

Article

Sustainable Meat: Looking through the Eyes of Australian Consumers

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Abstract: Sustainability is a complex and multifaceted concept that comprises environmental, economic, social, and cultural dimensions. Growing consumer concerns over the impacts of global meat production and consumption have led to increasing interest in sustainability initiatives and the use of sustainability labels. Yet, an understanding of what sustainability means to consumers in the context of meat and how consumers relate production-related credence attributes of chicken meat to sustainability remains limited. Between September 2019 and January 2020, an exploratory research study was conducted using a multi-method approach. Participants completed an online survey before participating in a series of eye-tracking choice tasks followed by in-depth interviews. The study revealed that the environmental dimension of sustainability is most important to consumers' definition of a "sustainable food system". Likewise, the sustainability of chicken meat products was most commonly associated with the perceived environmental impact of chicken meat production, followed by animal welfare aspects. Consumers made incorrect inferences about some sustainability labels and these inferences sometimes contributed to positive associations with sustainability. Consumers frequently associated a higher price with higher sustainability, indicating a belief that "doing the right thing" might cost more. This study provides new insights regarding consumers' perceptions of production-related credence attributes and sustainability labels.

Keywords: meat; consumer behaviour; sustainability; food systems; eco-labelling; perceptions; animal welfare; environment; eye-tracking



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1. Introduction

Food systems, from production to consumption, have an important role to play in achieving the United Nations' Sustainable Development Goals (SDGs) [1]. In fact, progress towards several of the SDGs depends on the development of more sustainable food systems [2]. Therefore, it is not surprising that food system issues have been explored in-depth in the sustainability literature, especially regarding the impact of food production and consumption on the environment [1,3]. Research shows that food production and consumption contribute significantly to life-cycle environmental impacts (together with mobility, housing, and energy), and account for 48% and 70% of household impacts on land and water resources, respectively [4,5]. Other sustainability issues relating to social and economic aspects of food production and consumption include food security [1,6] food waste [7], and animal welfare [8].

Animal-sourced products are among the most nutritious foods available to humans [9]. However, the sustainability of products derived from the modern livestock industry is increasingly under scrutiny [10]. Meat, for example, is one of the most criticized animal-based products, creating a "meat crisis" [11]. The critics usually emphasise production-related issues such as the environmental impact (e.g., water usage and greenhouse gas emissions [12]) and the welfare of farm animals [13,14]. If global meat demand growth patterns continue, the amount of meat consumed in 2030 will be 72% higher than the

total in 2000. This demand increase will be due mostly to increasing chicken and pork consumption [1,15].

In Australia, chicken has been the most consumed meat for over a decade, and this trend is expected to continue [16]. On average, chicken meat consumption was an estimated 43.5 kg per capita in 2019, accounting for 48% of total meat consumed (followed by pork, 20.3 kg; beef and veal, 19.7 kg; and sheep, 6.2 kg) [17]. On the production side, chicken meat continues to face challenges, including community concerns related to animal welfare and misperceptions about the use of antibiotics. However, relative to other meat products, chicken meat also has some potential unexploited advantages related to sustainability issues, such as lower greenhouse gas (GHG) emissions relative to beef (Australian conventional production of chicken, 1.9–2.4 kg CO₂ equivalent versus production of beef, 10.3–13.0 kg) [18,19].

To address growing consumer concerns about the impact of meat production, sustainability labels are increasingly used on meat products to provide consumers with point-of-purchase information regarding production-related credence attributes (e.g., ethical and environmental aspects of production) [20,21]. Sustainability labels (also termed ‘eco-labels’) provide consumers with an opportunity to make more sustainable purchase decisions [22]. Labels are instruments that can lessen the asymmetric information problem between producers and consumers, as well as reduce the search costs for consumers who are interested in information on production or process attributes [23]. Information asymmetry occurs when the consumer is unable to identify the credence attribute that he or she is looking for (e.g., environmental friendliness) by the look, taste, or smell of the product [24]. Thus, if a food product has been produced in a more sustainable way, communicating this information via labels is one way of creating awareness among consumers [25].

1.1. Literature Review

The growing literature on sustainable food production and consumption reflects the importance of the topic. However, the current understanding of how consumers relate production-related credence attributes to sustainability in the context of food remains limited [22,26,27]. Generally, findings indicate that consumers’ definitions of sustainable food systems are dominated by environmental aspects, but there is still confusion and a lack of knowledge among consumers regarding the role of food in environmental issues [22,26,28,29]. For example, research focusing on Australian consumers found that when directly asked about “environmentally-friendly food”, the most listed terms by consumers were organic, free-range, and recycled packaging [30]. Further, just 42% of consumers believed livestock farming plays a role in the human contribution to climate change [31].

A cross-country analysis revealed that consumers’ motivations and understanding of sustainability labels influences their use of sustainability labels and this differs across countries [22]. Additionally, consumers’ concerns about sustainability depend on the food product under investigation [22]. To date, only a few consumer studies have focused specifically on the topic of sustainability as it relates to meat or chicken [26,32–34]. Of the studies that focused on chicken meat, one found that “free-range” labels were favoured over other sustainability labels (e.g., carbon footprint and organic); but there was no deeper exploration of associations with sustainability [26]. Other studies examined the impact of providing additional information about sustainability labels on purchase intention or behaviour, and both found positive effects on visual attention to labels [32], or purchase intention of labelled products [33].

The design of the present study was guided by Grunert’s [35] framework, which identifies six possible barriers to consumers’ use of sustainability labels in food purchasing decisions. Three of these barriers are considered in this exploratory study. The first barrier essentially says, “exposure does not lead to perception”; the second says, “perception leads only to peripheral processing”, and the third says, “consumers make ‘wrong’ inferences”.

1.2. Study Objectives

Key study objectives are (1) to explore consumers' perceptions of sustainable food systems and sustainable chicken meat production systems; (2) to examine what (if any) factors consumers use to assess the sustainability of chicken meat products; and (3) to investigate how three sustainability labels (text claims and logos) and prices are used by consumers when assessing the sustainability of chicken meat products.

Key knowledge gaps in the existing literature are addressed in this exploratory research. Firstly, while previous studies have examined consumer perceptions of sustainability in a food context [22,26], no known studies have focused specifically on meat. Secondly, no known studies have sought to investigate how consumers identify sustainable meat products when grocery shopping (i.e., do production-related credence attributes play a role in forming perceptions of sustainability?).

Australia provides an ideal context in which to explore consumers' associations between sustainability and meat attributes due to the relatively high per capita consumption of both meat (in general) and chicken meat. Previous research revealed that 21–23% of Australian consumers were making conscious decisions to purchase meat products labelled as “free-range”, “certified humane”, or “antibiotic-free” [31]. However, if and how consumers relate these labels to sustainability remains unknown.

2. Materials and Methods

2.1. Study Design and Data Collection

This exploratory study used a three-stage multi-method approach to collect data. Participants completed an online survey (Stage 1) before participating in a one-hour study appointment during which they completed a series of 10 eye-tracking choice tasks (Stage 2); this was followed by in-depth semi-structured interviews (Stage 3). Ethics approval for the study was obtained from The University of Adelaide's Human Research Ethics Committee (H-2016-255).

