Segmentation of Australian meat consumers on the basis of attitudes regarding farm animal welfare and the environmental impact of meat production

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Abstract. While public concern over the welfare of farm animals is believed to have intensified across Australia in recent years, no empirical research has sought to examine and quantify the heterogeneity in farm animal-welfare (FAW) concerns among Australian meat consumers. The present study is the first to address this knowledge gap. Data were collected in 2015 by using a comprehensive online survey instrument completed by a representative sample of 1009 Australian meat consumers. Sample quotas were set for age, gender and location. Using these data, we were able to segment meat consumers according to their attitudes towards FAW and perceptions regarding the environmental impact of meat production. Six unique segments were identified and characterised by purchase behaviour, livestock-management knowledge, farming background and experience, beliefs regarding the consumer/farmer implications of improved FAW, influential information sources, participation in FAW-related activities and socio-demographic variables. Our findings showed that the majority of Australian meat consumers (70%) hold neutral views regarding FAW. However, there are two segments, termed 'concerned-FAW' (10%) and 'anti-FAW' (20%), which expressed strong views with respect to FAW. Overall, consumer knowledge regarding livestock-management practices was low across all segments, with only 11–42% of consumers indicating that they felt sufficiently informed about FAW. This insight into perceptions of FAW by different segments and the impact of meat production on the environment can assist the industry in developing targeted information campaigns to address consumer concerns and allow better-informed meat purchase decisions.

Additional keywords: credence attributes, cluster analysis, factor analysis, online survey.

Introduction

Australia has the highest per capita meat consumption among OECD countries, with the average Australian consuming 92.5 kg of meat (beef, veal, pork, chicken and lamb) in 2015. While data show a steady increase in Australia's meat consumption over the past two decades, farm animal welfare (FAW) has become a topical issue in recent years (Petrie 2016). Media stories suggesting unethical treatment of animals in livestock industries continue to bring FAW into the public eye. Additionally, the livestock industry is increasingly scrutinised over concerns about the environmental footprint of meat production (Meat and Livestock Australia 2012).

In an attempt to address consumer concerns, retailers and the Australian meat and livestock industry have introduced various production standards and animal welfare-related credence claims. However, despite the increasingly widespread use of animal welfare- and environment-related credence claims in meat markets, no empirical research has sought to quantify the level and heterogeneity of FAW or environmental concerns

among Australian meat consumers. Additionally, no previous studies have focussed on understanding consumer characteristics associated with variations in concerns. While consumer segments with differing FAW views have been shown to exist in Europe (Meuwissen and Van der Lans 2005; Vanhonacker *et al.* 2007), there are limited Australian data regarding consumer attitudes towards animal welfare (Bowd and Bowd 1989; Taylor and Signal 2005; Signal and Taylor 2006), and specifically FAW (Coleman 2007; Humane Research Council 2014). Further, we are aware of only one Australian study that has examined consumer beliefs regarding the environmental impact of meat consumption (Lea and Worsley 2008). Yet, there is potential value to the industry and policymakers in understanding consumer perceptions as this insight can help inform strategies for targeting animal welfare and environment-related information and products to different consumer segments.

Existing literature suggests that there are disconnects between consumers and producers with respect to communication around animal welfare (Kendall *et al.* 2006; Vanhonacker *et al.* 2008).

Specifically, self-perceived 'rational and informed' producers are seen to dismiss the 'emotional and uninformed' concerns of consumers. Conversely, consumers tend to view themselves as ethically driven, and producers as profit-driven (Kendall *et al.* 2006; Vanhonacker *et al.* 2008). Therefore, this raises concerns about the effectiveness of the communication and marketing strategies of the livestock industry, particularly if they are implemented in the absence of a comprehensive understanding of Australian meat consumers' current knowledge, attitudes and perceptions regarding FAW and environmental issues.

