
Consumer preference for naturalness - A new way to differentiate grass-fed dairy products

Abstract:

Due to the lack of recognised differentiation for grass-fed dairy products, producers of quality products have failed to capture consumer premium. The study investigates consumers' preference for the naturalness attributes, in terms of functional improvement, animal feed, grazing condition, and imagery attributes, as potential criteria for product differentiation of grass-fed milk. We found that consumers have different preference ranking and willingness to pay premiums for naturalness attributes of grass-fed milk. Respondents reported higher premiums for functional, animal feed and grazing condition attributes. We also evaluate whether preference for naturalness influences consumers' valuations. The results showed that those with high preferences for naturalness have higher premiums for grazing condition, while those with low preferences for naturalness have higher premiums for functional improvement. This study provides evidence of consumer premium for naturalness in grass-fed milk, establishes a structure to differentiate grass-fed products and capture market premium.

Keywords:

Grass fed, consumers, preference for naturalness, pasture grazing, dairy

1 Introduction

Nowadays, although the term 'grass-fed' is widely used on product labels and company websites (Joubran, Pierce, Garvey, Shalloo, & O'Callaghan, 2021; McGuinness et al., 2022), evidence suggests that consumers have little knowledge about grass-fed dairy (Schiano, Gerard, & Drake, 2021). For consumers in certain countries where grass-fed practices are widespread, there is an inclination to presume that all dairy products originate from grass-fed sources, resulting in a lack of anticipated claims (McCluskey, Durham, & Horn, 2009). For other consumers, the inclusion of feeding grass or finishing on grass is necessary but insufficient (Stampa, Schipmann-Schwarze, & Hamm, 2020).

The diverse definitions and standards of grass-fed dairy across different countries also make the label confusing to consumers, and the differentiation of grass-fed products challenging (Joubran et al., 2021). For example, countries such as Ireland and New

Zealand with a temperate climate, use a 'grass-fed' claim that establishes not only a minimum standard for the quantity of grass in the diet of dairy cows but also for how long cows spend outside grazing (Table 1). In America, while there is a clear requirement for a specific amount of grass in the animal's diet, there is no specification for the minimum duration of pasture grazing (USDA-FSIS 2019). Since products with varying standards can all be labelled using the single term "grass-fed", it is difficult for consumers to distinguish the quality differences of grass-fed dairy products from different countries and providers. On the other hand, it is also difficult for producers with higher grass-fed standards (eg. Longer natural grazing time, better pasture qualities, etc.) to differentiate their products from competitors and gain market premium.

Table 1 Standard for grass-fed in New Zealand¹, Ireland² and America³

	New Zealand (Fonterra)	Ireland	America
Animal feed	Grass comprises at least 80% of the diet calculated on a dry matter basis (this is equivalent to at least 92% as-consumed basis).	Composed of at least 90% grass or grass forage on a fresh weight basis.	Livestock can only consume grass and forage (except for milk prior to weaning)
Grazing condition	The cows spend at least 90% of their time on pasture for grazing (excluding milking time).	Cows must graze on pasture at least 160 d (national average days at grass—i.e., 240 d—less 80 d)	Livestock must have continuous access to pasture during the growing season

Nonetheless, grass-fed claims can be identified through its key naturalness sub-attributes: functional (functional improvement), animal feed (grass-fed vs. no grass-fed), grazing condition (eg. pasture grazing), and imagery (healthy, natural, tasty and sustainable). Originated as a production quality assurance scheme, grass-fed milk is well aligned to current natural food perceptions, representing a food that can be perceived as healthy and natural (Cheng et al., 2020; McGuinness et al., 2022). Consumers also consider milk derived from a grass-fed diet as more environmentally and animal welfare friendly (Joubran et al., 2021) --all of which are key perceptions of natural food.

Food naturalness is an important motivation for consumers' food choices due to their innate sense of attachment towards foods perceived as natural (Scott, Rozin, & Small, 2020; Wolf, Tonsor, & Olynk, 2011). This instinctive preference for natural products often

¹ "Grass-Fed FAQs - Frequently Asked Questions | NZMP.com." <https://www.nzmp.com/global/en/products/fonterra-sustainability-solutions/unique-claims-content/natural-dairy-claims/grass-fed-faqs.html>. Accessed 13 Jan. 2024.

² "Grass Fed Dairy Standard - Bord Bia." <https://www.bordbia.ie/globalassets/bordbia2020/farmers--growers/grass-fed-standard/grass-fed-dairy-rev01-final.pdf>. Accessed 13 Jan. 2024.

³ "Grass Fed Program for Small and Very Small (SVS) Producers." <https://www.ams.usda.gov/sites/default/files/media/Grass%20Fed%20Fact%20Sheet.pdf>. Accessed 13 Jan. 2024.

arises from the belief that natural foods are tastier, safer, healthier, involve less human intervention, and possess moral and aesthetic superiority (Chakraborty & Dash, 2022; Rozin et al., 2004; Wang, Li, Zhao, & Xi, 2023). A systematic review on consumer perceptions of the natural food by Roman, Sánchez-Siles, and Siegrist (2017) showed that consumers' perception for naturalness can be classified into three categories: 1) the way the food has been grown (food origin), 2) how the food has been produced (what technology and ingredients have been used), and 3) the properties of the final product. In particular to dairy products, no previous study has explored it from the aspect of perceived naturalness. Understanding what aspects related to grass-fed is more important can help to be effective and truthful in communicating these abstract benefits. Moreover, research on food naturalness from a consumer perspective in a Chinese context is almost non-existent (Rongduo Liu, Banovic, & Grunert, 2022).

In this study, we considered the different attributes of naturalness which can be considered in grass-fed labels. According to Weber, Heinze, and DeSoucey (2008), the content of naturalness for grass-fed dairy includes various characteristics, e.g. leaving nature untouched, working with nature, products that cause health, nutritional benefits from inclusion & purity, and unaltered flavour and texture. Therefore, this study divides these attributes into functional (functional improvement), animal feed (grass-fed vs. no grass-fed), grazing condition (eg. pasture grazing), and imagery (healthy, natural, tasty and sustainable) attributes, to investigate which naturalness attributes are crucial for consumers. Additionally, we investigated consumers' preference for natural products and verified the premium potentials for grass-fed dairy with higher preference for naturalness. The objectives of this study are twofold: 1) providing new empirical evidence of consumer preferences for grass-fed milk 2) investigating the moderating effect of consumer preferences for naturalness as a possible explanation for different preferences for grass-fed milk, and potential criteria for product differentiation.