2.1.1. Stage 1: Online Survey

The online survey included questions on socio-demographics (including sex, age, area of residence, educational attainment, and employment status); household characteristics (including income before tax and number of children); consumption frequency of animal-based and plant-based protein foods; dietary preferences [36]; awareness and use of information on chicken meat products (including the labels/claims explored in Stage 2, the eye-tracking choice tasks); and perceptions of sustainability. One of the questions assessing sustainability perceptions asked participants to rank four characteristics in terms of their importance to their definition of a “sustainable food system”: socially responsible; environmentally responsible; economically viable; and cultural integrity/preservation. Sustainability questions were adapted from the literature [22,37]. The time between participants' completion of the survey and their study appointment varied (ranging from 5–30 days).

2.1.2. Stage 2: Eye-Tracking

Eye-tracking is an indirect method of data collection that allows researchers to explore nonverbal processes. In the eye-tracking choice task, consumers were asked to consider 10 sets of two chicken meat products (see example in Figure 1) shown on a computer monitor positioned directly in front of them with eye-tracking software enabled. Each chicken meat product varied in price (five price levels based on prices observed in the market: \$9.00, \$11.40, \$15.00, \$18.60, \$21.00) and several production-related credence attributes (e.g., Free-Range/Accredited Free-Range, RSPCA (Royal Society for the Prevention of Cruelty to Animals) Approved Farming Scheme, and Antibiotic Free). The image of the chicken meat, the meat cut, and the country-of-origin label (“Grown in Australia”) were kept constant in all chicken meat products used in the choice sets. All credence information was provided in text form (claims) and some were in visual form (image/logo). All labels (i.e., on-package

claims and/or logos) and price tags were designed to have the same visual area (5.1 cm) in the choice tasks. Labels and price tags all appeared in the same location each time they were shown. All ten choice set images that were used in the study are provided in Appendix B.



Figure 1. Example of a sustainability choice task.

After visually examining the products on the monitor, participants were asked to indicate which of the two products they believed to be the ‘most sustainable’ product. Completion of the choice tasks was self-paced (i.e., no time limit was set) and participants were not provided with a definition of sustainability. Thus, participants made their choices based on their perceived meaning of sustainability.

The Tobii Pro TX300 (Tobii Pro, Stockholm, Sweden) desk-mounted eye tracker was used to record the eye movements of participants as they completed the choice tasks. Heat maps generated by the eye-tracking software (Tobii Pro Lab version 1.123—Tobii Pro, Stockholm, Sweden) provided a visual representation of the eye-tracking data. Specifically, heat maps showed the distribution of the participants’ attention on the screen to different product attributes when completing the choice tasks (see Figure 2).

Between each choice task, participants were presented with a fixation point (star image) positioned in the top centre of a white/blank screen, which they were instructed to click before proceeding to the next choice task [38]. This aimed to minimise first-fixation bias [39].

The three labels which were considered in the present study and which varied across chicken meat products were all used in the market at the time the research was undertaken. The underpinning standards or requirements for use of each claim or logo are provided in Table 1. At the time of the study, about 90% of the total production of chicken meat sold in Australia was conventionally produced. Free-range chicken meat accounted for 10% to 15% of chicken produced [40].

In Australia, chicken meat products can carry labels with text stating they are “Free-Range” as long as the chickens had some access to the outdoors during the day. There is not a standard definition of free-range chicken meat production systems in Australia and, therefore, the size of and access to the outdoor area can vary considerably from one free-range production system to the next. Free-Range Egg and Poultry Australia Ltd. (FREPA) is a not-for-profit auditing and certification body that oversees free-range accreditation of

one of the two largest Australian chicken meat brands [41]. The FREPA standard specifies various requirements for outdoor access.

The RSPCA Approved Farming Scheme label is another not-for-profit and audited certification scheme for animal products [33] that has specific production standards. Antibiotic resistance has been an ongoing concern in relation to the sustainability of poultry production, therefore we included the Antibiotic Free claim [42].

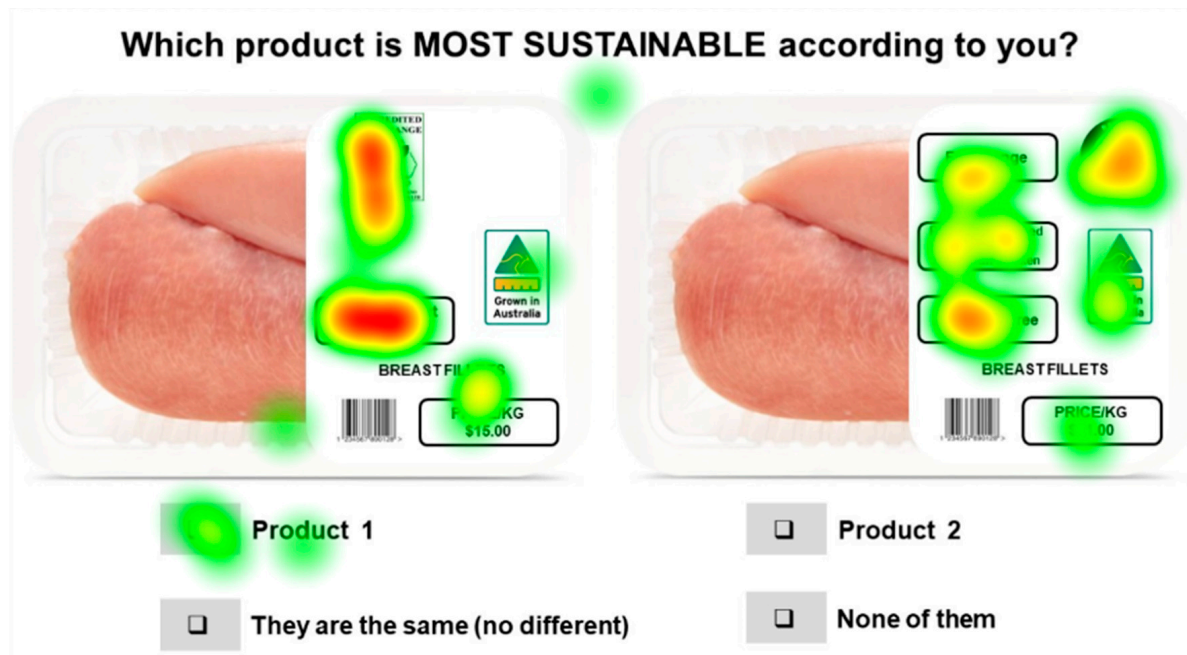


Figure 2. Example of a heat map produced by the eye-tracker (red areas show where attention was most concentrated, yellow areas indicate relatively less attention, green areas show the least attention and no colour indicates no attention).