Findings from the present research could be used to help improve current communication/marketing strategies. Specifically, the aims of the study were to assess Australian meat consumers' knowledge, attitudes and perceptions related to FAW and the environmental impact of meat production. Using this information, we segment consumers, and characterise consumer segments using a broad range of socio-demographic, psychosocial, knowledge and behavioural variables, some of which have previously been investigated in relation to FAW in European, US and UK studies (Bowd and Bowd 1989; Herzog *et al.* 1991; Paul and Serpell 1993; Taylor and Signal 2005; Boogaard *et al.* 2006; Kendall *et al.* 2006; de Jonge and van Trijp 2013). The resulting insight into how attitudes towards FAW and the environment differ among consumer segments, and how the segments differ with respect to certain consumer characteristics, will not only help appropriately frame information about FAW and environmental standards and credence claims to different segments of Australian meat consumers, but may also help identify the most effective education and communication strategies for increasing FAW and meat-production knowledge across segments.

Materials and methods

Participants and study design

A comprehensive online-survey instrument was completed by a nationally representative sample of 1009 Australian meat buyers in October and November 2015. Participant recruitment and survey administration were via a reputable online panel provider (Powerstats: www.powerstats.com.au, verified 17 July 2017). Roy Morgan meat (chicken, beef, veal, lamb, mutton, pork) buyer data from June 2014 to June 2015 were used to set sample quotas for age, gender and location (ensuring a representative spread across states and territories and city vs country areas). Eligibility criteria included sharing or being the main food shopper for the household, purchasing meat products (defined as 'red meat and poultry') at least monthly, and not working in market research. Ethics approval for the study was obtained from the University of Adelaide Human Research Ethics Committee (H-2014-262).

Variables measured

Questionnaire design was informed by a comprehensive review of the relevant animal welfare and livestock- and meat-production literature (Rozin *et al.* 1997; Schröder and McEachern 2004; Frewer *et al.* 2005; Boogaard *et al.* 2006; Kendall *et al.* 2006; de Boer *et al.* 2007; Kjærnes 2007; Vanhonacker *et al.* 2007; Needham 2010; Fischer *et al.* 2011; de Jonge and van Trijp 2013), as well as information on livestock-management practices

and standards for animal-welfare certification schemes provided on various Australian government and industry-body websites. Questions assessed the following: meat purchase and consumption behaviour; awareness, use and understanding of existing meat product labelling; concerns regarding meat production and consumption; beliefs regarding meat production and farm-animal welfare; knowledge of livestock-management practices; farming background and experience; influential information sources, participation in FAW-related activities, and socio-demographic characteristics. In total, 55 questions were included in the survey, including several matrix questions that elicited responses for multiple items. Only variables relevant to the aims of the present paper are described below.

FAW attitude

In the absence of a universally accepted scale for measuring attitude towards FAW, a pool of 30 items was compiled from the existing literature. Items measuring both expressive FAW attitudes (referring to underlying concerns about animal treatment) and evaluative FAW attitudes (relating to the utility of farm animals and the use of animals to satisfy human needs) were included on the basis of existing literature, suggesting that FAW attitudes comprise both evaluative and expressive components (Kellert 1989, 1996; Hills 1993). All items were scored on a 7-point Likert scale, where 1 = strongly disagree and 7 = strongly agree. Collectively, the 30 items had high internal consistency, indicated by a Cronbach's α of 0.851 (Georgy and Mallery 2001; Gliem and Gliem 2003).

Environmental concern

Concern regarding the environmental impact of meat production was assessed using a 7-point Likert scale item where 1 = strongly disagree and 7 = strongly agree with the following statement: 'I am concerned that meat production harms the environment (e.g. by increasing greenhouse gases)'.

Consumption frequency (beef, chicken, pork and lamb)

The following question was used to measure consumption frequency: 'Considering main meals in a typical week, how often are beef, chicken, pork and lamb products prepared by you and/or members of your household?' This matrix style question included nine response options (number of days per week scored: '1–7', 'less than one' or 'never') for each of the four meat types. Responses were recoded into three categories for analysis ('less than once per week', '1–2 days per week', and '≥3 days per week').