2 Literature and Hypothesis

2.1 Grass fed dairy product(s)

Although grass-fed is considered a top food trend (Morrison, 2022), the grass-fed dairy sector is still small, which is mainly due to the general challenge of effectively connecting with consumers using the grass-fed label or message (Weber, Heinze, & DeSoucey, 2008; Schiano, Gerard, & Drake, 2021). For example, in Italy, only 29% reported having any knowledge of grass-fed milk (Peira, Cortese, Lombardi, & Bollani, 2020). However, studies also find that the provision of information on grass-fed product has an effect on consumer attitudes, intentions and behaviour (Carabante et al., 2018; Morales, Aguiar, Subiabre, & Realini, 2013; van Vliet et al., 2021). McGuinness et al. (2022) found that Grass-Fed claim can increase the perceived healthiness and naturalness of Cheddar cheese without influencing the expected sensory characteristics. Moreover, consumers who were provided with grass-fed nutritional information after evaluating visual and taste aspects place auction bids that are 1.34 times higher compared to consumers who don't provide such information (Xue, Mainville, You, & Nayga Jr, 2010). Therefore, grass-fed producers need to develop an appropriate way of communicating information for the practicalities of exchange, thus creating a connection with consumers.

To differentiate grass-fed milk, emphasis could be placed on its naturalness. Over the decades, indoor livestock production, a key aspect of agricultural 'industrialization,' has significantly altered the traditional image of dairy farms, where cows graze on grass. This transformation has reduced agriculture's reliance on natural processes and the surrounding land, leading to a growing disconnect between people and nature (Shortall, 2019). In the late 20th century and early 21st century, the movement for grass-fed production arose in opposition to a highly institutionalised system of industrial agriculture and food production (Weber, Heinze, & DeSoucey, 2008). One grass-fed producer summarised his overall stance as "nature—work with it instead of against it" (Weber, Heinze, & DeSoucey, 2008). Moreover, grass-fed milk from New Zealand and Ireland has a higher standard of grazing and is more closely associated with nature than other grass-fed milks. Thus, naturalness is one of the central cultural codes to differentiate from other types of production.

Sub dimension attributes which could reflect the values of grass-fed products can increase clarity and confidence for the consumer and allow consumers to make informed decisions. Consumer knowledge around "grass-fed" is low and there is confusion around the terminology used, often failing to recognize that the production system behind grass-fed products indicates varying levels of pasture or grass (Joubran et al., 2021; Schiano, Gerard, & Drake, 2021). Thus, sub dimension attributes specifically related to the naturalness of grass-fed products not only allow producers to differentiate their products, but also satisfy the consumer's desire for natural foods. However, one cannot display all of this content, as too much information would lead to cognitive overload and consumer

confusion(Bogliacino et al., 2023). As such there is a need to categorise or group such attributes to support the consumer.

2.2 Communication elements influencing milk evaluations

Based on previous research (Chrysochou & Grunert, 2014; Schifferstein, de Boer, & Lemke, 2021), functional, process and imagery aspects can influence consumers' evaluations of food products. The naturalness of grass-fed milk can be expressed through functional (functional improvement), animal feed (grass-fed vs. no grass-fed claim), grazing condition (eg. pasture grazing), and imagery (healthy, natural, tasty and sustainable).

Functional aspect refers to nutritional attributes and are known to have a direct effect on people's perception of health, which in turn affect the overall evaluation of grass-fed dairy products. Grass-fed dairy products have a number of nutrition advantages over conventional dairy products, due to the feeding regime and physical activities. For example, pasture-raised meat and dairy have more vitamins and trace minerals compared to feedlot-finished counterparts (Van Vliet, Provenza, & Kronberg, 2021). Considering conjugated linoleic acid (CLA), pasture-raised meat and dairy products contain 1.5 and 3 times more CLA compared to grain-fed products respectively (Van Vliet, Provenza, & Kronberg, 2021), consumption of which may be associated with reduced risk of lifestyle diseases or metabolic syndrome(Benbrook et al., 2018; Dilzer & Park, 2012; Koba & Yanagita, 2014). Like CLA, Omega-3 levels are also increased, with levels of 0.049 and 0.020g/100g milk in grass-fed milk and conventional milk respectively (Benbrook et al., 2018). Because of higher consumption of dairy products relative to most other sources of omega-3 fatty acids and conjugated linoleic acid, these differences in grass-fed milk can help contribute to intakes of these nutrients, reducing the risk of cardiovascular and other metabolic diseases (Benbrook et al., 2018). Additional, Chassaing et al. (2011) found that the vitamin B9 content in milk is positively associated with grass-fed diets. Other nutrients, like vitamin A, Vitamin E and vitamin D also have increased content in grass-fed animals (Agabriel, Cornu, Journal, Sibra, Grolier, & Martin, 2007). In this research, we restrict functional improvement to increased content of CLA, omega-3 and vitamin B.

Compared to grain-fed products, consumers have a more positive perception of grass-fed products(Klopatek, Marvinney, Duarte, Kendall, Yang, & Oltjen, 2022; Schiano, Harwood, Gerard, & Drake, 2020). Dried ingredients labelled as "grass-fed" not only demonstrated significantly stronger associations with sustainability, naturalness, healthiness, trustworthiness, and ethical standards compared to those without the label, but the inclusion of this label, connected to the notion of cows grazing freely and improved animal welfare, holds the potential to positively influence various consumer

perceptions(Schiano et al., 2020). According to a study conducted by Xue et al. (2010), US consumers who prepare and consume beef at home more frequently, as well as older consumers and those who live with others but in smaller households, are willing to pay more for one pound of grass-fed beef compared to conventional beef, because of perceived positive impact of grass-fed production systems on human health, the environment, and animal welfare.

Consumers may form beliefs about the product based on their own subjective theories about grazing condition. Consumer behaviour regarding pasture-raised products is largely defined through health and environmental attitudes and depends substantially on the context of a purchase decision(Stampa, Schipmann-Schwarze, & Hamm, 2020). There are a variety of consumer groups willing to pay a premium for a pasture-raised attribute even on top of an organic price premium (Stampa, Schipmann-Schwarze, & Hamm, 2020). Specifically, since consumers have national stereotypes for different countries, they prefer dairy products from countries of origin with a better environment and nice grassland (R. Yang, Ramsaran, & Wibowo, 2018).