2.1.3. Stage 3: In-Person Semi-Structured Interviews

After participants completed the eye-tracking choice task, semi-structured in-person interviews were conducted by one of two researchers. All interviews were audio-recorded for analysis. Each participant was asked several general questions: “What comes to mind when you see the word ‘sustainable’ on food or in discussions around food?”, “What comes to mind when you see/think about the word sustainable and chicken meat?” and “How important to you is sustainability when buying chicken meat products? (0 = not at all important to 10 = extremely important)”.

Then, the participant’s heat maps from the eye-tracking task were used as probing aids to discuss each participant’s awareness of claims and logos (labels) and the associations they made with the labels. For example, participants were shown the heat maps for the eye-tracking choice sets and were asked specific questions about each of the labels and price. Specifically, of relevance to this study, they were asked: “Were you previously aware of [label]?”, “Do you think [label/price] has something to do with sustainability?” and “What do you think [label/price] has to do with sustainability?”. The interview guide is provided in Appendix A.



2.2. Participants

Participants were recruited between September and December 2019 using study advertisements shared on social media and displayed in food retail outlets around metropolitan Adelaide and The University of Adelaide city campus. After completing a brief online screening survey, participants were notified of their eligibility via e-mail. A unique link to the online survey was sent to eligible participants. A reputable market research company (Dynata™, Shelton, CT, USA) administered the online survey. Eligible participants were

aged 18-years or older; did the majority of or were jointly responsible for the household food shopping; purchased chicken meat at least once per month; were able to give informed consent; and had no eye conditions that could create difficulties with collection of eye-tracking data. The exclusion criteria included: wearing glasses with bifocal, trifocal, layered or regression lenses; or having cataracts, eye implants, glaucoma, lazy eye, strabismus and/or nystagmus. Additionally, as the eye-tracking equipment was not mobile, participation was restricted to participants who were physically able to attend the appointment at the University.

After completing the online survey (Stage 1), participants were redirected to an appointment-booking website where they could choose a day and time for the eye-tracking appointment (Stage 2), which was immediately followed by the in-person interview (Stage 3). All data were collected between September 2019 and January 2020 on weekdays and weekends. Before data collection began, the methods were pretested with several participants to check the understanding of interview questions and to test eye-tracking procedures.

Table 1. Sustainability labels considered in the study and currently in the Australian market.

Standards	RSPCA Approved Farming Scheme ¹	Free-Range ²	Free-Range ²	Antibiotic-Free ³
				
Confinement in cages ⁴	NO	NO	NO	NO
Antibiotics are allowed under veterinary advice	YES	Depends on accreditation program	If antibiotics are required, meat may no longer be sold as free-range	YES
Growth promoting hormones are allowed ⁵	NO	NO	NO	NO
Birds have access to an outdoor area	NO Birds can be raised indoors; only applies when 'free-range' is written on the logo,	YES Birds must have easy access to an area on which to range	YES	N/A
Animals are fed only certified organic feedstuffs	NO	NO	NO	NO
Animals are never fed grain or grain by-products	NO	NO	NO	N/A
On-farm assessment	YES	YES	YES	N/A

¹ RSPCA Approved Farming Scheme [43], the RSPCA Australia is the Royal Society for the Prevention of Cruelty to Animals and is a well-known charity, ² Free Range Accredited [44], ³ Australian Chicken Meat Federation [45], ⁴ In Australia confinement in cages is prohibited in the production of broiler chicken [46], ⁵ In Australia chickens are not given any growth-promoting hormones, it has been illegal since 1967 [45].

2.3. Analysis

2.3.1. Online Survey

Descriptive analyses (e.g., means and standard deviations) of the online survey data were performed using IBM SPSS Statistics (Chicago, IL, USA, version 25).

2.3.2. Eye-Tracking

Tobii Pro Lab (Tobii Pro, Stockholm, Sweden) was used to specify areas of interest (AOI) for each of the 10 choice tasks. AOIs of particular relevance to this study included the labels which varied (Free-Range/ Accredited Free-Range, RSPCA Approved Farming, Antibiotic Free) and price (which also varied). Additionally, metrics were obtained for other AOIs: country-of-origin label, the meat appearance, the meat cut name ('breast fillets'), and the total area occupied by each product on the screen.

Four eye movement metrics were analysed in this study: fixation duration, fixation count, visit duration and visit count. Fixation duration, the length of time a participant fixates within an AOI, is the most commonly analysed eye movement in eye-tracking research [47,48]. We used 60 milliseconds (ms) as the threshold value for defining a fixation. Fixation count is the total number of fixations that a participant makes in an AOI. Visit duration is the total length of time (ms) a participant spends in the AOI. Visit count is the total number of visits a participant makes to an AOI. A visit is characterized as the time span between the start of the first eye movement inside the AOI to the end of the last eye movement in the same AOI.

For each AOI, values for the 10 eye-tracking choice tasks were calculated for all four eye-tracking metrics (AOI fixation duration, AOI fixation count, AOI visit duration, and AOI visit count). The metrics were exported from the Tobii Pro Lab Software into an Excel spreadsheet, where means and standard deviations (SD) were calculated. Other tests were performed using IBM SPSS Statistics (version 25). One-way analysis of variance (ANOVA) was used for comparison of continuous variables. Statistical significance was set at $\alpha = 0.05$ (two-tailed) level.

2.3.3. Interviews

After transcribing the audio recordings, the interview data were analysed in NVivo 12.6 (2020) using a five-step framework approach [49]. The five steps carried out included: (1) familiarization (immersion in the data through reading all of the transcripts and listening to audio-recordings, when necessary); (2) identifying a thematic framework (identifying key ideas/themes in the data based on the research questions and on a priori themes highlighted in previous research [22], and using these themes to develop a data filtering and coding framework); (3) coding (identifying segments of text that correspond to the themes identified in step 2); (4) charting (arranging the coded text into matrices by theme using NVivo's framework matrix function, and later exporting those matrices to an Excel spreadsheet, to enable comparisons within and between participants); and (5) mapping and interpretation (analysing the key characteristics in the charts according to the research objectives). This framework approach has been used in previous research investigating participants' perceptions, understanding, and experiences related to sustainability and other food-related issues [50–52].

3. Results

3.1. Participant Characteristics

A total of 87 participants completed Stage 1 of the study and 30 of these participants completed Stages 2 and 3. The first column of Table 2 summarizes the socio-demographic characteristics of the 87 participants who completed Stage 1. Column 2 of Table 2 provides sociodemographic information specific to the 30 participants who completed Stages 2 and 3; and for comparison, the third column provides data for the relevant Australian population.

Table 2. Participant characteristics.

	Stage 1 (<i>n</i> = 87)	Stages 2–3 (<i>n</i> = 30)	Australian Adult Population ^c
Gender (females/males)	56%/44%	60%/40%	51%/49%
Age, years			
18–24 years	18%	10%	9%
25–34 years	26%	27%	19%
35–44 years	30%	20%	19%
45–54 years	15%	20%	19%
≥55 years	10%	23%	33%
Educational attainment (university degree) ^a	74%	80%	31%
Household income quintiles ^b			
≤\$35,000	12%	10%	20%
\$35,001–\$65,000	25%	10%	21%
\$65,001–\$105,000	21%	23%	19%
\$105,001–\$165,000	24%	23%	19%
>\$165,000	18%	33%	21%

^a Data is for Australians aged 20–64 years (May 2018) [53], ^b Gross household income per week multiplied by 52 weeks [54], ^c Data from the Australian Bureau of Statistics dataset [55].