Previous purchase of meat products with credence claims

Self-reported purchase behaviour was assessed using a question that asked whether respondents have previously purchased meat products with specific credence claims (shown in Table 1). A 'yes/no/don't know' response was required for each claim, with 'no' and 'don't know' responses collapsed for analysis.

Main source of meat products

Respondents were asked to indicate their 'main' source (one option) of fresh meat products and sources that are 'sometimes' used (multiple options could be selected), from a list of the

Table 1. Chi-squared tests of the associations between consumer clusters (C1–C6) and self-reported purchase behaviour ($n = 1009$)
Phi coefficient indicates strength of association. In each row, values followed by the same letter are not statistically significantly different (at $P = 0.05$)

Parameter	C1 (%)	C2 (%)	C3 (%)	C4 (%)	C5 (%)	C6 (%)	χ^2	d.f.	*P*-value	Phi
Organic	41.3a	65.3b,c	35.4a	32.9a	53.6ac	85.3b	76.57	5	<0.001	0.28
Free-range	70.6a	77.9ab	53.5c	45.2c	88.4bd	100.0d	73.18	5	<0.001	0.27
RSPCA approved farming	46.6a	61.2b	32.3a	32.9a	72.5b	76.5b	64.42	5	<0.001	0.25
No added hormones	49.8ab	63.3c	36.2b	34.2b	72.5c	70.6a,c	53.56	5	<0.001	0.23
Antibiotic-free	24.0ab	36.1cd	15.0b	19.2abd	34.8acd	52.9c	38.46	5	<0.001	0.20
Humane choice/humanely raised/certified humane	13.8a	24.5b	11.0a	6.8a	29.0b	35.3b	36.34	5	<0.001	0.19
Grown in Australia	64.3a	69.4a	41.7b	56.2ab	71.0a	73.5a	35.12	5	<0.001	0.19
Grain-fed/grain-finished	41.3a	48.6a	26.0b	30.1ab	52.2a	47.1ab	26.30	5	<0.001	0.16
Grass-fed/grass-finished	41.7a	48.3a	26.0b	35.6ab	49.3a	55.9a	23.53	5	<0.001	0.15

following nine options: supermarket (e.g. Woolworths/Safeway, Coles and IGA/Foodland), discount or warehouse supermarket (e.g. Costco), independent butcher or meat shop, ethnic market (such as e.g. Asian and Indian), speciality health, natural or organic retailer, farmer's market, directly from producer/farmer, organic market, internet or direct mail order. An 'other (please specify)' category was also included. For analysis, 'Supermarket' and 'Discount or Warehouse supermarket' were collapsed into one dummy variable, with another dummy variable created for 'independent butcher or meat shop'; only the 'main' source data were used.

Knowledge regarding livestock-management practices

Knowledge was assessed using four statements requiring 'true/false/don't know' responses and four multiple choice questions. These questions were based on information obtained from various reports and websites focusing on the Australian meat industry (Australian Chicken Meat Federation Inc. 2013; Cattle Council of Australia 2013; Sheep Standards and Guidelines Writing Group 2013; Department of Agriculture and Food 2016; Australian Pork Limited 2017). 'True/false/don't know' statements were as follows: 'it is legal to give growth promoting hormones to chickens that are raised for meat in Australia' (F); 'in Australia, no broiler chickens (those that are raised for meat) are raised in cages' (T); 'all sheep in Australia are mulesed (cutting flaps of skin from around a lamb's breech and tail)' (F); and 'farms which are 'sow stall free' may use farrowing crates to protect piglets (farrowing crates: an enclosure closely related to the sow's body size, in which sows are kept individually during and after farrowing)' (T). Multiple choice questions (*correct answers shown in parentheses*) were as follows: 'tail docking in sheep is done (*to prevent blowfly strike*; *to increase production efficiency*)', 'pasture-fed cattle (*can be given hay*, *silage and pasture*)', free range chickens (*have access to an outdoor range and an indoor shelter*)', and 'according to the industry farrowing crates are used to (*protect the piglets from being crushed by their mother*)'. Six response options were provided for each multiple-choice question, including four statements, 'none of the above' and 'I don't know'. A cumulative knowledge score was calculated, with each correct answer assigned a score of one and each incorrect or 'don't know' answer assigned a score of zero. Maximum possible score was nine, with an overall range from zero to eight obtained. Additionally, respondents were asked to indicate how strongly they agreed or disagreed with