Imagery, as a powerful tool to communicate an underlying meaning and affects perceptions, can provide consumers with salient purchase motives that coincide with their life beliefs. Previous research highlights the importance of visual elements, such as imagery, in shaping the product perceptions and choices (Delivett, Farrow, Thomas, & Nash, 2022; Hallez, Boen, & Smits, 2022). For example, Delivett et al. (2022) find that the presence of health imagery on a food product's package can lead consumers to infer health benefits, even when other, more direct cues indicate that the product is unhealthy.

Given this background, we hypothesise:

H1: Functional, animal feed, grazing condition and imagery aspects have positive effects on consumers' preference for grass-fed milk.

2.3 The effect of preference for naturalness on milk evaluations

The effectiveness of communication can be driven by consumers' motivation to process product-related information. Consumers with low motivation to process information are likely to seek heuristic cues or other ways to minimise their cognitive effort, while those with high motivation to process information are willing to accept recommendations and switch from declared attribute preferences (Gupta & Harris, 2010). Preference for naturalness, which refers to people's inclination to prefer natural entities over those produced with human intervention (Rozin et al., 2004), is one potential driver

that can shape an individual's motivation to process information when it comes to natural products.

Preference for naturalness could influence the motivation to process information, especially food. When individuals have a strong preference for natural products, they may show a higher willingness to read labels, or gather information about a product's sourcing, manufacturing processes, or potential environmental impacts. They generally prefer food for its clean label and natural processing. This motivation can stem from various factors, including ideational(moral/aesthetic) reasons, health concerns, environmental considerations, or a desire for authenticity (Hartmann, Hieke, Taper, & Siegrist, 2018; Rozin et al., 2004). On the other hand, individuals who do not prioritise naturalness may have lower motivation to process specific information related to natural attributes. Their decision-making process may be guided by other factors such as price, convenience, taste, or brand loyalty (Hartmann, Furtwaengler, & Siegrist, 2022). Therefore, we further hypothesise that:

H2: Compare consumers with a stronger preference for naturalness, grazing condition and animal feed attributes have a larger effect on their preferences than consumers with a low preference for naturalness.

3 Methodology

Natural-related product characteristics can help to differentiate grass-fed milk. In order to investigate consumer preferences and willingness to pay (WTP) concerning these characteristics, we employed a choice experiment for this study. Since discrete choice experiment (DCE) build on the assumption that consumers' preferences are reflected through its characteristics or attributes (De Bauw, Franssens, & Vranken, 2022), they can also be used to identify interactions between attributes and to quantify the relative importance of attributes.

3.1 Experimental design

An online DCE on 1553 nationally representative Chinese dairy consumers was conducted. As some consumers are vegetarians or lactose intolerant who are not potential target groups for dairy products, only respondents who had purchased or consumed dairy products in the past 6 months were included. The survey was conducted in September

2022.

Using an online questionnaire, delivered using the Qualtrics platform, participants were presented with three sets of questions: Dietary intake, consumer sensory perceptions and portion selection, and consumer preferences. This project involves interdisciplinary collaboration. The other two parts are led by nutrition scientist and sensory scientist. This paper focuses mainly on the consumer preference study and using relevant data.

Respondents were instructed to select their choices as follows; “Suppose you are to buy dairy products. In the following question, you will be presented with 16 scenarios. Please assume that each scenario is an independent shopping trip. Other than the (price, etc.), please assume that all other characteristics of the two products are the same. Based on aforementioned information, please choose the one that you will purchase in grocery shopping. If you are not satisfied with either product, please choose the Neither option. All the information presented is for a box of 200g milk.” In each scenario, product pictures were used to help aid in comprehension.

As shown in table 3, the chosen attribute of the functional improvement included in this study is the increased content of CLA, Omega-3 and Vitamin B, which is determined by the benefits of grass-fed. For animal feed, there are two levels for this attribute (1) Grass fed (2) No (grass-fed) label. For the attributes of grazing condition, five levels are introduced (1) Pasture grazing (2) Pasture grazing from Ireland (3) Pasture grazing from New Zealand (4) Pasture grazing from Xinjiang (5) No pasture grazing claim. Finally, based on popular imagery of existing dairy products on the market, imagery varies by five levels: healthy, natural, tasty, sustainable imagery and no label. Instead of pictures, words were used to represent the imagery, in case of misunderstanding by the participants.

Table 3 Attributes, levels and description in grass-fed dairy product

Attribute	Level	Description
Functional improvement	2	Increase the content of CLA, Omega-3 and Vitamin B
		No functional improvement
Animal feed	2	Grass fed
		No grass-fed claim
Grazing condition	5	Pasture grazing
		Pasture grazing from Ireland
		Pasture grazing from New Zealand
		Pasture grazing from Xinjiang
		No pasture grazing claim
Product imagery	5	Healthy
		Natural
		Tasty
		Sustainable
		No imagery
Price	4	2.2 yuan/200ml
		4.2 yuan/200ml

6.2 yuan/200ml
8.2 yuan/200ml

Alongside the above attributes, the price attributes chosen in this study reflect the current price levels for this product in different stores, ranging from 2.24 RMB per carton to 8.25 RMB per carton for 200g UHT milk products. Four price levels between 2.2 RMB per carton and 8.2 RMB per carton were chosen based on the price range of products available in the market and to ensure the efficiency of the WTP estimates⁴. Table 1 presents three aspects, five attributes and their specific levels.

A full-factorial design would include 400 (2*2*5*5*4) possible product profiles. To reduce the cognitive burden of participants and create efficient designs, the choice experiment was designed in Stata using D-efficient. The generated design included 32 choice sets and divided these into two blocks with 16 choice sets each. Each choice set included two milk product profiles and a neither-choice option. By including the "I would not purchase either product" option, it avoids making the choice set conditional and allows the estimation of more realistic demand models (Meas, Hu, Batte, Woods, & Ernst, 2015; Nguyen, Gao, & Anderson, 2022). To avoid possible ordering effects, the order of the choice sets presented to the participants was randomised.

3.2 Econometric methods

The consumer choice decision process is modeled within a random utility theory framework (Manski, 1977). The utility that decision maker i will derive from consuming alternative j can be expressed as:

$$U_{ij} = \beta_{1i} \text{Functional improvement}_{ij} + \beta_{2i} \text{Animal feed}_{ij} \\ + \beta_{3i} \text{Grazing condition}_{ij} + \beta_{4i} \text{Product imagery}_{ij} + \beta_{5i} \text{Price}_{ij} \\ + \varepsilon_{ij}$$

⁴ The lowest price (RMB2.24 per carton) is from the Mengniu Pure Milk online shop and the highest price (RMB8.25 per carton) is from the Children's Growing Up milk sold at Fresh Hema. We excluded the price of organic milk and A2 beta-casein milk, the high price of which comes from the organic and A2 beta-casein labels.

