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## Don't mind milk? The role of animal suffering, speciesism, and guilt in the denial of mind and moral status of dairy cows

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### ABSTRACT

Reminding meat-eaters that animals are being harmed for meat production, elicits psychological tension about meat consumption. Individuals deal with this tension by either reducing or stopping meat consumption or by denying the mind of food animals, thereby lowering the moral status of animals. It is currently unclear whether similar reactions occur when considering dairy consumption. In a preregistered experiment ( $N = 345$  animal product consumers), we manipulated perceived harm levels inflicted upon dairy cows (higher versus lower) to investigate people's use of dairy-related cognitive dissonance reduction strategies. Participants in the high (vs low) harm condition felt more guilty which in turn, was associated with a) lower mind attribution and moral concern for the cow and b) greater intentions to reduce or stop dairy consumption. These effects were especially pronounced for participants higher in speciesism, while among those lower in speciesism, the effects were weaker (on guilt and intentions to change dairy consumption) or non-significant (on mind attribution, moral concern). The findings demonstrate that increased awareness of animal harm in dairy farms, elicits guilt and dissonance reduction reactions similar to meat-related dissonance reactions. Evidence of dairy-related cognitive dissonance highlights the need for a greater research focus on the consumption of animal products other than meat.

*“Often, the greater our ignorance about something, the greater our resistance to change.” (Marc Bekoff, 2007, Animals Matter, p 166)*

### 1. Introduction

People experience moral conflicts regularly and one of the most salient examples concerns people's relationships with other animals (Dhont & Hodson, 2020). While most people claim to love animals, they may also engage in activities or consume products that involve the exploitation of animals (e.g., in food, cosmetics, clothes, and zoos) (Dhont & Hodson, 2020; Herzog, 2010; Loughnan & Davies, 2020). Some animals, however, are treated better than others. People distinguish between different animal categories such as companion animals (e.g., cats and dogs) and farm animals (e.g., pigs, cows, and chickens), and attribute different moral value to them which has implications for

how they are then treated (Dhont et al., 2020; Herzog, 2010; Joy, 2011; Leite et al., 2019). For example, many people consider companion animals as part of their family and form strong bonds with them, showing them affection and care (Bastian & Loughnan, 2017; Dhont & Hodson, 2020; Joy, 2011). However, many of these people still eat farm animals, which are considered less sentient and unworthy of being treated with the same level of care and respect as companion animals (Bastian & Loughnan, 2017; Dhont & Hodson, 2020; Joy, 2011; Leach et al., 2023a). This moral inconsistency and differential treatment of animals has been referred to as speciesism which is the ideological belief in human superiority over animals and the belief that some animals are more worthy of moral concern than others (Caviola et al., 2019; Dhont et al., 2020; Leach et al., 2023a; Leite et al., 2019).

A specific example of this moral conflict is illustrated by the 'meat paradox' where people claim to care about animals yet eat them

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(Loughnan et al., 2014; Loughnan & Davies, 2020; Piazza, 2020). The treatment of animals in factory farm settings, especially in the meat industry (e.g., animals are being shot, suffocated and/or electrocuted), has been widely criticized (Deckers, 2016; Francione, 2021), and is often at the centre of public debate (e.g., Foer & Gross, 2020; Levit, 2021). Research has indicated that when people are reminded that animals are being harmed for meat production, they experience psychological tension (i.e., cognitive dissonance) and guilt about meat consumption (Earle et al., 2019; Kunst & Hohle, 2016; Loughnan & Davies, 2020; Rothgerber, 2020). Only recently researchers have started to explore these processes in the context of the consumption of other animal products, including dairy (Ioannidou et al., 2023a, 2023b). Experimental research investigating dissonance reduction strategies in response to animal harm in the dairy industry is currently lacking. Would similar reactions occur when considering dairy consumption, given that the dairy industry also involves animal exploitation?

### 1.1. Meat production and consumption

Prominent philosophers have written extensively about the ethical problems associated with meat consumption and production (Francione, 2021; Regan, 2003; Singer, 2015). For instance, animals raised for meat consumption live on factory farms in confined spaces with no ability to move freely (Deckers, 2016; Dhont & Hodson, 2020; Foer, 2009). At the same time, the animals' basic rights such as access to clean water and food are often violated (Deckers, 2016; Kolbe, 2018). Moral concern about the welfare of animals is one of the most common reasons for reducing or stopping meat consumption, with other reasons including health and environmental concerns (Bastian & Amiot, 2020; Dhont & Ioannidou, 2021; Hopwood et al., 2020). People are likely to vary in the extent to which they care morally about animals and their treatment with those who hold stronger speciesist beliefs tending to express lower moral concern for animals and greater acceptance of using animals for human purposes including meat consumption (Dhont & Hodson, 2014; Dhont et al., 2020; Krings et al., 2021; Leite et al., 2019).

Yet, even the most passionate meat lover may experience feelings of guilt and discomfort when they are reminded or informed about the treatment of animals in the meat industry (Bastian et al., 2012; Bastian & Loughnan, 2017; Earle et al., 2019; Kunst & Hohle, 2016; Loughnan et al., 2014); dependent on the type of information provided (e.g., specific farming conditions) (Anderson & Barrett, 2016; Joy, 2011). A series of studies by Anderson and Barrett (2016) focused on how exposure to information, such as a photo and brief description of meat industry practices, influenced evaluation of meat. For example, when participants read that the meat was produced in a factory farm where animals were confined to concrete indoor pens, they evaluated the look, smell, and taste of meat as less pleasant than when they read that the meat came from a "humane farm", where animals could graze in outdoor pastures. Participants in the factory farm condition were also less likely to want to eat and pay for the meat compared to participants in the humane farm condition. These findings show that awareness of the living conditions of animals in the meat industry can influence meat-

eating experiences and behaviour (Anderson & Barrett, 2016).

More broadly, there is growing literature indicating that most people find standard factory farm practices morally troublesome (Bastian & Loughnan, 2017; Ladak & Anthis, 2021). Indeed, when making salient the suffering or killing of animals for meat, meat consumers typically feel uncomfortable with their meat-eating behaviour because of the inconsistency between their behaviour and their beliefs (e.g., 'I love animals, I don't want them to get harmed and yet I eat meat'). Scholars have argued that meat consumers want to reduce this cognitive dissonance, for instance, by reducing or stopping meat consumption and thereby changing their behaviour (or behavioural intentions) to be more consistent with their attitudes and beliefs (Loughnan et al., 2014; Loughnan & Davies, 2020; Rothgerber, 2020). Studies have shown that moral discomfort related to meat consumption (increased feelings of guilt) leads to decreased willingness to eat meat (Earle et al., 2019; Gunther et al., 2023; Kunst & Hohle, 2016). Alternatively, meat consumers can engage in psychological strategies that change their attitudes and beliefs in ways that make them feel more comfortable with their meat-eating behaviour (Loughnan & Davies, 2020; Rothgerber, 2020).