the statement 'I feel sufficiently informed about farm animal welfare'; scored on a 7-point Likert scale, where 1 = strongly disagree and 7 = strongly agree.

Farming/livestock background and experience

Farming/livestock background and experience was assessed using the following four items, each requiring a 'yes' or 'no' response: 'my parents, relatives or close neighbours have livestock on their farm', 'I grew-up on a farm with livestock', 'I have worked on a farm with livestock', and 'I have visited a farm with livestock in the last 2 years'. Similar items have been used in previous FAW studies to gauge and assess farming background and experience (Frewer *et al.* 2005; Kjærnes 2007; Vanhonacker *et al.* 2007; de Jonge and van Trijp 2013).

Sources that influence FAW views

In an effort to identify influential information sources, respondents were asked which of the six sources listed in Table 2 have influenced their FAW views over the past few years. Each source required a 'yes/no' response. This question was adapted from Kjærnes (2007).

Participation in FAW-related activities

Participation in FAW-related activities was assessed using the following question: 'Have you taken part in any of the following activities over the last few years?' Nine activities were listed (shown in Table 3), each requiring a 'yes/no' response. A similar question was asked in Kjærnes (2007).

Socio-demographic and household-composition variables

A broad range of socio-demographic and household-composition variables was assessed, many of which have been examined in previous FAW research (Bowd and Bowd 1989; Herzog *et al.* 1991; Paul and Serpell 1993; Taylor and Signal 2005; Boogaard *et al.* 2006; Kendall *et al.* 2006; de Jonge and van Trijp 2013). Variables included in the present analysis were gender (M/F), age (years, continuous variable), area of residence (rural versus metropolitan), educational attainment (university degree versus no university degree), gross annual household income (quintiles 1–2 versus quintiles 3–5), employment status (employed versus unemployed), living with a partner (yes/no), children living in household (yes/no), pet ownership (yes/no), born in Australia (yes/no), practicing a religion (yes/no).

Table 2. Chi-squared tests of the associations between consumer clusters (C1–C6) and sources believed to influence animal-welfare views (*n*Phi coefficient indicates strength of association. In each row, values followed by the same letter are not statistically significantly different (at *P* = 0.05)

Parameter	C1 (%)	C2 (%)	C3 (%)	C4 (%)	C5 (%)	C6 (%)	χ^2	d.f.	*P*-value	Phi
Mass media, like TV, radio, newspapers	40.3ab	57.5c	23.6d	26.0bd	71.0c	58.8a,c	77.79	5	<0.001	0.28
Friends, family and/or colleagues	19.7a	39.1b	11.0a	13.7a	39.1b	64.7b	86.46	5	<0.001	0.29
Animal protection campaigns	24.0a	44.2b	10.2c	15.1ac	63.8bd	79.4d	136.33	5	<0.001	0.37
Visits to farms[A]	13.1a	23.4bc	12.2ac	14.5abc	30.8b	19.4abc	22.43	5	<0.001	0.16
Product information/labelling	25.7a	42.5b	13.4a	20.5a	43.5b	64.7b	68.53	5	<0.001	0.26
Government advertising or information	17.7ab	32.3c	12.6b	15.1abc	31.9ac	29.4abc	35.51	5	<0.001	0.19

[A]*n* = 938 because an item was added after online pilot.