(1)

Individuals' utility consists of a deterministic component and a random component, ε_{ij} . The deterministic portion of utility determined by included attributes and their associated preference parameters, β . All attribute levels were dummy coded except for the price (Price). The attribute price was treated as a continuous variable.

The impact of opt-out option is modelled by an alternative-specific constant, $\beta_{i,opt-out}$, which represents something about the utility of an alternative not related to an attribute specified in the utility function (Hensher, Rose, & Greene, 2005).

$$U_{i,opt-out} = \beta_{i,opt-out} + \varepsilon_{i,opt-out} \quad (2)$$

Since each choice set consists of three options in the choice experiment, our model would contain three equations. The first two equations represent the utility of the two product profiles (Equation 1), while the third equation represents the utility of opt-out (Equation 2).

The probability of an individual i choosing alternative j in choice situation t is:

$$P_{ijt} = P(Y_{it} = j) = \frac{\exp(X_{ijt}\beta)}{\sum_{j=1}^J \exp(X_{ijt}\beta)} \quad \text{for } j = 1, 2, \dots, J \quad (3)$$

Where Y_{it} is an indicator variable indicating the option individual has chosen in t^{th} choice set.

When assessing the consumers' preferences and willingness-to-pay for food products' attributes, it is important that models are able to account for possible unobserved heterogeneity in the data and that findings are robust across methodological alternatives. A Mixed logit model assumes that at least some of the parameters are random, which allows for the heterogeneity in preferences and relaxes the assumption of independence of irrelevant alternative (IIA) (Greene & Hensher, 2003; Hensher, Rose, & Greene, 2005). In other words, a mixed logit model is a specific case of the logit models in which the parameters are assumed to vary from one individual to another (Qiu & Fan, 2022). There are many names for this model form, including mixed logit, random parameters logit, kernel logit, and mixed multinomial logit (MMNL) (Hensher, Rose, & Greene, 2005). The mixed logit model specifies the choice probability as:

$$P_{ijt} = P(Y_{it} = j) = \int \frac{\exp(X_{ijt}\beta)}{\sum_{j=1}^J \exp(X_{ijt}\beta)} f(\beta) d\beta$$

(4)

Where $f(\cdot)$ is the probability distribution function of random parameter (Train, 2009). If the parameters are fixed at β_c (non-random), the distribution will collapse, i.e., $\beta = \beta_c$, then $f(\beta_c)=1$ (Ruifeng Liu, Gao, Snell, & Ma, 2020).

We assign normally distributed parameters to the non-price attributes, while assuming fixed coefficients for the ASC (Choose no variable) and price. This is because the opt-out alternative does not have any specific attribute values and the price coefficients are assumed to be invariant across respondents (Hensher, Rose, & Greene, 2005). Preference heterogeneity is revealed through the standard deviation estimates, which relates to the amount of dispersion that exists around the sample population (Hensher, Rose, & Greene, 2005).

The marginal WTP for each non-price attribute is derived using coefficients from each mixed logit model, that is, the negative ratio between the estimated parameter of a non-price attribute and the estimated price parameter (Louviere, Hensher, & Swait, 2000). The marginal WTP can be interpreted as the monetary values that respondents are willing to pay to acquire a level-differentiated attribute.

In addition to investigating the main effects of product attributes, we also extend our empirical model to examine the possible interaction effects between product attributes and individuals' naturalness preference (PFN). It can provide valuable insights into whether the effects of attributes on utility varies depending on the level of preference for naturalness by the individual. The individual preference for natural food was investigated using seven-point Likert agreement scales, as suggested by Bearth, Cousin, and Siegrist (2014), ranging from "completely disagree=1" to "completely agree=7". With the interaction term, the random utility model in equation (1) can be expressed as:

$$U_{ij} = \beta_{1i} \text{Functional improvement}_{ij} + \beta_{2i} \text{Animal feed}_{ij} + \beta_{3i} \text{Grazing condition}_{ij} + \beta_{4i} \text{Product imagery}_{ij} + \beta_{5i} \text{Price}_{ij} + \beta_{6i} (\text{Functional improvement}_{ij} * \text{PFN}_i) + \beta_{7i} (\text{Animal feed}_{ij} * \text{PFN}_i) + \beta_{8i} (\text{Grazing condition}_{ij} * \text{PFN}_i) + \beta_{9i} (\text{Product imagery}_{ij} * \text{PFN}_i) + \varepsilon_{ij}$$

3.3 Sample and statistical description

The socio-demographic and purchase behaviour characteristics of the sample are summarised in Table 4 and Table 5. Compared to the national average⁵, respondents are more likely to have a younger age and a higher level of educational attainment, but were in line with other online food consumer surveys in China(Zhang, Hu, Zhu, & Penn, 2023). More than half of the respondents are business/service workers (55.2%), and 20.3% are government institution staff. In terms of household income, the largest proportion of respondents (30.8%) are between ¥10001 and ¥20000, while the smallest proportion (2.7%) are under ¥5000. Respondents in our sample are more likely to have a household size of 3-4 people compared to the national sample (68.3% vs. 40.1%).

Table 4 Summary statistics of socio-demographic variables.

Observations	Sample(n=1553)		National Sample
	Freq.	Percent	Percent
Gender			
Male	793	51.1%	51.0%
Female	755	48.6%	49.0%
Prefer not to say	5	0.3%	
Age			
18-24	251	16.2%	12.7% ⁶
25 - 34	334	21.5%	17.8%
35 - 44	348	22.4%	16.8%
45 - 54	279	18.0%	19.8%
55 and older	341	22.0%	32.8%
Education			
Middle school or less	75	4.8%	64.5%
High school degree	173	11.1%	16.7%
Associate degree	282	18.2%	9.5%
Bachelor's degree	789	50.8%	8.4%
Post-graduate degree	234	15.1%	1.0%
or above			
Employment			
Business/service worker	858	55.2%	
Government institution staff	316	20.3%	

⁵China Statistical Yearbook 2022 compiled by the National Bureau of Statistics. See: <http://www.stats.gov.cn/sj/ndsj/2022/indexch.htm>

⁶ As the 18-24 age group was not available in the China Statistical Yearbook 2022, the 15-24 age group was substituted in this study for comparison. 12.7% is the proportion of the national population in the 15-24 age group.