A common psychological strategy is to deny the cognitive capacities of animals and their ability to suffer (i.e., mind denial, e.g., Bastian et al., 2012), thereby adopting the belief that animals do not suffer or are not being harmed for meat production (Loughnan & Davies, 2020; Piazza, 2020; Rothgerber, 2020). This leads to lower moral concern for animals and greater acceptance of meat-eating behaviour (Bastian et al., 2012; Bastian & Loughnan, 2017; Leach et al., 2021; Loughnan & Davies, 2020). Several studies have demonstrated that categorising animals as a 'food animal' leads people to attribute lower mental capacities to these animals (Bastian et al., 2012) such as the perceived capacity to suffer, and in turn, to withdraw moral concern for them (Bratanova et al., 2011). Loughnan et al. (2010) provided direct evidence that eating meat reduced the perceived moral status of food animals through the denial of animal minds (e.g., sentience and the ability to suffer). Taken together, existing research shows that people can resolve the conflict between enjoying meat and caring about animals by engaging in mind denial and lowering the moral status of animals (Bastian & Loughnan, 2017; Loughnan & Davies, 2020; Rothgerber, 2020).

### 1.2. Dairy production and consumption

To date, the dominant research focus in this area has been on the psychology of meat consumption and animal suffering in the meat industry, restricting scientific knowledge to a single animal product (Ioannidou et al., 2023a). Yet dairy consumption is common and widespread, and the dairy industry is also characterised by animal suffering and harm (Francione, 2021; Kolbe, 2018). Standard practices in the dairy industry include forcibly impregnating cows, separating calves from their mother cow within days after they are born, and severely restricting the cows' ability to move and exercise (Deckers, 2016; Kolbe, 2018; Taylor & Fraser, 2019). Such living conditions result in increased risk of several health problems (bacterial infections, inflamed and painful udders, injuries to joints and knees, lameness)

(Algers et al., 2009; Barkema et al., 1992; Hussain, 2023; Washburn et al., 2002; White et al., 2002), and have emotional implications (e.g., extreme anxiety) because both the cow and the calf cannot engage in natural behaviours, including social behaviours (Bohanec & Bohanec, 2013; Kolbe, 2018).

Some scholars have argued that greater harm is inflicted upon animals in the dairy industry than in the meat industry (Kolbe, 2018; Mandel et al., 2022). For instance, recent survey results from a sample of animal welfare experts indicated that cows in common dairy production systems experience worse welfare than cows in common beef production systems (Mandel et al., 2022). At the same time, perceptions of the dairy industry have received less research attention compared to perceptions of the meat industry (Faunalytics, 2018). One possible reason for this could be because some dairy companies make dairy production appear more “humane” (or appear less harmful), by allowing cows to go outdoors, to exercise, and to eat grass, and thus resulting in slight improvements in the cows’ living conditions, yet without changing the dairy production practices themselves (The Humane League, 2021; Peta, 2021). Unlike meat consumption, dairy consumption is not directly linked to the killing of an animal and there is the common belief that cows are meant to produce milk for human consumption (Francione, 2021; Kolbe, 2018). For these reasons, people may perceive dairy consumption as more morally acceptable and less harmful as compared to meat consumption, and therefore experience less cognitive dissonance, particularly if it appears that efforts are being made to minimize harm (Deckers, 2016; Francione, 2021). On the other hand, recent findings indicate that dairy and egg consumers, including vegetarians and pescatarians, tend to deny the suffering of animals in the dairy and egg industry (Ioannidou et al., 2023b). Such findings suggest that cognitive dissonance strategies are not only used in the context of meat consumption but also in the context of the consumption of other animal products, including dairy products. Only few studies have investigated public beliefs and reactions to harmful practices in the dairy industry and the implications for dairy consumption (e.g., Ioannidou et al., 2023a, 2023b). The current research is novel in that it investigates whether similar psychological processes linked to meat-related cognitive dissonance are also involved with respect to dairy consumption.

### 1.3. Aims and objectives

The aim of this study was to establish whether information on dairy farming methods had the potential to change peoples’ thoughts about dairy product consumption. The objective was to investigate people’s use of dairy-related cognitive dissonance reducing strategies after being informed (or not) about the harm being inflicted upon animals in the dairy industry. Specifically, we manipulated perceptions of dairy farming practices and associated harm levels by exposing participants to information about farming practices on either a) a conventional farm where cows live in a very confined environment leading to increased risk of significant health problems (*conventional farming condition, high perceived harm*), or b) an organic farm where cows live in a spacious environment, leading to decreased risks of significant health problems

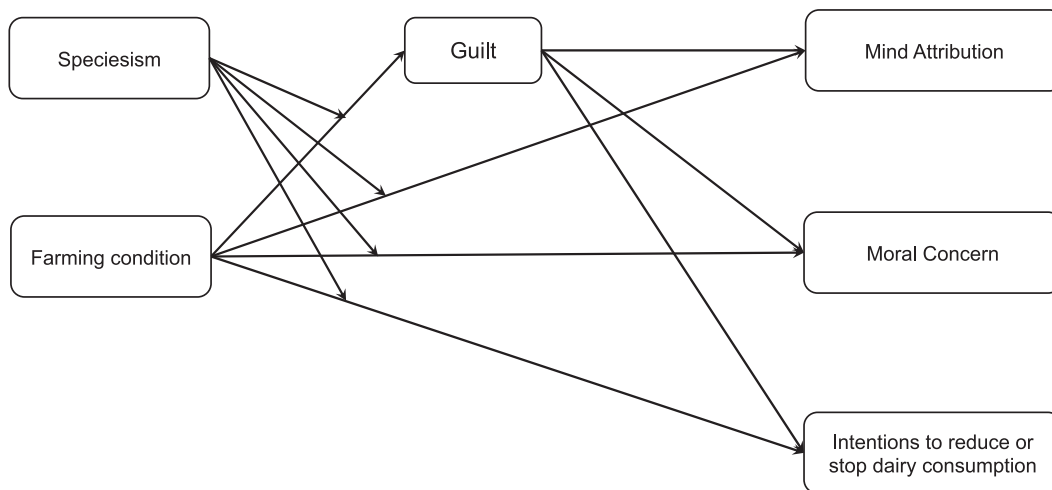
(*organic farming condition, low perceived harm*). We were interested in whether the two conditions would elicit different reactions in terms of participants’ feelings of guilt about dairy consumption, attributions of mental abilities to dairy cows (mind attribution), moral concern for the animals involved and intentions to change dairy consumption.