Table 3. Chi-squared tests of the associations between consumer clusters (C1–C6) and participation in animal welfare-related activities (*n*A)
Phi coefficient indicates strength of association. In each row, values followed by the same letter are not statistically significantly different (at *P* = 0.05)

Parameter	C1 (%)	C2 (%)	C3 (%)	C4 (%)	C5 (%)	C6 (%)	χ^2	d.f.	*P*-value	Phi
Avoided purchasing meat or eggs because of the way they were produced (e.g. battery cages, gestation stalls)	38.4a	54.0b	21.6c	9.1c	73.4bd	96.7d	127.20	5	<0.001	0.37
Deliberately chose specific meat products for animal-welfare reasons	23.7a	45.2b	13.5ac	7.6c	68.8d	83.3d	142.65	5	<0.001	0.40
Deliberately purchased free-range or cage-free products	57.6a	72.4b	30.6c	28.8c	79.7bd	100.0d	114.03	5	<0.001	0.36
Encouraged friends or family to purchase farm animal-friendly products	17.1a	40.2b	10.8a	9.1a	54.7bc	70.0c	121.06	5	<0.001	0.37
Read newspaper articles, listened to radio programs, or watched television programs about livestock or poultry farming	44.3ab	52.5ab	21.6c	34.8bc	60.9a	66.7ab	45.50	5	<0.001	0.22
Expressed dissatisfaction or support for livestock farming by signing a petition or writing to a newspaper	10.4a	18.8bc	6.3a	7.6ac	32.8bd	60.0d	80.64	5	<0.001	0.30
Participated in a protest or demonstration related to farm animal welfare	2.1a	10.0bc	2.7ac	7.6abc	7.8abc	23.3b	36.25	5	<0.001	0.20
Contacted a politician on a farm animal-welfare issue	3.7a	13.0bc	2.7a	1.5ac	17.2b	20.0b	41.11	5	<0.001	0.21
Donated money and/or goods, or volunteered time to an animal welfare organisation	17.6a	31.0b	6.3a	10.6a	46.9b	50.0b	72.42	5	<0.001	0.28

[A]*n* = 907 because a question was added after piloting.

Piloting

Piloting was conducted in two stages. First a hardcopy of the survey was piloted with 14 university staff from Adelaide, South Australia. Changes were made to wording and formatting of questions on the basis of feedback from the hardcopy pilot and before programming the survey into online format. The online survey was then piloted with 102 members of the online national consumer panel. After calculating descriptive statistics for all variables, a single change was made to the skip logic to ensure that all participants were shown all response options for the question regarding influential information sources. As this was a minor change, these 102 respondents were included in the final study sample.

Statistical analyses

Statistical analysis was a three-step process. First, an exploratory factor analysis (EFA) was performed in SPSS (Version 22.0; IBM Corp., Armonk, NY, USA) on the pool of 30 items relating to attitudes and views regarding meat production and consumption and farm animal welfare. The KMO measure of sampling adequacy and Bartlett's test of sphericity were performed to check the suitability of factor analysis. To determine whether oblique or orthogonal rotation was more suitable, promax (oblique) rotation was performed and the factor correlation matrix was checked for correlations exceeding

the recommended 0.32 (Tabachnick and Fidell 2001). The highest correlation between factors was 0.35, indicating sufficient correlation between factors to warrant oblique rotation. After performing EFA using principal axis factoring extraction and promax rotation, communalities were examined and items with communalities <0.40 (indicating that less than 40% of the item variance was explained by the extracted factors) were removed one at a time (Osborne and Costello 2009). After this stepwise removal of items with low communalities, the structure matrix and pattern matrix were examined and items with low loadings (<0.50) or cross-loadings (more than one factor loads on variable ≥0.32) were removed stepwise. The final EFA was performed on 10 items and the number of factors retained was based on eigenvalues >1 and number of factors above the point of inflection in the scree plot. The internal consistency of items included in the final factors was measured using Cronbach's α.