3.2. Perceptions of Sustainable Food Systems and Sustainable Chicken Meat Production Systems

3.2.1. Relative Importance of the Four Pillars of Sustainability to Food Systems

In the online survey (Stage 1), participants were asked to consider and rank the importance of the four pillars of sustainability—environmental, social, economic, and cultural—to their definition of a “sustainable food system”. The majority of participants (75%) identified the environmental pillar as the most important followed by economic (20%) and social (14%) dimensions (see Table 3). The cultural dimension, which is a relatively recent addition [56], was the least important pillar for the majority of participants. As the remainder of this results, this section focuses on the findings from Stages 2–3 of the study, in Table 3 we have provided a comparison between the rankings of the participants in Stage 1 (*n* = 87) and the participants completing some or all of Stages 2–3 (*n* = 30). No significant differences in the rankings were found between the larger sample of participants in Stage 1 and the smaller sample of participants that completed Stages 2–3.

Table 3. Percentage of participants ranking each sustainability pillar as the most important pillar to their definition of a sustainable food system and comparison of samples.

Pillar	Most Important Ranking (%)			Mean Rank Score		
	Stage 1 Participants (<i>n</i> = 87)	Stage 2–3 Participants (<i>n</i> = 30)	<i>p</i> -Value	Stage 1 Participants (<i>n</i> = 87)	Stage 2–3 Participants (<i>n</i> = 30)	<i>p</i> -Value
Environmental	75%	69%	0.835	3.61	3.55	1.000
Economic	20%	21%	0.959	2.54	2.48	0.717
Social	14%	10%	0.960	2.69	2.69	0.792
Cultural	2%	0%	0.574	1.48	1.31	0.285

Q. The following characteristics are often used to describe SUSTAINABLE food systems. Rank the FOUR characteristics in terms of their importance to your definition of a sustainable food system.

3.2.2. Importance of Sustainability When Purchasing Chicken Meat

During the interviews, participants ($n = 30$) were asked to indicate how important (0 = not at all important to 10 = extremely important) sustainability is to them when buying chicken meat products. The mean importance score of sustainability to participants in their chicken meat purchasing decisions was 5 out of 10 (medium importance). One-third ($n = 10$) of participants indicated that sustainability was of high importance (score $\geq 7/10$); 50% ($n = 15$) said it was of medium importance (score 4–6/10) and 17% ($n = 5$) said it was of low importance (score $< 4/10$).

3.2.3. Perceived Associations between Chicken Meat and Sustainability

During the interviews (Stage 3), participants were asked “what comes to mind when you see the word sustainable on chicken meat?”. Table 4 shows the factors discussed, grouped by the level of importance participants placed on sustainability when purchasing chicken meat products. Most participants were able to discuss some factors that they associated with sustainability and chicken meat. Answers were generally balanced across the low, medium and high importance groups for the majority of dimensions, considering the share of participants in each group: low (17%, $n = 5$), medium (50%, $n = 15$), and high (33%, $n = 10$).

The environmental impact dimension of sustainability was most often discussed by participants. When discussing environmental impact, participants often compared the impact of chicken production to other food-producing animals (e.g., cows and fish). Participants generally perceived chicken production to have a relatively lower environmental impact. For example, one participant believed that chicken meat would be more sustainable than beef due to lower methane emissions and less land-use demand; and would be more sustainable than fish due to reductions in the fish supply that her family members had observed when fishing.

“... well chicken doesn't produce much methane because they don't fart, I don't think. I've never really considered it. Yeah, less sustainable. (...) So, the cows obviously produce more methane and then in terms of how they're killed, I just think that it's less sustainable, also because of how big they are. They obviously need more room and then they're also grazing on farm or land. (...) I just think we're over-fishing in a lot of places (...), you can tell because (...) my husband and my dad love crabbing and squidding and fishing, and over the years, even a short amount of time, there's just less things in the ocean because people are just catching them all and they don't have time to reproduce.”

(Participant #9, Medium importance, female, 30 y, university degree, income Q5)

Animal welfare was the dimension mentioned second-most frequently. Participants showed general perceptions that sustainability encompasses animal welfare.

“So, I equate sustainable with ethical so like whether the welfare of the chicken is the primary concern.”

(Participant #36, Low importance, female, 26 y, university degree, income Q4)

Economic and social dimensions were also discussed. The affordability of the product was discussed in terms of the cost-effectiveness of production (affordability for producers) or of the final product (affordability for consumers). Additionally, one consumer hinted at making trade-offs between dimensions (environmental and economic).

“To me, as I said, sustainability is more economic than anything else. It’s also got to be sustainable for the producers in Australia.”

(Participant #53, High importance, female, 64 y, university degree, income Q4)

“I was thinking about environmental concerns more than my personal sustainability (laughs), so obviously buying a higher costing chicken breast is less sustainable (laughs) for me personally, if you could think about it like that. But I was thinking more of environmental concerns.”

(Participant #62, High importance, female, 28 y, university degree, income Q2)

A few participants also expressed the view that the use of antibiotics in chicken meat production is not sustainable. Lack of antibiotic use was believed to be associated with better animal welfare and/or positive human health outcomes.

Labels, including those not used in the eye-tracking task, were also mentioned when discussing sustainability and chicken meat. One male participant discussed a label that he had seen on red meat products that addressed the total life-cycle impact (carbon neutrality). While he perceived this label positively, he believed the label was unlikely to be adopted by the chicken meat industry due to a perception that the total life-cycle impact of chicken was negative relative to beef and lamb. He explained that he believed that chicken meat production can be positive on gross greenhouse gas emissions, but when compared to beef and lamb it is more negative as it does not have sequestering potential. This highlights that some participants are aware of the complexity of sustainability-related issues with regards to the different environmental implications of different livestock production systems.

“... there’s a wholesaler in Melbourne that’s actually started promoting carbon neutral meat (for beef and lamb) and so they source meat from people that have actually measured their carbon footprint and then they’ve calculated the downstream carbon use and then offset the total which I think is excellent. I know if I was in the chicken industry I might not want to go too far down that track because at the moment the chicken industry has shown, because they talk about gross emissions, and gross emissions chicken meat is fantastic compared to beef and lamb but on cycle emissions, it doesn’t have any sequestering in it. It’s just out. Whereas the beef and lamb industry have huge sequestering that they can do.”

(Participant #89, Medium importance, male, 47 y, university degree, income Q4)

Table 4. Dimensions discussed when asked, “what comes to mind when you see the word sustainable on chicken meat?” ($n = 30$).