Given the more harmful practices in the conventional dairy industry compared to organic dairy farms, we expected that making people more aware of these practices would lead to feelings of guilt, which in turn, could lead to two possible reactions: a) denial that dairy cows possess mental abilities such as experiencing pain, fear, pleasure and suffering and lowering their moral status (i.e., changing beliefs or attitudes) or b) less willingness to consume dairy products and greater intentions to stop consuming them altogether (i.e., changing behaviour). We also tested whether reactions of dairy-related cognitive dissonance depend on levels of speciesism. Those high on speciesism have been shown to care less about animals and find harming animals less problematic because they consider animals as inferior to humans and means to human ends (Dhont et al., 2020). Therefore, they may be less sensitive to differences in living conditions and animal suffering between different types of farming conditions. For this reason, those higher on speciesism may feel limited guilt feelings and dairy-related cognitive dissonance when being informed about harmful practices in the conventional farming condition compared to the organic farming condition. On the other hand, those low on speciesism find harming animals morally problematic and perceive animals as more equal to humans. Therefore, they may be particularly sensitive to the living conditions and suffering of cows, resulting in particularly strong guilt feelings and reactions of dairy-related cognitive dissonance when being informed about animal harm in the conventional farming condition compared to the organic farming condition. We tested the following preregistered hypotheses (Fig. 1) (<https://osf.io/85sdf>).

**Hypothesis 1.** *We expected that participants in the conventional farming condition would a) attribute less mind to the animal and would feel less morally obliged to show concern for the animal, compared to those in the organic farming condition or b) report greater intentions to reduce or stop dairy consumption compared to those in the organic farming condition.*

**Hypothesis 2.** *We expected that the effect of farming condition on mind attribution, moral concern, and behavioural intentions would be mediated by guilt. Two possible patterns could emerge, such that those in the conventional farming condition would feel more guilt compared to those in the organic farming condition, which in turn, would be a) associated with lower mind attribution (e.g., mental abilities such as experience of pain, fear, pleasure, and suffering), and lower moral concern, or b) greater intentions to reduce or stop dairy consumption.*

**Hypothesis 3.** *We hypothesised that the effect of farming condition would be moderated by participants’ levels of speciesism. Specifically, the effects of farming condition described above would be stronger for those lower in speciesism than for those higher in speciesism.*



**Fig. 1.** Conceptual model presenting the effect of farming condition on mind attribution, moral concern, and intentions to reduce or stop dairy consumption (Hypothesis 1), via guilt (Hypothesis 2), with speciesism as moderator (Hypothesis 3).

## 2. Method

All hypotheses were pre-registered prior to data collection and analysis. The pre-registration, materials, and data, can be accessed via the Open Science Framework (preregistration: <https://osf.io/85sdf>; project page: <https://osf.io/h5x8m/>).

### 2.1. Participants

#### 2.1.1. Sample size justification

We determined the target sample size using a pre-registered power analysis. We relied on the guidelines for required sample sizes to detect indirect effects provided by Fritz and MacKinnon (2007). Based on previous research on similar topics and using similar manipulations, we assumed a standardized coefficient of 0.26 for both the a-path and the b-path (and c' path) in the mediation model. Hence, our goal was to obtain 0.80 power to detect the expected effects (with  $\alpha = 0.05$ ). Using the Monte Carlo simulations for power analysis in R ("mc\_power\_med" shinyapp) (Schoemann et al., 2017), adopting a model with 1 mediator, the resulting sample size was  $N = 154$  ( $N_{\text{replications}} = 1000$ , draws per rep = 20000). To further account for the expected moderation effect of speciesism, we doubled the sample size following the recommendations on how to power interaction effects by Giner-Sorolla (2018), resulting in a minimum sample size of  $N = 308$  (154 in each condition). Because we anticipated that approximately 20 % of participants would fail the comprehension check criterium, we set the target sample size at  $N = 370$ .

#### 2.1.2. Sample

Of the 359 recruited participants, 14 failed the comprehension check criterium and were excluded,<sup>4</sup> resulting in a final sample size of 345 participants ( $M_{\text{age}} = 32.41$  years,  $SD_{\text{age}} = 9.24$  years), ranging from 18 to 70 years old (see Table 1 for full demographic information), which was above the minimum sample size determined via power analyses. Inclusion criteria were that participants were aged 18 years and older, had no diagnosis of dementia, no history of an eating disorder, or any clinically diagnosed mental health condition, and did not identify as "vegan" (i.e., given the focus on dairy consumption intentions). The study received ethical approval from the Chair of the Humanities, Social and Health Sciences Research Ethics Panel at the University of Bradford.

<sup>4</sup> As per preregistration, participants who failed two out of three comprehension checks were excluded.

**Table 1**  
Sample Demographics.

	n
Gender	
Women	245
Men	92
Non-binary	5
Prefer not to say	2
Other	1
Dietary Group	
Omnivores	151
Pescatarians	49
Vegetarians	83
Flexitarians	62
Ethnicity	
White	306
Mixed/Multiple	21
Black/African/Caribbean	14
Asian	3
Prefer not to say	1
Highest educational level	
Secondary school up to 16 years old	3
Higher/secondary/further education	57
College or university	114
Postgraduate degree	147
Doctoral degree	21
Prefer not to say	3

### 2.2. Materials

**Speciesist beliefs** were measured with the Human Supremacy Beliefs Scale (Dhont & Hodson, 2014), which consists of six items completed on 7-point Likert scales (1, *strongly disagree*; 7, *strongly agree*). A sample item was "The life of an animal is just not of equal value as the life of a human being". Items were averaged with higher scores indicating higher speciesism ( $\alpha = 0.93$ ).

**Experimental manipulation.** Participants were randomly allocated to one of two different farming conditions (conventional/high perceived harm vs organic/low perceived harm). They were then asked to read a text-based vignette that described the life of a cow on a dairy farm. Participants in both conditions read an identical section that described the life of a cow in dairy farming:

"A mother cow produces milk for the same reasons that humans do, which is to nurture their new-born calf. After nine months of pregnancy, a mother cow gives birth to her calf, which then will be taken away from

their mother within a day of their birth. From then on, the farmer operator will milk the cow two or more times a day using milking machines.”

For participants in the conventional farming condition, the text continued with information about a cow that does not have access to the outdoor area with increased health risk problems:

“Throughout her life the cow will be living in a confined environment and is expected to produce as much milk as possible. The cow will not have access to outdoor areas and will not be able to walk on grass and to move freely. Furthermore, the cow will not have the ability to exercise, to express their natural instincts and to socialise with other cows. According to several scientific studies, these conditions increase the risk of significant health problems including more bacterial infections, inflamed and painful udders, and higher frequency of injuries to the cow’s joints and knees. Cows that have no access to pasture are also significantly more likely to suffer from lameness, which refers to a variety of disorders or injuries in the foot or legs that typically cause intense pain, stress, and abnormalities in the way cows walk”.