Retired/unemployed	137	8.8%	
Self-employed	126	8.1%	
Students	116	7.5%	
Monthly household income			
Below 5,000	42	2.7%	
5,001- 10,000	184	11.8%	
10,001- 20,000	479	30.8%	
20,001-30,000	340	21.9%	
30,001 - 40,000	180	11.6%	
40,001- 50,000	142	9.1%	
50,001 and above	186	12.0%	
Family size			
1	39	2.5%	17.0%
2	243	15.6%	24.3%
3-4	1061	68.3%	40.1%
5-6	206	13.3%	15.1%
7 or above	4	0.3%	3.4%

Half of the respondents are regular consumers of dairy products, with 40.2% consuming once a day and 11.5% consuming two or more times a day. Only 0.1% of respondents reported never consuming dairy products, which is in line with methodology that specifically recruited dairy consumers. But it must be noted that this is not in line with the national average, where only 20.3% of consumers are reported to be dairy consumers (Y. Yang et al., 2022). Respondents prioritised nutrients, healthy information and quality when making decisions about purchasing dairy products. Specifically, more than half of the respondents (53.1%) identified nutrients as one of the top three factors in the decision-making process, followed by health information (47.7%) and quality (37.1%).

Table 5 Summary statistics of dairy food consumption and purchasing behavior

Observations	Percent
Dairy products consumption per week	
Never	0.1%
Once a week or less	3.5%
2~3 times a week	17.9%
4~5 times a week	26.7%
One times a day	40.2%
Two or more times a day	11.5%
Change of consumption in the past two years (%)	
Decreased	10.9%
No change	31.2%
Increased	58.0%
Top 3 factors in making your dairy purchase decision	
Nutrients	53.1%
Health benefit	47.7%
Quality	37.1%
Safety	36.8%

Taste	35.6%
Brand	24.5%
Price	22.3%
Expiration date	20.0%
Non-GMO	13.0%
Environmentally-friendly	12.5%
Sustainability	11.1%
Country of origin	9.7%
Traceability	9.5%
Package Size	7.0%
Animal welfare	5.7%

Concerning grass-fed dairy products, more natural (54.35%) and healthier (52.61%) are the top two primary perceptions of respondents (Figure 1). While better taste was less commonly perceived among respondents (26.34%), 71.69 % of them reported that grass-fed milk tastes better than regular milk when asked specifically about its taste.

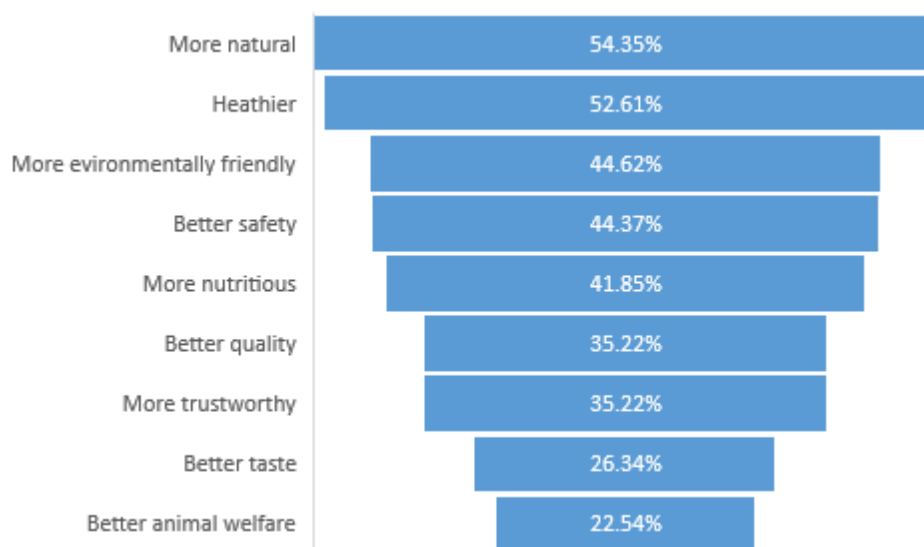


Figure 1 Perception of grass-fed dairy product

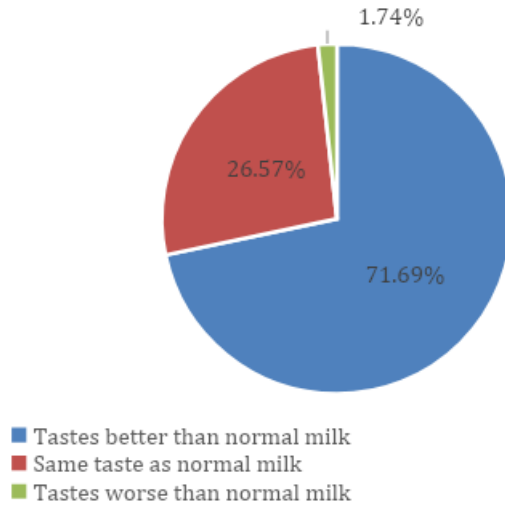


Figure 2 Taste of grass-fed dairy product

4 Results

4.1 The results of main effects

Estimation results of mixed logit model and WTP for main effects are reported in table 6. The mean estimate of price is statistically significant. The negative and significant estimate of the price variable indicates that an increase in the price variable results in a decrease in the utility associated with a product, all else being equal. The coefficient estimates of the no purchase option (opt-out) are significant and negative, indicating that, on average, the attributes included in the experiment are relevant and important to consumers relative to the status quo.

For the functional aspect, the mean and standard deviation estimates of functional improvement of “Increase the content of CLA, Omega-3 and Vitamin B” are both significant. The positive coefficient indicates that consumers place a higher value on the products with functional improvement. This result is consistent with the literature (Ballco, de-Magistris, & Caputo, 2019; Bechtold & Abdulai, 2014; Bimbo et al., 2017; Kraus, 2015). Several studies have found consumers place high value on dairy products enriched with CLA (Bimbo et al., 2017), omega-3 fatty acids (Bechtold & Abdulai, 2014; Kraus, 2015) and vitamin B (Ballco,

de-Magistris, & Caputo, 2019). However, the significant standard deviation estimates implies that consumers are heterogeneous in their preference for this attribute. With normal distribution specification, it can be inferred that approximately 26% of the respondents do not consider functional improvement to be more valuable than no functional attribute (Train, 2009). That means not all consumers may include functional improvement as an important criterion in their choice.

In terms of consumers' preferences for animal feed, the mean coefficient is statistically positive and significant. The positive estimate for grass fed variable implies that compared no grass-fed claim, milk with this claim is more likely to be chosen, adding to the literature on the effect of grass-fed labels (Evans, D'Souza, Collins, Cheryl, & Sperow, 2011; White & Brady, 2014). The standard deviation estimate is also significant, which suggests that there is some variation in such preference across the consumers and 30% of the respondents value grass fed claim less than no such claim. Some consumers don't prefer grass-fed products over conventional products (Xue et al., 2010).