Dimensions	Categories (Examples of the Most Relevant Type of Answers)	Level of Importance Placed on Sustainability			Total ($n = 30$)	% ($n = 30$)
		Low ($n = 5$)	Medium ($n = 15$)	High ($n = 10$)		
Environmental pillar/impact	Less use of water	1	2	3	6	20
	Reduced environmental impact	1	2	2	5	17
	Less use of land/without destroying	1	1	1	3	10
	Less production of waste/food waste		1	1	2	7
	Less food miles (shorter distance from farm to point of purchase)		1	1	2	7
	Reduced carbon emissions caused by food production		1		1	3
	Using less packaging		1		1	3
	Reduced chemicals used in food production			1	1	3
Animal Welfare	Animal welfare-friendly food production practices, indicated by specific labels (e.g., Free-range and RSPCA)	2	3	3	8	27
	Animal welfare-friendly food production practices, no specific examples or labels cited		2	2	4	13
	Antibiotics not being used improves animal welfare		1	1	2	7
	Don't think animal welfare relates to sustainability		1		1	3
Economic and Social pillars/impacts	Farmers maintaining production and profits		3	3	6	20
	Affordable for consumers	1	1	2	4	13
	Fair working conditions and wages for food producers (e.g., Grown in Australia label, cited once)		1	2	3	10
Information on labels	Other examples cited: organic ($n = 1$), carbon neutral ($n = 1$) and sustainable ($n = 1$)	1	2		3	10
	Current labels don't help to decide	1	1		2	7
	Don't look for information on labels			2	2	7
	Sustainability is not in the 'back of the head' while shopping		1		1	3
Antibiotic use	Look for information on labels			1	1	3
	Antibiotics not being used improves animal welfare		1	1	2	7
	Antibiotics not being used improves the healthiness of foods		1		1	3
Farmland conservation	Farmland conservation for multiple generations (will sustain for a long period of time)	1	1	2	4	13
Healthier for consumers	Healthier food products		3		3	10
Don't know	Don't know/No thoughts		1		1	3

3.3. Factors Consumers Use to Assess the Sustainability of Chicken Meat Products

Table 5 provides the metrics from the 10 eye-tracking choice tasks, including the average fixation time, the average fixation count, the average fixation duration, the average visit count, and the average visit duration for the AOIs (labels and price). Although 30 participants completed Stage 2, the data available for analysis from this stage is limited to 28 participants due to technical issues with the eye-tracking software.

Of the sustainability labels considered in this study, the Free-Range logo was most frequently fixated on, followed by the Antibiotic Free and Free-Range text claims. As a point of comparison, we also provide the metrics for the Grown in Australia label (country of origin labelling information is required on all packaged meat sold in Australia), price, cut, and meat appearance.

Curiously, the 'Grown in Australia' label was fixated on by the majority of participants, even though this label was present on all of the products included in the eye-tracking tasks. This could be an indication that origin is an important factor used to signal sustainability.

3.4. Perceptions and Use of Sustainability Labels and Prices When Assessing the Sustainability of Chicken Meat Products

Table 6 shows the participants' perceived associations between each of the sustainability labels and price, and the sustainability of chicken meat products. The main results for each sustainability label and price are presented in the subsections below.

3.4.1. RSPCA Approved Farming Scheme

Most participants (87%) were aware of the RSPCA Approved label and there was a common perception that farmers who care about animal welfare issues are also more likely to care about the environment.

"I was thinking that they might be more sort of 'earthy' (laughing)."

(Participant #79, Low importance, female, 42 y, university degree, income Q5)

"I would like to think something that's bad for the chickens is also going to be bad for the environment. So environmentally I would say that you're probably better off with that stamp."

(Participant #61, Low importance, male, 36 y, no university degree, income Q4)

The association with sustainability was also influenced by participants' trust (or lack of trust) in the RSPCA label, with higher trust in the label positively associated with sustainability. However, despite trusting the label, one participant mentioned that he prioritizes the overall amount of meat produced, over the label, when thinking about sustainability.

"You can be like very nice in the RSPCA approved farming, but if you kill way too much then it's not, and then it's not sustainable."

(Participant #17, Low importance, male, 22 y, university degree, income Q1)

Results of the interviews also suggested that some participants associated RSPCA Approved labels with aspects of sustainability that are not explicitly considered in the production system/labelling criteria (i.e., they make "wrong" inferences). For example, despite some participants' perceptions, the RSPCA Approved label alone does not guarantee that animals have access to the outdoors; rather it only guarantees that meat chickens were raised in a housing system that conforms to RSPCA welfare standards. The RSPCA Approved logo must carry specific words which indicate that the birds had access to an outdoor area to guarantee the chicken meat comes from animals that had access to an outdoor range (see Table 1).

Table 5. Eye-tracking data from sustainability choice tasks expressed as mean \pm standard deviation ($n = 28$).

Labels/Claims (Areas of Interest)	Free-Range, Text	Free-Range, Logo	RSPCA Approved, Logo	Antibiotic Free, Text	Grown in Australia	Price	Cut	Meat Appearance
Number of choice tasks in which label is shown	7	5	7	5	10	10	10	10
Average % fixated each time label shown ¹	90% ^{c,d}	96% ^d	71% ^b	94% ^d	94% ^d	88% ^{c,d}	76% ^{b,c}	44% ^a
Average fixation count (number)	3.12 \pm 1.68 ^{c,d}	4.03 \pm 1.94 ^d	2.20 \pm 1.45 ^{b,c}	3.94 \pm 1.69 ^d	2.14 \pm 0.87 ^{b,c}	2.01 \pm 1.14 ^b	1.14 \pm 0.64 ^{a,b}	0.38 \pm 0.26 ^a
Average fixation duration (seconds)	0.66 \pm 0.40 ^{d,e}	0.89 \pm 0.46 ^e	0.46 \pm 0.30 ^{c,d}	0.79 \pm 0.33 ^e	0.41 \pm 0.17 ^{b,c}	0.38 \pm 0.23 ^{b,c}	0.22 \pm 0.13 ^{a,b}	0.06 \pm 0.05 ^a
Average visit count (number)	2.36 \pm 1.26 ^d	2.33 \pm 1.00 ^d	1.30 \pm 0.72 ^{b,c}	2.53 \pm 1.07 ^d	1.63 \pm 0.58 ^c	1.43 \pm 0.71 ^{b,c}	0.94 \pm 0.52 ^{a,b}	0.34 \pm 0.19 ^a
Average visit duration (seconds)	0.69 \pm 0.41 ^{d,e}	0.95 \pm 0.49 ^f	0.50 \pm 0.33 ^{c,d}	0.83 \pm 0.35 ^{e,f}	0.43 \pm 0.18 ^{b,c}	0.40 \pm 0.25 ^{b,c}	0.22 \pm 0.13 ^{a,b}	0.06 \pm 0.06 ^a

^{a,b,c,d} Values followed by different letters are significantly different ($p < 0.05$) based on results of Tamhane's T2 multiple comparison test. ¹ The 'Average % fixated each time label shown' values were calculated for each AOI based on how many times it appeared in the 10 choice tasks. Example interpretation for Free-Range, text: on average, 90% of participants fixated on this label when it was shown in a choice task.