For participants in the organic farming condition, the text continued with information about a cow that can spend time in outdoor areas and have decreased risk of health problems:

“Throughout her life the cow will be living in a spacious environment and is expected to produce milk. The cow will have access to outdoor areas and will be able to walk on grass and move freely. Furthermore, the cow will have the ability to exercise, to express their natural instincts and to socialise with other cows. According to several scientific studies, these conditions decrease the risk of significant health problems including less bacterial infections, reduced risk of inflamed and painful udders, and lower frequency of injuries to the cow’s joints and knees. Cows that have access to pasture are also significantly less likely to suffer from lameness, which refers to a variety of disorders or injuries in the foot or legs that typically cause intense pain, stress, and abnormalities in the way cows walk”.

**Comprehension checks.** Participants completed three comprehension check questions with multiple choice response options: To what industry did the scenario you just read refer to (options: meat, dairy, or fish); Does the cow have access to outdoor area? (options: yes or no); Does the calf stay with their mother more than 24 h? (options: yes or no).

**Manipulation check.** As a manipulation check to determine if perceived harm had been successfully manipulated, we asked participants: *To what extent do you think a cow suffers on the dairy farm described above?* and *To what extent do you think a cow is being harmed on the dairy farm described above?*, which had to be completed on 7-point Likert scales (1 = not at all; 7 = extremely), and averaged into a single score ( $\alpha = 0.99$ ).

**Guilt** over dairy consumption was assessed with three items based on measures of Piazza et al. (2015) and Earle et al. (2019), who focused on meat consumption. We adapted the items to focus on dairy consumption and to match the description of the cow used in the current experiment. Participants completed the items using a 7-point Likert scale (1 = not at all; 7 = extremely). A sample question was “*To what extent does the description of the cow’s life make you feel guilty about your typical dairy consumption?*”. Item scores were averaged with higher scores indicating

more guilt towards dairy consumption ( $\alpha = 0.98$ ).

**Mind Attribution** (Leach et al., 2023b). Participants rated on 7-point Likert scales (1 = not at all; 7 = very much) which of the following eight mental capabilities they believed that the cow (from the experiment) possesses (agency: thought, self-control, planning, remembering; experience: fear, pain, pleasure, suffering). Averaging the item scores separately for the agency and experience subscales showed that both subscales were strongly positively correlated ( $r = 0.75$ ,  $p < .001$ ) suggesting substantial conceptual overlap. Extracting a single factor using factor analysis showed high factor loading ranging from 0.58 to 0.89, explaining 62 % of the variance. The internal consistency reliability across all items was excellent ( $\alpha = 0.92$ ). For this reason, item scores were averaged into a single score with higher scores indicating that participants attributed more mental abilities to the cows (see also Leach et al., 2023b).

**Moral concern.** Based on previous research (e.g., Piazza et al., 2015), we assessed the extent to which participants believed that the cow described deserves moral consideration with three items, answered on a 7-point Likert scale (1 = Not at all; 7 = Extremely). An example item was “*To what extent do you think this animal deserves to be protected from harm?*”. Item scores were averaged with higher scores indicating that participants believed that cows deserve to be morally considered and protected from harm ( $\alpha = 0.94$ ).

**Dairy consumption intention.** To assess dairy consumption intentions, we adjusted items of Lentz et al.’s (2018), which focused on meat reduction willingness and intentions, and adapted them to ask about participants’ willingness and intentions to reduce (2 items) and to stop (2 items) of dairy consumption, totalling four items. An example item was: “*How willing would you be to consider reducing your dairy consumption in the near future?*”. Participants indicated their responses on a 7-point Likert scale (1, not at all; 7, extremely willing, for willingness; 1, do not intend at all; 7, fully intend, for intentions). Item scores were averaged with higher scores indicating that participants expressed greater willingness and intentions to reduce or stop their dairy consumption ( $\alpha = 0.93$ ).

### 2.3. Procedure

The study was advertised through several social media platforms (Facebook, Twitter) and then conducted online using Gorilla Experiment Builder (<https://gorilla.sc>). Before being able to start the study, participants provided informed consent. Participants were first asked to provide demographic information (gender, age, educational level, and ethnicity), to self-identify their dietary group (omnivore, pescatarian, vegetarian or flexitarian) and to state their personal motivation for their dietary preference in reply to an open-ended question. Following this, participants completed the human supremacy beliefs scale. Next, they were randomly assigned to either the conventional farming condition (high perceived harm) or the organic farming condition (low perceived harm), using the default randomiser provided on the Gorilla platform. Depending on condition assignment, participants were then asked to read one of the text-based vignettes about how cows are being treated in the dairy industry (conventional or organic), followed by three comprehension check questions, and two manipulation check questions.

Participants then completed the measures of guilt, mind attribution, moral concern, and dairy consumption intention. Upon completion, participants were thanked and debriefed. The study took approximately 15 min to complete.

#### 2.4. Design and analysis

This study adopted an experimental design with farming condition as the between-groups independent variable (conventional; organic), guilt as the mediator, and mind attribution, moral concern, and behavioural intention as dependent variables, and speciesism as a continuous moderator. To test for differences in reactions to the two conditions (**Hypothesis 1**), we conducted a Multivariate Analysis of Variance (MANOVA, in SPSS) with condition (conventional vs. organic farming) as the independent variable and scores on scales measuring mind attribution, moral concern, and behavioural intentions as the dependent variables.

To test for the mediating role of guilt (**Hypothesis 2**), we conducted mediation analyses using three linear regression models with Process for SPSS (Model 4; Hayes, 2022) with condition (conventional vs organic farming) as the independent variable, guilt as the mediator, and i) mind attribution, ii) moral concern, and iii) behavioural intentions as the dependent variables.<sup>5</sup> In a final set of analyses, we tested the moderation role of speciesism (**Hypothesis 3**). We ran three simple moderation models (Process, Model 1; Hayes, 2022) to test whether speciesism moderated the effect of farming condition on mind attribution, moral concern, and behavioural intentions. Next, we added guilt as the mediator in the moderation models, with speciesism as the moderator of the paths from farming condition (the independent variable) to guilt (the mediator) and from farming condition to each of the three dependent variables (moderated mediation in Process, Model 8; Hayes, 2022). To interpret significant interaction effects, we followed up with simple slope analyses to probe the effects of farming condition at higher (1 standard deviation above the mean;  $M + 1SD$ ) and lower (1 standard deviation below the mean;  $M - 1SD$ ) levels of speciesism (Aiken & West, 1991; Hayes, 2022).<sup>6</sup>

### 3. Results

#### 3.1. Manipulation check

First, we verified whether participants in the conventional farming condition perceived higher levels of harm for the cow compared to the organic farming condition. The results of a univariate ANOVA confirmed that the manipulation had been successful  $F(1,343) = 321.61, p < .001, \eta_p^2 = 0.48$ , with participants in the conventional farming condition perceiving higher levels of harm than participants in the organic farming condition (conventional:  $M = 6.62$  vs organic:  $M = 3.48$ ).