Grazing condition is also an important factor influencing consumers' choices of milk. Compared to milk without pasture grazing, the mean coefficients of all pasture grazing related attributes are significant and positive. Among pasture grazing related attributes, specific labels (pasture grazing from Ireland, New Zealand and Xinjiang) provide higher utility than general label (pasture grazing). This result is reasonable because the label is likely to be effective only when it addresses specific information needs and can be adequately processed and used by its target consumers (Verbeke, 2008). Specifically, consumers prefer milk with pasture grazing from Ireland and pasture grazing from New Zealand to pasture grazing from Xinjiang. This result is consistent with previous studies that Chinese consumers have a preference towards dairy products from foreign countries (Yang, Ramsaran, & Wibowo, 2018; Yin, Li, Xu, Chen, & Wang, 2017).

The imagery also positively influences consumers' choice, given the statistically significant estimates of coefficients for these four imageries. Furthermore, consumers have higher valuation for the products with natural imagery than those with other imagery (healthy, tasty and sustainable). The standard deviation is not significant, which infers that consumers have homogenous preference for milk products with imagery.

Table 6 Estimated Parameter of Mixed logit models

Attribute	Mean	St. Dev
Price	-0.078*** (0.004)	
Functional Improvement (base = No functional improvement)		
Functional improvement	0.605*** (0.029)	0.931*** (0.028)
Animal Feed (base = No grass-fed claim)		
Grass fed	0.460*** (0.027)	0.814*** (0.027)
Grazing Condition (base = No pasture grazing claim)		
Pasture grazing	0.315*** (0.031)	0.116* (0.063)
Pasture grazing from Ireland	0.562*** (0.037)	0.432*** (0.059)
Pasture grazing from New Zealand	0.493*** (0.032)	0.191*** (0.059)
Pasture grazing from Xinjiang	0.479*** (0.037)	0.518*** (0.054)
Product Imagery (base = No imagery)		
Healthy	0.148*** (0.033)	0.024 (0.077)
Natural	0.232*** (0.032)	0.01 (0.076)
Tasty	0.093*** (0.033)	0.36*** (0.053)
Sustainable	0.185*** (0.032)	0.045 (0.065)
Opt out	-1.740*** (0.051)	
Number of respondents	1,553	
Number of observations	24,848	
Log likelihood function	-18862	
AIC	37768	
McFadden Pseudo R2	0.31	

4.2 The results of moderating effects

Table 7 presents results of the mixed logit model, in which we include preference for naturalness (PFN) as an interaction variable. The results of interaction effects show that among four attributes (functional improvement, animal feed, grazing condition and imagery), animal feed, grazing condition and imagery have significant interaction effects

with preference for naturalness, while the interaction effect is insignificant for functional improvement.

The mean and standard deviation estimates for the functional improvement are consistent with the estimates in Table 6. The interaction between the functional attribute and preference for naturalness is negative, indicating that intrinsic preference for functional improvement decreases as preference for naturalness increases, but the difference is not significant.

As for animal feed and grazing condition attributes, the negative sign of its coefficients and the positive sign associated with the interaction between these attributes and preference for naturalness indicate that relationship between these attributes and product choice may change depending on the level of preference for naturalness. In other words, the positive effect of these attributes on consumer utility is weaker when preference for naturalness is low, but stronger when preference for naturalness is high. It is worth noting that for grazing condition, the interaction effect between preference for naturalness and New Zealand grazing and Xinjiang grazing is stronger than that of Ireland grazing.

The results for imagery indicate that as the level of preference for naturalness increases, consumers attach greater preference to the milk with imagery. Moreover, the interaction coefficients for tasty and sustainable imagery are higher than those for natural and healthy imagery.

Table 7 Estimated Parameter of Mixed logit models

Attribute	Mean	St. Dev
Price	-0.078*** (0.004)	
Functional Improvement (base = No functional improvement)		
Functional improvement	0.805*** (0.186)	0.930*** (0.028)
Animal feed (base = No grass-fed claim)		
Grass fed	-0.773*** (0.169)	0.791*** (0.027)
Grazing Condition(base = No pasture grazing claim)		
Pasture grazing	-0.567*** (0.184)	0.089 (0.063)
Pasture grazing from Ireland	-0.327	0.432***

	(0.225)	(0.060)
Pasture grazing from New Zealand	-0.833***	0.181***
	(0.188)	(0.060)
Pasture grazing from Xinjiang	-0.812***	0.494***
	(0.219)	(0.056)
Product Imagery (base = No imagery)		
Healthy	-0.319	0.022
	(0.198)	(0.078)
Natural	-0.254	0.004
	(0.187)	(0.076)
Tasty	-0.919***	0.344***
	(0.202)	(0.056)
Sustainable	-0.740***	0.052
	(0.192)	(0.064)
Opt out	-1.772***	-1.772***
	(0.051)	(0.051)
Functional improvement*PFN	-0.049	
	(0.046)	
Grass fed*PFN	0.308***	
	(0.042)	
Pasture grazing*PFN	0.221***	
	(0.045)	
Pasture grazing from Ireland*PFN	0.223***	
	(0.056)	
Pasture grazing from New Zealand*PFN	0.333***	
	(0.047)	
Pasture grazing from Xinjiang*PFN	0.324***	
	(0.054)	
Healthy*PFN	0.118**	
	(0.049)	
Natural*PFN	0.122***	
	(0.046)	
Tasty*PFN	0.254***	
	(0.050)	
Sustainable*PFN	0.232***	
	(0.047)	
Number of respondents	1,553	
Number of observations	24,848	
Log likelihood function	-18758	
AIC	37581	
McFadden Pseudo R2	0.31	

The mean parameters from mixed logit models only provide the impacts of attributes and interaction terms on consumer utility separately. To further understand the total marginal utility of an attribute at various preferences for naturalness and how the twist

happened, we use graphs to display their relationships. As shown in Figure 3, the downward sloping graph indicates that the marginal effect of functional improvement on utility decreases with an increase in preference for naturalness. Nevertheless, for animal feed, grazing condition and imagery attributes (figure 4, figure 5, figure 6), the effect of these attributes on utility become positive when the preference for naturalness rises.