Table 6. Perceived association between the labels and price and the sustainability of chicken meat products ($n = 30$).

Dimensions	Categories (Examples of the Most Relevant Type of Answers)	RSPCA Approved		Free-Range		Antibiotic Free		Price	
		<i>n</i>	% ($n = 30$)	<i>n</i>	% ($n = 30$)	<i>n</i>	% ($n = 30$)	<i>n</i>	% ($n = 30$)
Related to sustainability in general	It is accredited/trusted, which influences the positive association with sustainability	4	13	4	13	3	10	1	3
	Extra factor if combined with other labels	3	10			4	13	10	33
	General positive association with sustainability/better than other labels	1	3	6	20	3	10		

Table 6. Cont.

Dimensions	Categories (Examples of the Most Relevant Type of Answers)	RSPCA Approved		Free-Range		Antibiotic Free		Price	
		<i>n</i>	% (<i>n</i> = 30)	<i>n</i>	% (<i>n</i> = 30)	<i>n</i>	% (<i>n</i> = 30)	<i>n</i>	% (<i>n</i> = 30)
Not related to sustainability	Not related to sustainability and not trusted	4	13	5	17	2	7		
	Not trusted/believed the label has low standards	3	10			2	7		
	Not related to sustainability, only with animal welfare	7	23					3	10
	Not related to sustainability because of the higher land requirements of this farming husbandry method when compared to non-free-range			3	10	5	17		
	Not related/nothing to do with sustainability					1	3		
Animal Welfare	Animal Welfare friendly production practices	4	13	6	20	1	3		
	Not in cages/more space	2	7	3	10			2	7
	Happy animals			3	10	7	23		
	Good feed	1	3			5	17		
Environmental pillar/impact	Perceived association between this label and environmental sustainability	5	17	6	20	1	3		
	Reduced use of chemicals and antibiotics			3	10	1	3		
	Chickens are walking outdoors and fertilizing soil			3	10			13	43
Healthier for consumers	Healthier products for consumers			3	10			2	7
Economic and social pillars/impacts	Not sustainable because of its smaller scale			2	7			2	7
	Not sustainable because of the potential to lose chickens in the open field			1	3			4	13
	Farm is run properly and can continue in business	1	3			1	3		
Don't know	Don't know/No thoughts	5	17	1	3	1	3		

3.4.2. Free-Range

The majority of the participants (90%) were aware of the Free-Range label and most perceived free-range chicken meat products to be more sustainable. Positive associations between Free-Range and sustainability related predominantly to the perceived positive animal welfare implications of free-range production systems. Further, similar to the RSPCA Approved label, participants assumed that animal-friendly farmers are more likely to also consider the environmental impact of their production practices. Free-Range was also considered more environmentally sustainable, due to reduced use of chemicals in production and the perceived positive impact of free-ranging chickens on soil health.

“I guess I just assume that if a farm is a free-range farm, then the people that are running that farm are more likely to be a bit more concerned with treating the animals better and maybe they’re concerned with sustainability and the environmental impact as well.”

(Participant #16, High importance, male, 34 y, university degree, income Q5)

“I’d like to think that free-range isn’t going to be washing a ton of chemicals down the drain. Because if you’ve got a battery farm (. . .) you need to wash it down (. . .). You have diseases going through (. . .). I just don’t feel that battery farms and things give too much care into things like that.”

(Participant #62, High importance, female, 28 y, university degree, income Q2)

Conversely, some participants believed Free-Range was not related to sustainability due to the perception that free-range systems would occupy more land, thus reducing the environmental sustainability of production. Likewise, a few participants believed free-range production systems were less economically sustainable due to perceptions that they are smaller scale and the potential loss (e.g., to predators) of chickens when raised in open fields.

“I guess if they’re also free-range that takes up land, and that land has to be farmed, so that’s clearing land for that.”

(Participant #44, High importance, female, 32 y, university degree, income Q3)

“Sort of knowing that free-range is certainly way more exposed to fox predation (. . .) I think that’s probably it, and the potential to lose more chickens and makes them more expensive in the long run.”

(Participant #27, Medium importance, female, 23 y, university degree, income Q1)

3.4.3. Antibiotic Free

Despite only 23% of participants indicating they were aware of the Antibiotic Free label prior to the study, chicken meat products with this label were commonly perceived to be more sustainable. Positive associations between Antibiotic Free labelled chicken meat and sustainability mainly related to perceptions participants had about the negative impacts of antibiotic use in chicken meat production on human health, the environment, and animal welfare. The human health dimension was most frequently discussed with key concerns relating to antibiotic resistance, in addition to general/unspecified health concerns.

“So, the antibiotics was an easy one to make a decision. It’s not sustainable to use antibiotics because the unintended long-term consequences are, to me, the most important thing in terms of the sustainability question. That’s what sustainability is all about, yes you can do this today, but what’s going to happen in 50 years’ time? Overuse of antibiotics is going to cause problems in 50 years’ time.”

(Participant #89, Medium importance, male, 47 y, university degree, income Q4)

“I was probably thinking about the antibiotics staying in the environment, whether they actually dissipate or whether they’re still there the whole time. I don’t know enough about antibiotics, but that’s what I was thinking (. . .) It

could be that never-ending circle, you eat the chicken meat and then it comes out in your excretions and then goes in the waterways and keeps on.”

(Participant #34, High importance, female, 67 y, university degree, income Q5)

“With the sustainability, well, I guess antibiotic use in chicken just springs to mind a warehouse crammed full of chickens, that are all—because they don’t have any room or any sunlight or air or anything—they all need to be pumped full of antibiotics. So as a general rule, I don’t really want to support that model.”

(Participant #62, High importance, female, 28 y, university degree, income Q2)

In contrast, several participants perceived Antibiotic Free chicken meat products to be less sustainable. This view was expressed from an animal welfare perspective—whereby antibiotic use was considered important for maintaining the health of chickens; and from an economic perspective—whereby antibiotic use was considered important for maximizing production efficiency/reducing chicken losses to illness.

“If they use antibiotics, probably it helps a bit with the life or the quality of the chicken.”

(Participant #18, Medium importance, female, 48 y, university degree, income Q4)

“I do remember thinking that if they raised them with antibiotics, it would actually be more sustainable. Again, related to output of production.”

(Participant #70, Low importance, female, 47 y, university degree, income Q4)

Notably, some participants recognized that the Antibiotic Free label helped them to assess the sustainability of the product, despite there being no explicit reference to sustainability on the label. In some cases, participants considered the antibiotic labels together with the other labels present to form their overall perception of sustainability, such that if they associated the other labels with sustainability then they were more likely to believe that Antibiotic Free labelling also contributed to the sustainability of the chicken meat. Conversely, others said it did not help them to decide which was more sustainable.