<sup>5</sup> The simple mediation and moderation models were not included in the preregistration. However, adding these models greatly help with the interpretation of the results and direct test of the hypotheses, before testing the full preregistered moderated mediation model. In the simple mediation models, speciesism was added as covariate to allow for comparing the results of the mediation models with the results of the moderation, and moderated mediation models.

<sup>6</sup> We also conducted an additional set of analyses to verify if the main findings still held after including demographic variables as controls. The results of these analyses are reported in the online supplement and showed that including these demographic variables in the main regression analyses did not meaningfully change the pattern of results.

**Table 2**

Means and Standard Deviations of Dependent Variables for Each Condition, and F-test Results.

	Conventional Farming		Organic Farming		F-test		
	M	SD	M	SD	F(1, 343)	p	$\eta_p^2$
Guilt	6.10	1.12	3.47	2.29	187.56	<0.001	0.354
Mind Attribution	4.02	1.88	4.91	1.07	28.49	<0.001	0.077
Moral Concern	5.14	2.16	5.92	1.08	17.31	<0.001	0.048
Behavioural Intention	4.63	1.59	3.22	2.21	46.75	<0.001	0.120

#### 3.2. Main results

##### 3.2.1. Differences between farming conditions (**Hypothesis 1**)

The results of the MANOVA testing **Hypothesis 1** showed a significant multivariate effect of the manipulation (farming condition) on guilt, mind attribution, moral concern, and behavioural intentions,  $F(4, 340) = 57.12, p < .001, \eta_p^2 = 0.40$ . As expected (**Hypothesis 1**; **Table 2**), the univariate test results showed that participants in the conventional farming condition felt significantly more guilty about their dairy consumption, attributed lower levels of mental capacities to the cow, showed lower moral concern for the cow, and reported greater intention to reduce or stop their dairy consumption than those in the organic farming condition.

##### 3.2.2. The mediating role of guilt (**Hypothesis 2**)

The results of the mediation analyses (**Fig. 2**) showed that the effect of farming condition on guilt was significant (in line with the MANOVA results). As expected (**Hypothesis 2**), higher guilt levels, in turn, were significantly associated with lower mind attribution, lower moral concern, and at the same time, also with greater intention to reduce or stop dairy consumption. Further confirming the mediating role of guilt, farming condition had a significant indirect effect on mind attribution ( $b = 0.33, 95\% \text{ CI } [0.23, 0.45]$ ), moral concern ( $b = 0.34, 95\% \text{ CI } [0.23, 0.46]$ ), and intentions to stop or reduce dairy consumption ( $b = 0.34, 95\% \text{ CI } [0.23, 0.46]$ ) via guilt.<sup>7</sup> In other words, the effect of farming condition on all three dependent variables was explained in part by higher levels of guilt in the conventional farming compared to the organic farming condition.

##### 3.2.3. The moderating role of speciesism (**Hypothesis 3**)

The results of the moderation analyses showed that the interaction effect between farming condition and speciesism was significant for each of the dependent variables (**Table 3**; **Fig. 3**). Simple slope analyses showed that, unexpectedly, participants higher (+1SD) on speciesism showed lower mind attribution (**Fig. 3a**) and lower moral concern (**Fig. 3b**) in the conventional farming condition compared to the organic farming condition. For those lower (-1SD) on speciesism, there was no significant effect of farming condition on mind attribution and moral concern (**Fig. 4**). Both participants with higher and those with lower levels of speciesism expressed greater intentions to reduce or stop dairy consumption in the conventional condition as compared to the organic farming condition (**Fig. 3c**). However, contrary to expectation, this effect was significantly stronger among those who were higher in speciesism as compared to those who were lower in speciesism (**Fig. 4**).

Finally, when including guilt as the mediator in the moderation models, the results showed that speciesism also significantly moderated

<sup>7</sup> An indirect effect is considered significant if the 95% CI does not include zero.

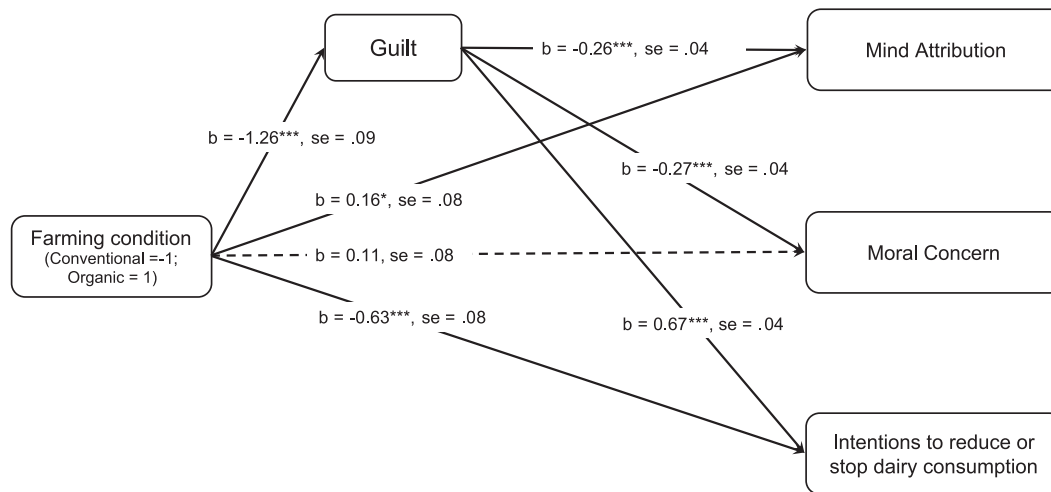


Fig. 2. Results of the Mediation Analyses Testing the Effect of Farming Condition on the Dependent Variables, via Guilt.

Table 3

Results of the Moderation Models Testing the Effects of Farming Condition and the Farming Condition X Speciesism Interaction on Mind Attribution, Moral Concern, and Behavioural Intentions to Reduce or Stop Dairy Consumption.