To be more specific regarding the attributes related to grazing condition, as the preference for naturalness increases, the positive relationships between marginal utility and pasture grazing from New Zealand (mean: 0.332, $p < 0.001$) or Xinjiang (mean: 0.329, $p < 0.001$) is stronger compared to the correlation between marginal utility and pasture grazing from Ireland (mean: 0.229, $p < 0.001$) or pasture grazing (mean: 0.221, $p < 0.001$). This indicates that consumers with a strong preference for naturalness, prefer milk from New Zealand or Xinjiang pasture, over milk from Ireland or pasture grazing in general. Figure 6 graphically displays the interactions between preference for naturalness and imagery for marginal utility. The graph shows that when sustainable (mean: 0.232, $p < 0.001$) and tasty (mean: 0.257, $p < 0.001$) imagery are presented, consumers who strongly prefer naturalness evaluate products more positively than those presented with healthy (mean: 0.118, $p < 0.001$) and natural (mean: 0.122, $p < 0.001$) imagery.

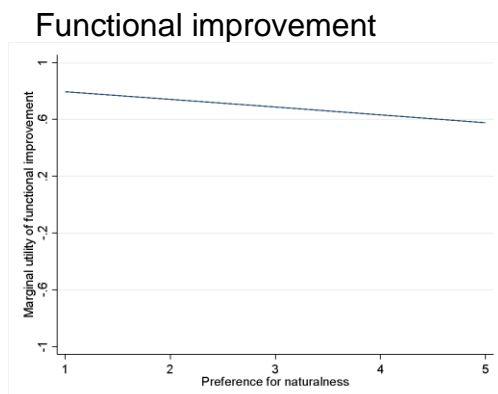


Figure 3 Interaction effects between preference for naturalness and functional improvement on marginal utility

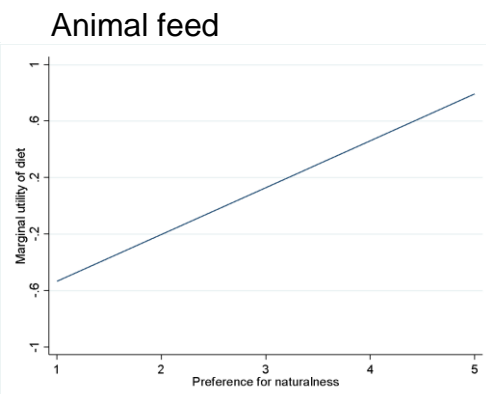


Figure 4 Interaction effects between preference for naturalness and animal feed on marginal utility.

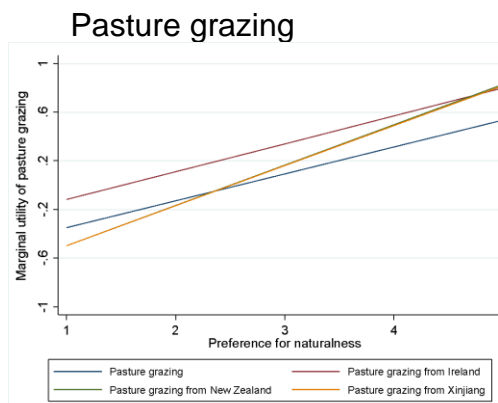


Figure 5 Interaction effects between preference for naturalness and pasture grazing on marginal utility.

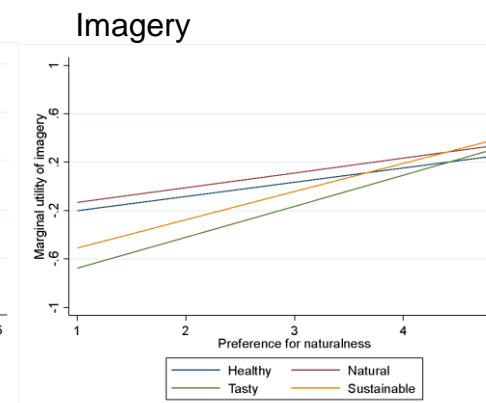


Figure 6 Interaction effects between preference for naturalness and product imagery on marginal utility.

4.3 WTP

Table 8 reveals the mean estimates and 95% confidence intervals of the WTP values for all non-price attributes of milk. On average, milk with functional improvement received highest WTP (¥7.7), followed by milk pasture grazing from Ireland (¥7.2), New Zealand (¥6.3) and Xinjiang (¥6.1), while milk with imagery received low WTP (Healthy: ¥1.9, Natural: ¥3.0, Tasty: ¥1.2, Sustainable: ¥2.4). It is worth noting that Chinese consumers prioritise functional improvement over other attributes when it comes to specific attributes. This implies that consumers desire information related to nutritional value when they purchase milk products. However, there is greater variation among consumers in their preferences for functional improvement compared to attributes related to grazing condition (Table 6).

Table 8 WTP and 95% Confidence Intervals for Grass-fed Attributes

Attribute	Mean Estimate	S.E.	95%CI	
	Coef.		Lower bound	Higher bound
Price				
Functional Improvement (base = No functional improvement)				
Functional improvement	7.727	0.565	6.619	8.834
Animal feed (base = No grass-fed claim)				
Grass fed	5.878	0.454	4.989	6.767
Grazing Condition (base = No pasture grazing claim)				
Pasture grazing	4.020	0.433	3.171	4.870
Pasture grazing from Ireland	7.177	0.604	5.994	8.361
Pasture grazing from New Zealand	6.300	0.500	5.319	7.280
Pasture grazing from Xinjiang	6.121	0.555	5.034	7.208
Product Imagery (base = No imagery)				
Healthy	1.895	0.427	1.058	2.732
Natural	2.964	0.421	2.139	3.789
Tasty	1.185	0.416	0.369	2.001
Sustainable	2.366	0.420	1.543	3.190

4.4 The relative importance of attributes

After examining the effect of different levels within an attribute on utility and WTP, we next explore the relative effect of each attribute on utility. Relative importance (RI) offers a way to compare attribute importance generally without considering attribute level (He, Shi, Gao, & House, 2020). The results presented in Table 9 show that for the overall sample, grazing condition (25.8%) is the most important attribute in determining consumers' choice of milk, followed by functional aspect (24.91%), animal feed (20.17%) and price (19.24%), while imagery (9.89%) is the least important. This is inconsistent with Chrysochou and Grunert (2014), who have concluded that health imagery has the largest impact on consumers' product evaluations, while functional claims and process claims have much smaller effects. One potential explanation for this difference is our use of verbal labels instead of images. Compared to verbal labels, images easily capture the consumer's

attention and require less cognitive effort to process (Benn, Webb, Chang, & Reidy, 2015; Piqueras-Fiszman, Velasco, Salgado-Montejo, & Spence, 2013), so they have higher impact on consumers' product evaluation. However, as the image itself is ambiguous and can evoke multiple interpretations (Schifferstein, de Boer, & Lemke, 2021), it is difficult to clearly communicate the properties of the final product (healthy, tasty, natural, sustainable) to the consumer through images. It should be noted that although the text is clear, for example when we claim to be natural, consumers do not interpret it as healthy, these abstract constructs, in themselves, are ambiguous. Hence, the use of functional and process aspects may make more sense as they are more concrete and explicit.

