreiner, P. J. (2016). Emerging cardiovascular risk research: Impacts of pets on cardiovascular risk prevention. *Current Cardiovascular Risk Reports*, 10, 1–8. <https://doi.org/10.1007/s12170-016-0489-2>.
- Sevillano, V., & Fiske, S. T. (2016). Warmth and competence in animals. *Journal of Applied Social Psychology*, 46(5), 276–293. <https://doi.org/10.1111/jasp.12361>.
- Smith, E., Seger, C., & Mackie, D. (2007). Can emotions be truly group level? Evidence regarding four conceptual criteria. *Journal of Personality and Social Psychology*, 93, 431–446. <https://doi.org/10.1037/0022-3514.93.3.431>.
- Sparks, P., Guthrie, C. A., & Shepherd, R. (1997). The dimensional structure of the perceived behavioral control construct. *Journal of Applied Social Psychology*, 27(5), 418–438. <https://doi.org/10.1111/j.1559-1816.1997.tb00639.x>.
- Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with “green consumerism.” *Social Psychology Quarterly*, 55, 388–399. <https://doi.org/10.2307/2786955>.
- Swanson, K. S., Carter, R. A., Yount, T. P., Aretz, J., & Buff, P. R. (2013). Nutritional sustainability of pet foods. *Advances in Nutrition*, 4, 141–150. <https://doi.org/10.3945/an.112.003335>.
- Van der Werff, E., Steg, L., & Keizer, K. (2014). I am what I am, by looking past the present: The influence of biospheric values and past behavior on environmental self-identity. *Environment and Behavior*, 46, 626–657. <https://doi.org/10.1177/001391651247520>.
- Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30, 305–314. <https://doi.org/10.1016/j.jenvp.2010.01.003>.
- Winter, K. (2019). As the raw diet increases in popularity, how can the veterinary nurse educate the public? *Veterinary Nursing Journal*, 34, 178–180. <https://doi.org/10.1080/17415349.2019.1613203>.

- Yoon, Y., Gürhan-Canli, Z., & Schwarz, N. (2006). The effect of Corporate Social Responsibility (CSR) activities on companies with bad reputations. *Journal of Consumer Psychology*, 16, 377–390. https://doi.org/10.1207/s15327663jcp1604_9.
- Young, J., Pritchard, R., Nottle, C., & Banwell, H. (2020). Pets, touch, and COVID-19: Health benefits from non-human touch through times of stress. *Journal of Behavioral Economics for Policy*, 4, 25–33. <https://sabeconomics.org/wordpress/wp-content/uploads/JBEP-4-S2-3.pdf>.
- Zafalon, R. V. A., Risolia, L. W., Vendramini, T. H. A., Rodrigues, R. B. A., Pedrinelli, V. Teixeira, F. A., Rentas, M. F., Perini, M. P., Alvarenga, I. C., & Brunetto, M. A. (2020). Nutritional inadequacies in commercial vegan foods for dogs and cats. *PLoS ONE*, 15, e0227046. <https://doi.org/10.1371/journal.pone.0227046>.