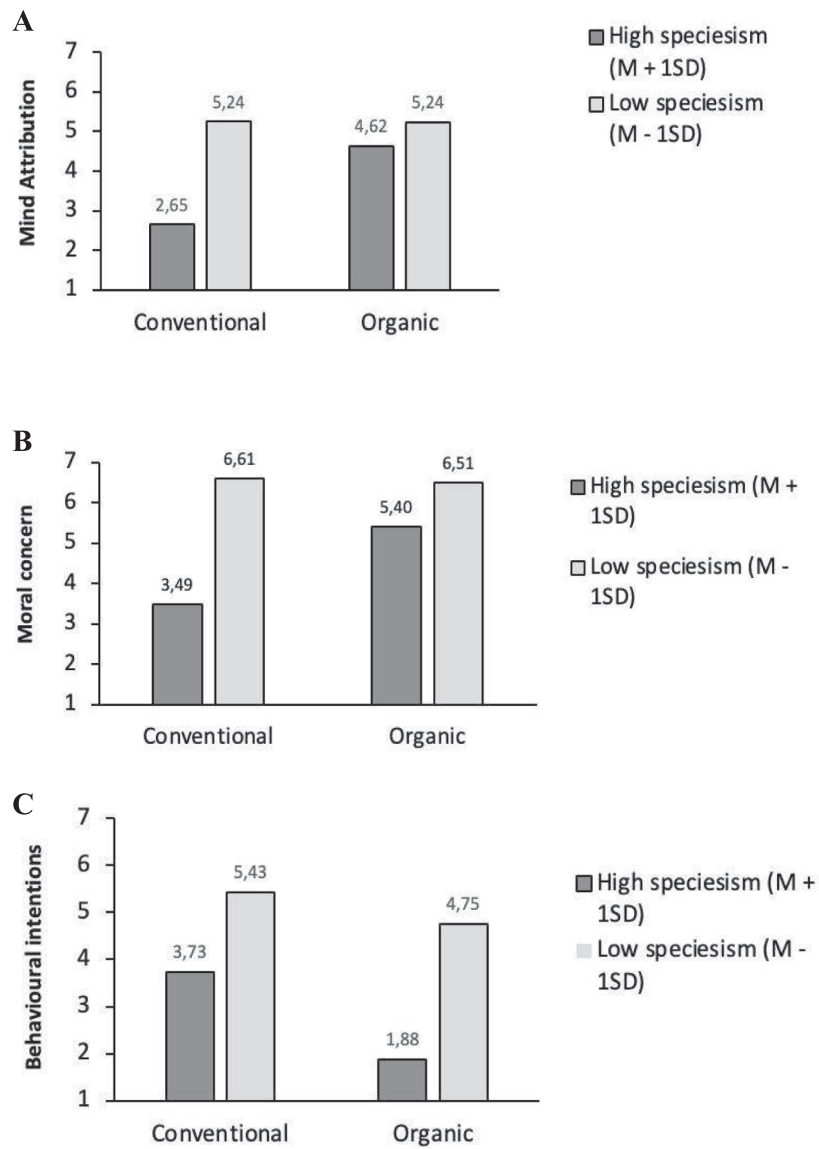
	Mind Attribution			Moral Concern			Behavioural intentions		
	<i>b</i> 95 %CI[LL,UL]	<i>t</i>	<i>p</i>	<i>b</i> 95 %CI[LL,UL]	<i>t</i>	<i>p</i>	<i>b</i> 95 %CI[LL,UL]	<i>t</i>	<i>p</i>
Farming condition	0.49 [0.36, 0.62]	7.68	< 0.001	0.45 [0.32, 0.58]	6.84	0.003	-0.63 [-0.79, -0.47]	-7.62	< 0.001
Speciesism	-0.49 [-0.57, -0.41]	-12.50	< 0.001	-0.66 [-0.74, -0.57]	-15.86	< 0.001	-0.71 [-0.81, -0.61]	-13.69	< 0.001
Condition X Speciesism	0.31 [0.23, 0.39]	7.64	< 0.001	0.31 [0.23, 0.39]	7.55	< 0.001	-0.18 [-0.28, 0.08]	-3.53	< 0.001

Note. Farming condition: conventional = -1 organic = 1.

the effect of farming condition on guilt (Table 4; Fig. 5). Specifically, both participants with higher and those with lower levels of speciesism felt significantly more guilty in the conventional condition as compared to organic farming condition, yet this effect was significantly stronger among those higher in speciesism than those lower in speciesism (Fig. 5).

The indirect effects of farming condition on each of the three outcome variables via guilt were also significantly moderated by speciesism (Table 4). Specifically, for all three outcome variables, the indirect effects of farming condition were significant for both participants with higher and those with lower speciesism levels, but were stronger for those higher on speciesism, compared to those lower in speciesism (Table 5). The direct effects of farming condition on the three dependent variables were also moderated by speciesism (Table 4;

Fig. 5). Taken together, the results confirmed that participants exposed to information conveying higher levels of harm (conventional farming condition) felt more guilty about their dairy consumption, which in turn was associated with both a) attributing less mind to the animal and feeling less morally obliged to show concern for the animal, and b) greater intentions to reduce or stop dairy consumption, compared to those exposed to the information depicting lower levels of harm (i.e., organic farming condition). Although higher speciesism was associated with lower levels of guilt, mind attribution, moral concern, and intention to reduce or stop dairy consumption, the moderation analyses showed, unexpectedly, that the effects of farming condition were stronger (instead of weaker), among those higher in speciesism compared to those lower in speciesism.



**Fig. 3.** Effect of Farming Condition on a) Mind Attribution, b) Moral Concern, and c) Intentions to Reduce or Stop Dairy Consumption (Behavioural Intention) at Higher (M + 1SD) and Lower (M - 1SD) Levels of Speciesism.



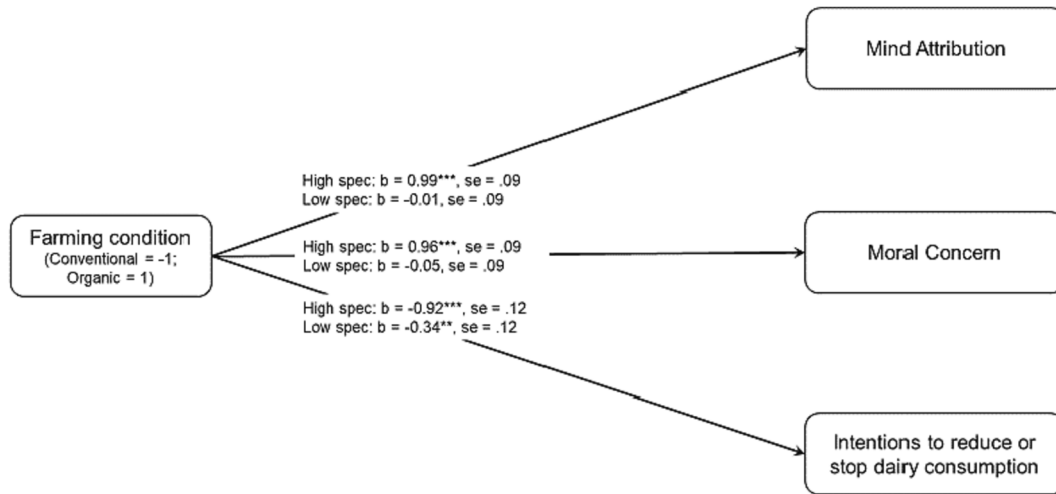


Fig. 4. Results of Simple Slope Analyses Showing the Effect of Farming Condition on the Dependent Variables at Higher (M + 1SD) and Lower (M -1SD) Levels of Speciesism.