“But I suppose if it doesn’t tell me directly on the label that it’s sustainable, then I look at other elements of the label that might suggest that as well as these qualities (...) and that they’re not full of antibiotics, then if you accept those things are true, then you could probably put into that bundle that the production of that meat that I’m looking at, was sustainable along the line. But that’s a supposition.”

(Participant #80, Low importance, female, 63 y, university degree, income Q5)

Only two participants said that they had no opinion on the topic of sustainability.

“I don’t have strong opinions on antibiotics (laughing) and maybe I should and I don’t know what sustainable really means, yeah.”

(Participant #79, Medium importance, female, 42 y, university degree, income Q5)

3.4.4. Price

Participants commonly associated higher prices with higher sustainability. This association appeared to be due to beliefs that more sustainable practices would incur higher production costs. In particular, environmentally friendly and animal-friendly production practices were expected to be costlier for producers and ultimately, also more costly for consumers. This is consistent with findings of previous Australian and Italian studies showing that some consumers are willing to pay a price premium for higher animal welfare standards [57–60].

“Probably just more money that goes into it—the chickens need more space, more farmland, more money, you know if they’re not using as many antibiotics then maybe more chickens die (...). I guess that if I saw that it was more expensive then I automatically assume that maybe it was more sustainable.”

(Participant #25, Medium importance, male, 27 y, university degree, income Q1)

“Yes, one would imagine so because it would be more expensive to do the right thing by the environment than to just jam them into a cage and, you know, put all the entrails into the river so I’m paying for that.”

(Participant #80, Low importance, female, 63 y, university degree, income Q5)

In contrast, some participants perceived higher-priced products to be less sustainable, explaining that most consumers would not be able to afford to purchase higher-priced products in the long term. This suggests that consumer affordability is a key aspect of sustainability for some participants. Additionally, several participants did not perceive any associations between price and sustainability.

“To make it sustainable, I’d be looking at the price because I think nobody can, in general, the public can’t continue to pay \$18 kilo (. . .) so that wouldn’t be sustainable long-term.”

(Participant #53, High importance, female, 64 y, university degree, income Q4)

“I found myself leaning to price a fair bit, (. . .) because I wasn’t quite sure from a business perspective how you’re going to be able to sustain a business if you’re not selling a product and if there’s \$21 chicken regardless of how many stamps you put on it versus a \$9 sticker (. . .) you’re going to irrespective look at that \$9 chicken over the \$20 chicken.”

(Participant #61, Low importance, male, 36 y, no university degree, income Q4)

“If I’m looking at sustainability only, then price is not important.”

(Participant #36, Low importance, female, 26 y, university degree, income Q4)

4. Discussion

This is the first known study to examine consumers’ perceptions and understanding of sustainability in relation to chicken meat. This study provides new insight into the role that production-related credence attributes and meat product pricing play in forming perceptions of chicken meat product sustainability. Overall, most participants were able to discuss some factors that they associate with sustainability and chicken meat. Not surprisingly, a broader range of factors were mentioned and discussed by those participants who placed more importance on sustainability in their chicken meat purchasing decisions. Environmental aspects of chicken meat production were most frequently cited when discussing chicken meat sustainability. Further, most participants who discussed the environmental impact of chicken meat production, perceived chicken meat production to be more sustainable than the production of other animal foods.

Insights were generated regarding participants’ use of labelling/credence attributes to inform perceptions of sustainability or to evaluate the sustainability of chicken meat products. Considering the results of the eye-tracking experiment, most labels were noticed (fixated on) by participants. This suggests that lack of exposure to sustainability labels is not likely to be a barrier to the use of the labels [35]. However, the eye-tracking task was conducted in a lab environment and not in a real-life shopping setting (e.g., in a retail outlet) where often other distractions exist, and limitations are placed on attention/information processing.

The RSPCA Approved and the Free-Range labels were both primarily used by participants to signal social aspects (i.e., animal welfare) and environmental aspects of sustainability. Importantly, some participants made incorrect inferences about the production systems underpinning these labels. For example, several participants had misperceptions about RSPCA Approved chicken meat with regards to animals having outdoor access. Likewise, environmentally friendly practices are not explicitly considered in the production system/labelling criteria for either the RSPCA Approved Farming Scheme or most Free-Range production systems [61]. Yet, both labels were known and trusted by the majority of participants, highlighting the need for ensuring clear communication around these labels to avoid misleading and losing the trust of consumers, and to maintain their value in the

market. Integrating environmentally sustainable practices into the certification standards underlying these labels, and/or communicating the environmental benefits associated with existing practices, could help to ensure that practices more closely align with consumer perceptions. Building on recognition and trust could be a good strategy for increasing customer loyalty and profitability.

Chicken meat products with Antibiotic Free labels were commonly perceived to be more sustainable from environmental and social (both animal and human health) standpoints. However, with respect to economic aspects, some participants mentioned that the production efficiency could be adversely impacted by an antibiotic-free production system. It may be important to provide consumers with more accessible information about how antibiotic use relates to the sustainability of meat production systems. However, it will be challenging to communicate given the complexity of the environmental, economic and health-related issues associated with antibiotic use in chicken meat production [42,62].

Product price was also found to influence participants' judgment of sustainability and in fact consideration of price led to participants discussing fair prices for farmers and how the price consumers pay may ultimately influence whether or not the farmers are able to stay in business. Overall, participants expected environmentally friendly and animal friendly production practices to be costlier for producers. While some participants said they would expect to pay a premium for such practices, others noted that products would only be sustainable if they remained affordable. Although previous researchers [63] have noted that market and economic issues are not of direct interest to consumers when considering sustainability, in our study, economic issues were considered by some participants when making decisions around sustainable meat purchases.

4.1. Key Implications

Overall, the information on sustainability perceptions that emerged from this research leads to some recommendations for those involved with the design, use and/or communication of sustainability labels and information related to these labels. For instance, results show that there is a perception among some participants that 'doing the right thing' might cost more and previous studies show that inclusion of on-package sustainability information can lead to higher willingness to pay [64]. Therefore, producers/marketers must clearly communicate their sustainable actions to consumers, particularly the ones that they already do and that consumers may not currently be aware of [27,65–68]

Retailers could help consumers who are concerned about sustainability make more informed chicken meat purchase decisions by simplifying the assessment process at point-of-purchase. Lowering consumers' search costs for sustainability information could be achieved by providing access to relevant information at the point-of-purchase, such as through a QR code, mobile app and/or on-site promotional materials [35]. For example, previous research has found that a video with narration may be an effective presentation format for conveying such information [69].

There is often a certain halo effect triggered by trusted sustainability labels, and this holds even for social sustainability indicators [70]. For example, in this study, some participants wrongly associated environmentally friendly production practices with RSPCA Approved and Free-Range products. These misperceptions often contribute to consumers' overall positive perceptions of sustainability associated with some labels. This could become an issue for the industry if participants lose trust in these labels upon learning the correct meaning. This highlights the importance of companies being transparent and clearly communicating to consumers the production standards underlying each accreditation program. For example, stakeholders in the RSPCA Approved or Free-Range programs may need to partner with existing trusted environmental accreditation programs. This action would help these programs to avoid losing the trust of consumers who might feel they have been misled if/when they learn that their perceptions are more favourable than reality [71].