Regression-factor scores were calculated in SPSS and used in subsequent latent class cluster analysis performed using Latent Gold (Version 5.1 Statistical Innovations, Inc., Belmont, MA, USA). Latent clusters were derived on the basis of the following two variables: (1) regression-factor scores calculated for the 'human–animal hierarchy' factor, which was the most representative of attitudes towards FAW (continuous variable), and (2) scores on a 7-point Likert-scale item, assessing environmental concerns ['I am concerned that meat production harms the environment (e.g. by increasing greenhouse gases)', rated 1 = strongly disagree to 7 = strongly agree]. Model

performance was checked for up to 10 clusters and the minimum Bayesian information criterion (BIC) was used to identify the optimal solution.

Post hoc Chi-squared tests, including *z*-tests with adjusted *P*-values (Bonferroni method), were then performed in SPSS to characterise clusters by socio-demographics, livestock-management knowledge, farming background and experience, purchase behaviour and FAW perceptions. Characterisation aimed to link differences in FAW and environmental attitudes to observable covariates, and better understand the unique clusters of Australian meat consumers. Level of significance was set at $P < 0.05$.

Results

Factor analysis

The EFA resulted in three factors, which collectively explained 67.8% of the total variance. Required statistical criteria for EFA were met (Field 2000). The KMO >0.5 (0.793) and significant Bartlett's test of sphericity ($P < 0.001$) indicated an adequate sample size. The average communality greater than 0.60 (0.68) indicated that the extracted factors collectively explain sufficient variance in each of the included items, and Cronbach's α >0.70 for each factor indicated good internal consistency of the items retained in each factor. Table 4 shows that the pattern and structure matrices, as well as the communalities, explained variance and Cronbach's α for each extracted factor. All three factors could be meaningfully interpreted and were named on

the basis of the latent variables/factors they were believed to be representing (on the basis of the retained items).

Factor one, named 'emotive meat eaters', explained 33% of total variance and described emotional reactions to meat consumption and meat production (higher scores indicated that consumers associated meat consumption with stronger negative emotions). Factor two, named 'human–animal hierarchy', explained 24% of total variance and described views regarding the use and treatment of animals and the level of concern regarding FAW (higher scores indicated lower concern about FAW). Factor three, named 'consumer benefits of good FAW', explained 11% of total variance and described beliefs regarding the health and sensory/taste benefits of good FAW to meat consumers (higher scores indicated stronger perceived personal benefits).

Cluster descriptions

Model performance was checked for up to 10 clusters. The six-cluster model had the lowest BIC value and was, therefore, determined to be the optimal solution. The following names were assigned to the clusters on the basis of their differing levels of concern for FAW and the environment (see Table 5): Cluster 1, 'neutral-FAW/neutral-environment'; Cluster 2, neutral-FAW/concerned-environment'; Cluster 3, 'anti-FAW/neutral-environment'; Cluster 4, 'anti-FAW/apathetic-environment'; Cluster 5, concerned-FAW/neutral-environment; and Cluster 6, concerned-FAW/concerned-environment.

Table 4.   Results of the exploratory-factor analysis, showing pattern and structure matrices and communalities (C), percentage explained variance (% EV) and Cronbach's α (α) for extracted factors (*n* = 1009)