Table 4

Results of the Moderated Mediation Analyses Testing the Effects of Farming Condition and the Farming Condition X Speciesism Interaction on Mind Attribution, Moral Concern, and Behavioural Intentions to Reduce or Stop Dairy Consumption, Mediated by Guilt.

	Guilt			Mind Attribution			Moral Concern			Behavioural intentions		
	<i>b</i> 95 %CI	<i>t</i>	<i>p</i>	<i>b</i> 95 %CI	<i>t</i>	<i>p</i>	<i>b</i> 95 %CI	<i>t</i>	<i>p</i>	<i>b</i> 95 %CI	<i>t</i>	<i>p</i>
Farming condition	-1.26 [-1.40, -1.11]	-16.80	< 0.001	0.31 [0.14, 0.48]	3.63	< 0.001	0.27 [0.09, 0.44]	3.02	0.003	0.34 [0.18, 0.50]	4.24	< 0.001
Speciesism	-0.55 [-0.64, -0.46]	-11.78	< 0.001	-0.58 [-0.67, -0.48]	-12.29	< 0.001	-0.74 [-0.83, -0.64]	-15.23	< 0.001	-0.28 [-0.37, -0.20]	-6.42	< 0.001
Condition x Speciesism	-0.49 [-0.58, -0.40]	-10.61	< 0.001	0.23 [0.14, 0.32]	5.14	< 0.001	0.24 [0.15, 0.33]	5.07	< 0.001	0.20 [0.12, 0.28]	4.69	< 0.001
Guilt				-0.15 [-0.23, -0.05]	-3.15	0.002	-0.15 [-0.24, -0.06]	-3.13	0.002	0.77 [0.69, 0.86]	17.99	< 0.001

Note. Farming condition: conventional = -1 organic = 1.

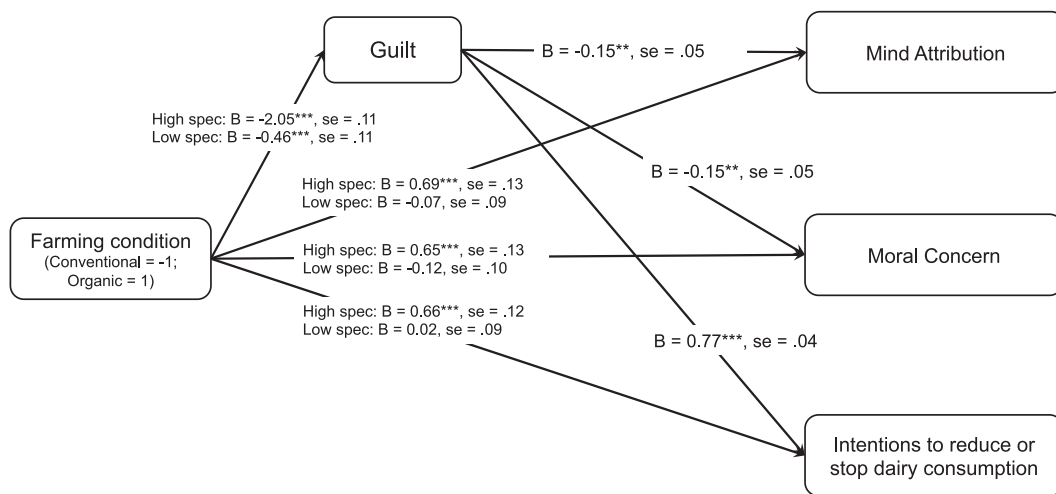


Fig. 5. Results of the Moderated-Mediation Analyses Testing the Effect of Farming Condition on the Dependent Variables at Higher (+1SD) and Lower (-1SD) Levels of Speciesism, Mediated via Guilt.

**Table 5**

Results of the Conditional Indirect Effect Analyses, Estimating the Indirect Effect of Farming Condition on Each DV at Higher ( $M + 1SD$ ) and Lower ( $M - 1SD$ ) Levels of Speciesism, via Guilt.

	Moderated Mediation Index		Indirect effect at low speciesism		Indirect effect at high speciesism	
	<i>b</i>	95 %CI	<i>b</i>	95 %CI	<i>b</i>	95 %CI
Mind Attribution	0.07	[0.03; 0.12]	0.07	[0.023; 0.125]	0.30	[0.13; 0.48]
Moral Concern	0.07	[0.03; 0.12]	0.07	[0.026; 0.125]	0.30	[0.13; 0.50]
Behavioural Intention	-0.38	[-0.46; -0.31]	-0.35	[-0.531; -0.185]	-1.59	[-1.82; -1.37]

Note. An indirect effect is considered significant if the 95 % CI does not include zero.

#### 4. Discussion

We investigated people's use of dissonance reduction strategies after informing them about the harm levels associated with different farming conditions in the dairy industry. Supporting Hypothesis 1a, participants in the conventional farming condition—who were informed about high levels of harm inflicted upon dairy cows—attributed less mind (sentience and intelligence) to the cow and expressed lower moral concern for the cow than participants in the organic farming condition—who were informed about lower levels of harm. At the same time, in line with Hypothesis 1b, participants in the conventional farming condition also reported greater intention to reduce or stop dairy consumption compared to those in the organic farming condition.

**Hypothesis 2**—that the effect of farming condition on mind attribution, moral concern, and behavioural intentions to reduce or stop dairy consumption would be mediated by guilt—was also supported. Being informed about conventional farming practices made participants feel more guilty about their dairy consumption compared to being informed about organic farming practices. Higher guilt feelings were, in turn, associated with lower mind attribution and lower moral concern. These findings indicate that awareness of animal harm in the dairy industry induces dissonance feelings (guilt) as it conflicts with people's concern for animal welfare. To reduce this negative state of dissonance, people appear to deny mind to dairy cows, denying them agency and ability to suffer, such that they do not need to feel morally concerned about the cow. This is consistent with our theoretical rationale that mind denial and decreased moral concern for animals help people to feel better about their dairy consumption despite knowing the harm being done to animals (see also Ioannidou et al., 2023a). At the same time, higher feelings of guilt were also associated with greater intentions to reduce and/or stop dairy consumption. This finding suggests that consumers may show different reactions to dairy-related dissonance feelings, by either changing beliefs in ways that facilitate the continuation of dairy consumption, or by expressing a greater willingness to reduce and stop dairy consumption.