4.2. Strengths/Limitations

A greater understanding of how consumers perceive and evaluate sustainability in the context of food and meat products can help to identify new strategies for promoting behaviour change. Increasing consumer demand for more sustainably produced meat products could potentially lead to more environmentally friendly/sustainable production practices. Study limitations include conducting eye-tracking tasks in a lab environment, which may produce different results in a real-life setting. However, the lab environment allowed the researchers to conduct in-depth interviews to better capture nuances in consumers' use, perceptions, and understanding of the labels, which may not have been possible in a supermarket setting. Thus, the present study contributes new findings to the growing consumer literature on perceptions of sustainability and understanding of eco-labelling.

Further research on consumers' willingness to pay for "sustainable" meat products—and specifically, for different aspects of sustainability (e.g., environmental and animal welfare concerns)—can provide additional usable insight for producers/marketers. Future studies could compare consumers' current knowledge and behaviour both before and after providing information on different themes (e.g., environmental impact, animal welfare, health) [69]. Future research could also test the impact of different information/messaging on personal motivation to purchase more sustainable meat products.

5. Conclusions

Results of this exploratory multi-method study suggest that the environmental pillar of sustainability is most important to Australian consumers' definition of a "sustainable food system", followed by the economic, social, and cultural pillars. In general, Australian consumers incorrectly interpret many of the production-related sustainability labels in the market. However, results suggest that consumers' use of production-related credence labels to inform their perceptions/judgements of the sustainability of a meat product is less likely to be limited by their lack of awareness and understanding of the label, and more likely to be limited by the relatively lower importance they place on sustainability in their meat purchase decisions. The insights generated by this study can help to inform the communication and marketing strategies of stakeholders seeking to increase consumer interest in sustainability and influence consumers' decision to purchase more sustainable meat products.

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Appendix A

Interview Guide

Questions for Sustainability Choice Sets

What comes to mind when you see the word sustainable on FOOD or in discussions around food?

How do you usually know if a product is sustainable or NOT?

What about CHICKEN MEAT products specifically, what comes to mind when you see the word sustainable on chicken meat?

How important to you is sustainability when you’re buying chicken meat?

→ on a scale where 0 = not at all important and 10 = ‘extremely’ or most important

Ok, so now let’s look at these heatmaps:

Do you think [insert label name] has something to do with the sustainability of chicken meat?

What do you think [insert label name] has to do with the sustainability of chicken meat?

It looks like you didn’t really look at [insert label name], can you think of why that might be?

Can you think of any other information that wasn’t shown here that you would usually use to help you know or decide if a chicken meat product is sustainable?

Appendix B

Sustainability Choice Sets Shown to Participants

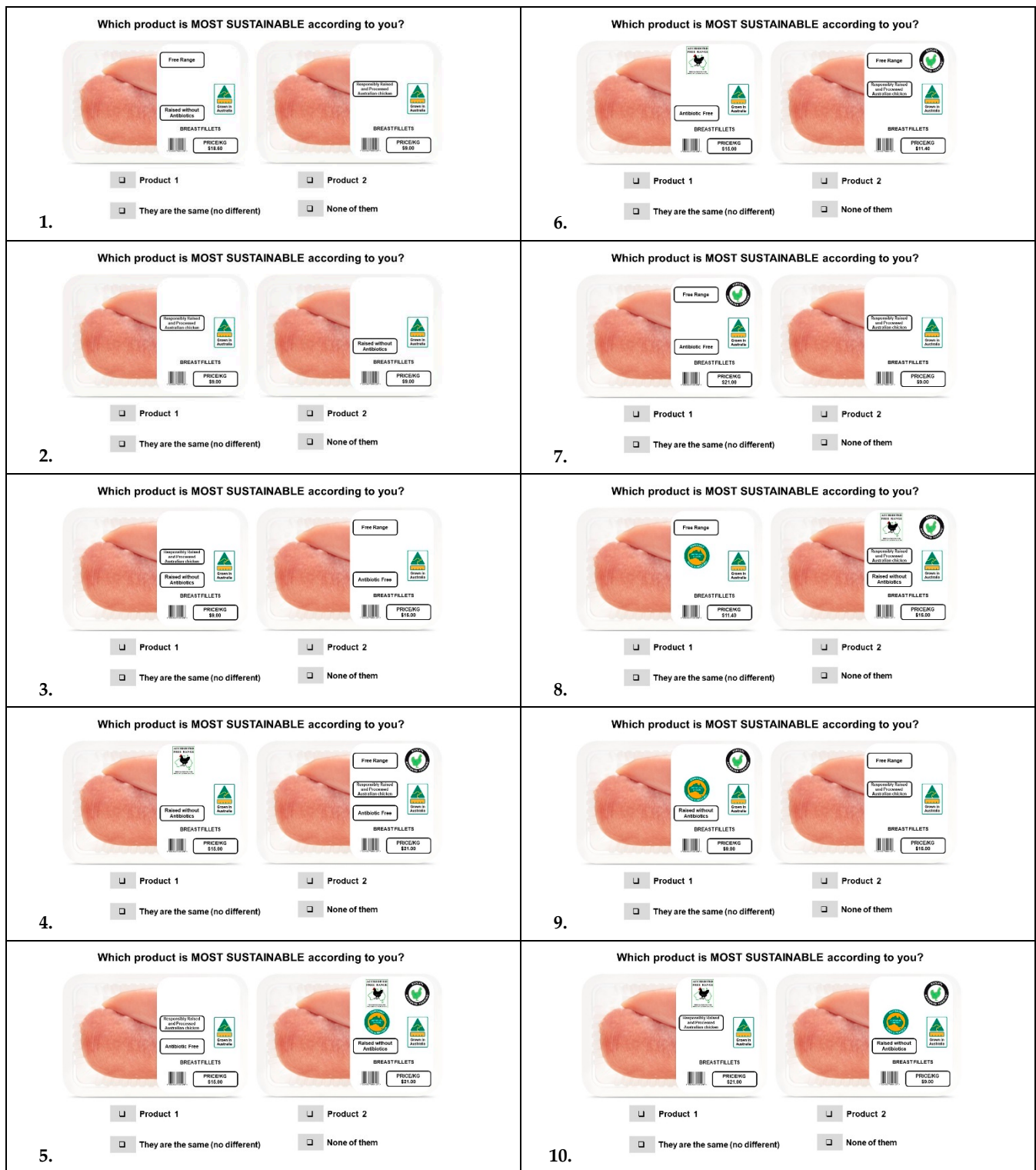


Figure A1. Sustainability choice tasks shown to participants. (1) Choice task number 1; (2) choice task number 2; (3) choice task number 3; (4) choice task number 4; (5) choice task number 5; (6) choice task number 6; (7) choice task number 7; (8) choice task number 8; (9) choice task number 9; (10) choice task number 10.

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