Grazing condition holds greater importance compared to cow's diet. This result is reasonable because many consumers are unfamiliar with specific feed systems and are therefore unable to differentiate between grass-fed and conventional total mixed ration (TMR) diets, whereas pasture grazing is widely considered to be the most natural and species-appropriate way to raise cattle (Croissant, Washburn, Dean, & Drake, 2007; McGuinness et al., 2022; Stampa, Schipmann-Schwarze, & Hamm, 2020).

We grouped respondents according to their level of preference for naturalness into low preference for naturalness (mean less than or equal to three) and high preference for naturalness (mean greater than three). In the low preference for naturalness group, the most important attribute is functional improvement (29.68%), while in the high preference for naturalness the most important attribute is grazing condition (26.38%). In addition, imagery is least important for both groups (10.34% and 4.04%).

Table 9 Estimated relative importance of attributes

Attributes	Total (n=1553)				Low (n=112)				High (n=1441)			
	RI	Std.Err	95%CI		RI	Std.Err	95%CI		RI	Std.Err	95%CI	
			Lower bound	Upper bound			Lower bound	Upper bound			Lower bound	Upper bound
Functional improvement	24.91	0.44	24.04	25.78	29.68	1.58	26.55	32.80	24.54	0.46	23.64	25.44
Animal feed	20.17	0.37	19.44	20.90	18.90	1.47	15.99	21.81	20.27	0.38	19.51	21.02
Pasture grazing	25.80	0.24	25.33	26.26	18.34	1.18	16.01	20.67	26.38	0.23	25.92	26.83
Imagery	9.89	0.11	9.66	10.11	4.04	0.44	3.16	4.92	10.34	0.11	10.13	10.55
Price	19.24	0.18	18.89	19.58	29.05	1.08	26.90	31.20	18.47	0.15	18.17	18.78
	100				100				100			

Note: Relative attribute importance is estimated by dividing the difference in utility of an attribute by the sum of the differences of all attributes. The difference in utility of an attribute = highest utility value of an attribute – lowest utility of an attribute.

5 Discussion and conclusion

Much of the attention in the literature about grass-fed products has focused on the overall concept or environmental aspects. No other studies have examined the effect of naturalness attributes of grass-fed milk on consumer choices. To fill this gap, this paper includes four attributes that allow for the ranking of preferences for naturalness attributes of grass-fed milk and expands our understanding of the consumer perception of grass-fed milk. This study investigates opportunities to rely on the provision of naturalness attributes as a means of incentivizing consumers to choose grass-fed milk. Moreover, the preference for naturalness has played a crucial role in natural foods becoming global food trends today. This study examines a growing group of natural food consumers who no longer prioritise nutrition as the sole focus when acquiring food. Instead, they place greater emphasis on the naturalness of food.

Supporting Hypothesis 1, this paper identifies positive consumer preferences for four attributes related to the naturalness of grass-fed milk. Nevertheless, these four attributes have different levels of importance for consumers. Our results indicate that grazing condition is more important than functional improvement, animal feed and imagery attributes. Therefore, to positively differentiate grass-fed milk from conventional milk, highlighting grazing condition can be a viable option for dairy product manufacturers and policymakers. Within grazing condition attribute, pasture grazing from specific regions (Ireland, New Zealand and Xinjiang) is more attractive to consumers, due to consumers' image of different countries and national stereotypes, consumer ethnocentrism and animosity, product familiarity and experience, product involvement and some cultural value differences (R. Yang, Ramsaran, & Wibowo, 2018).

We observed a differential moderating effects of preferences for naturalness on grass-fed attributes, which provide a useful lens for understanding grass-fed milk consumption. Hypothesis 2- that compare consumers with a stronger preference for naturalness, grazing condition and animal feed attributes have a larger effect on their preferences than consumers with a low preference for naturalness - was also supported. For all attributes except functional improvement, when interacting with preference for naturalness, they exhibit an enhancing effect. These results are significant for the target consumers who prioritize naturalness. When promoting grass-fed milk to this demographic, emphasis should be placed on product methods. It is crucial to be cautious about highlighting functional improvements, as consumers may perceive them as unnatural enhancements.

This study established the possibility of product differentiation for grass-fed dairy products based on different attributes of naturalness. By further communicating the perceived advantages of naturalness to consumers, countries and companies with higher grass-fed standards should be able to gain benefits based on such product differentiation.

Several policy implications can be derived from this study. Firstly, our results found that when consumers buy a food product that is perceived to be natural (grass-fed milk), their primary interest lies in its beneficial nutrients and traditional production methods. Since dairy food suppliers face intense market competition, it is easy to overuse these labels when promoting competitive milk products. The use of nutritional benefits and production labels can appeal to consumers, as these kinds of attributes can influence consumer evaluations of the product and stimulate purchases by reinforcing attitudes towards products associated with naturalness. Therefore, public authorities may consider monitoring the use of such labels, such as specifying the proportions of grazed pasture in the diet. Secondly, our findings suggest that compared to healthy, tasty and sustainable imagery, natural imagery is the most attractive product imagery for consumers. Policymakers should guide and educate consumers that the "Natural" label does not necessarily imply health benefits or specific production methods that consumers might associate with "Natural" label foods. To align natural expectations for grass fed dairy with production realities, it may be preferable to move towards a labelling of natural scores such as Food Naturalness Index (FNI) rather than simply a "Natural" label (Sanchez-Siles et al., 2019).

The results of this study provide insight into how to promote the naturalness of grass-fed milk, and empirically demonstrate differential moderating effect of preferences for naturalness. But there are limitations to our study. Firstly, although our sample is nationally representative, it is not sufficient to support a regional comparative study. Considering the fact that regional disparities in economic development levels and dietary habits can both influence consumers' preferences for milk products, future research in this direction can be valuable. More research is needed to develop a systematic understanding of consumer acceptance and WTP for grass-fed milk. Particular attention should be paid to consumers' response to different ways of naturalness related information disclosure.

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