These findings show parallels with research on meat consumption that has demonstrated that reminders of animal harm make meat eaters feel conflicted about their meat consumption, which can elicit different reactions (Earle et al., 2019; Kunst & Hohle, 2016; Loughnan & Davies, 2020). That is, to resolve the meat-related dissonance (meat paradox), meat eaters may engage in mind denial and lower their perceived moral status of animals, which helps make them feel more comfortable about their meat-eating behaviour (Bastian et al., 2012; Loughnan & Davies, 2020; Rothgerber, 2020). On the other hand, meat eaters may also express a greater willingness to consume less meat and more plant-based alternatives (Earle et al., 2019; Gunther et al., 2023; Kunst & Hohle, 2016). By showing similar patterns for dairy-related cognitive dissonance, our findings extend previous research and highlight that the theoretical scope of the meat paradox (Loughnan & Davies, 2020; Rothgerber, 2020) is not restricted to just meat consumption, but also

applies to dairy consumption, and plausibly, to the consumption of a range of animal products (see Ioannidou et al., 2023a; 2023b).

Rooted in the speciesist belief of human superiority over other animals, some people find animal exploitation for human benefits more morally acceptable than others (Caviola et al., 2019; Dhont & Hodson, 2014; Dhont et al., 2020). For this reason, we expected that those higher on speciesism would show weaker reactions when being made aware of animal harm. However, contrary to our prediction (**Hypothesis 3**), those higher on speciesism showed a stronger reaction to the manipulation compared to those lower on speciesism. That is, among those higher on speciesism, being made aware of the high levels of harm in conventional dairy farming (vs. organic farming), led to pronounced reactions in terms of increased guilt, and greater use of dissonance reduction strategies, including lower mind attribution and moral concern, and stronger intentions to change dairy consumption. In other words, despite being more accepting of animal harm in principle, those higher in speciesism are clearly reactive to perceived animal harm. This finding is important in identifying intervention strategies that aim to reduce animal product consumption. Theoretically, holding strong speciesist beliefs could be considered a cognitive barrier that prevents such interventions to have a meaningful impact, with higher speciesism also being associated with higher animal product consumption (e.g., Dhont & Hodson, 2014; Rosenfeld, 2019). Arguably, interventions would lose part of their practical relevance if they turned out to be unsuccessful among those people that are the most in need of change (for a similar discussion on prejudice reduction interventions, see Hodson, 2011; Hodson & Dhont, 2015; Turner et al., 2020). Our findings suggest that those higher on speciesism might gain the most from information campaigns that raise awareness of animal harm in conventional farming industries, given their stronger intentions to change dairy consumption. They also reacted with stronger mind denial and lowered moral concern to higher levels of harm, which could counteract intentions to change and prevent effective behaviour change. More research is therefore needed to identify the factors that can maximise the effects on behavioural intentions while minimising or even reversing the paradoxical effects on mind denial and moral concern.

Among those lower in speciesism, the effects of greater perceived harm compared to lower perceived harm were weaker (on guilt and behavioural intentions) or non-significant (on mind attribution, moral concern). One possible explanation for the limited effects on behavioral intentions to reduce animal product consumption among those lower in speciesism could be attributed to the fact that their baseline scores were relatively high, with limited room left to increase (ceiling effects). Noteworthy however, is the fact that those lower on speciesism also scored high on mind attribution and moral concern and therefore had the most room on these scales to decrease their levels of mind attribution and moral concern when reading about the conventional farming practices. We did not observe such reactions, suggesting that those lower in speciesism may refrain from using these dissonance reduction strategies (see also Graça et al., 2016; Piazza et al., 2015).

##### 4.1. Limitations and future directions

Like previous experiments on meat-related cognitive dissonance (e.g., Bastian et al., 2012; Earle et al., 2019; Kunst & Hohle, 2016), the current study only included two conditions (conventional versus organic farming) to compare participants reactions to high and low perceived animal harm. By not including a baseline control condition where no information about dairy production is being presented, we do not know how much participants were willing to change their dairy consumption in the absence of information. As such, part of the observed effects of farming condition could be explained by those in the organic farming condition (low perceived harm), especially those higher on speciesism, becoming less inclined to change their dairy consumption after reading about the living conditions about cows in the organic dairy industry. However, such interpretation remains speculative, and it would be

valuable to investigate this idea in future research.

Our study was also limited to the use of self-report measures, which might be subject to social desirability biases, and it is unclear how well participants' self-reported intentions to change dairy consumption would correspond to observational measures of real consumption behaviour (e.g., Thomson et al., 2003). Despite being informative and impactful immediately after exposure, brief single-shot information interventions are unlikely to be sufficient for behaviour change, especially in the long term (Bianchi et al., 2018; Mathur et al., 2021). Future research is needed to test the impact of stronger manipulations in real-world settings, for instance by using informative texts alongside videos or images of animal harm on actual dairy consumption.

Finally, our data were collected online through convenience and snowball sampling, which resulted in a sample that included a majority of women, and participants that were predominantly highly educated and identified as White. This potentially limits the generalisability of the findings, and it would be valuable to replicate the experiment in a more diverse sample of participants.

#### 4.2. Conclusion

The market share of plant-based dairy alternatives has been growing steadily in the past few years (Plant Based Food Association, 2023). However, most consumers still choose dairy products (Good Food Institute, 2023), typically selecting milk from industrial factory farms, over these alternatives. In fact, many consumers may be unaware (or might not be fully aware) of the harmful practices in the dairy farming industry (Aizaki & Takeshita, 2023; Faunalytics, 2018; Ventura et al., 2016). The current findings demonstrate that increasing people's awareness of animal harm in dairy farms, elicits feelings of guilt about dairy consumption and dissonance reduction reactions similar to the ones previously observed in the context of the meat paradox. The results therefore highlight the generality of the phenomenon of animal product-related cognitive dissonance, and the need for a greater research focus on the consumption of animal products other than meat.

#### CRedit authorship contribution statement

**Maria Ioannidou:** Conceptualization, Methodology, Formal analysis, Investigation, Visualization, Writing – original draft. **Valerie Lesk:** Supervision, Writing – review & editing. **Barbara Stewart-Knox:** Supervision, Writing – review & editing. **Kathryn B. Francis:** Conceptualization, Methodology, Supervision, Validation, Writing – review & editing.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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