FAW, farm animal welfare

Parameter	Pattern matrix	Structure matrix	C	% EV	Cronbach's α
Factor 1: emotive meat eaters				33.4	0.94
Eating meat is offensive, repulsive or disgusting	0.83	0.83	0.72		
Eating meat makes me feel ashamed	0.93	0.93	0.86		
The idea that meat comes from an animal gives me an uneasy feeling	0.91	0.91	0.84		
Eating meat makes me feel guilty about animals being raised for their meat	0.89	0.89	0.82		
Factor 2: human–animal hierarchy				23.9	0.79
People exaggerate the feelings and sensitivity of farm animals	0.73	0.69	0.50		
The needs of humans are more important than the needs of farm production animals	0.71	0.68	0.47		
Humans have the right to use animals as they want	0.74	0.76	0.58		
I don't care about farm animal welfare issues	0.61	0.67	0.47		
Factor 3: consumer benefits of good FAW				10.5	0.86
Meat from animals raised with higher welfare standards is healthier for me	0.80	0.82	0.68		
Good animal welfare will improve the taste of meat	0.93	0.91	0.84		

Table 5.   Mean farm animal-welfare (FAW) attitude-factor score and environmental-concern score by cluster (C1–C6; *n* = 1009)

Animal-welfare attitude, mean human–animal hierarchy-factor score, with positive scores indicating anti-FAW attitude and negative scores indicating concerned-FAW attitude. Environmental concern, mean score for a 7-point Likert-scale item assessing environmental concerns ('I am concerned that meat production harms the environment (e.g. by increasing greenhouse gases)', rated 1 = strongly disagree to 7 = strongly agree). In each row, values followed by the same letter are not statistically significantly different ($P = 0.05$)

Parameter	C1 (41%)	C2 (29%)	C3 (13%)	C4 (7%)	C5 (7%)	C6 (3%)
Animal-welfare attitude	−0.03a	0.04a	0.47b	0.94bc	−1.40d	−1.81d
Environmental concern	3.19a	5.29b	3.81ac	1.50d	2.52ce	6.23f

Chi-squared tests of independence found significant associations between cluster membership and the following factors: gender, age, pet ownership, living with a partner, tertiary education, living in metropolitan versus rural areas, household income, employment status and frequency of pork consumption (Table 6). Significant associations were also found with respect to self-reported purchase behaviour (Table 1), knowledge regarding livestock-management practices and farming experience (Table 7), perceptions regarding consumer/farmer implications of improved FAW (Table 8), influential information sources (Table 2) and participation in FAW-related activities (Table 3). For the overall sample, knowledge scores ranged from zero to eight of a possible nine. The median knowledge score was three, with an inter-quartile range of 1–4.

No significant associations were found with respect to being Australian-born, religion, presence of children in the household, main source of meat products (e.g. supermarket or an independent butcher/meat shop), or frequency of beef, chicken or lamb consumption. Each of the six consumer clusters are characterised below.

Neutral-FAW: Cluster 1 vs Cluster 2

Clusters 1 and 2 were the largest clusters, comprising 41% and 29% of the study sample respectively. While consumers in both clusters held relatively neutral views regarding animal welfare (with regression scores of about zero on the human–animal hierarchy factor), consumers in Cluster 2 (C2) were significantly more concerned about the environmental impact of meat production than those in Cluster 1 (C1), who held a more neutral view towards the environment.

While equal proportions of consumers in the two clusters were female and had pets living at home, consumers in the more environmentally concerned cluster (C2) were significantly more likely to live in metropolitan areas, have a university degree, be employed, have a household income in the top three income quintiles for the Australian population, and were less likely to be living with a partner. Consumers in C2 also tended to be younger, with more consumers under the age of 34 and fewer aged 65 years or over, than for C1.

Consumers in C2 were significantly more likely than those in C1 to report previously purchasing meat products with the following claims: 'organic', 'humane choice'/'humanely raised'/

Table 6. Chi-squared tests of the associations between consumer clusters (C1–C6) and socio-demographic characteristics (*n* = 1009)
Phi coefficient indicates strength of association. In each row, values followed by the same letter are not statistically significantly different (at *P* = 0.05)

Parameter	C1 (%)	C2 (%)	C3 (%)	C4 (%)	C5 (%)	C6 (%)	χ^2	d.f.	*P*-value	Phi
Female	51.5a	55.8a	52.8a	20.5b	68.1a	76.5a	45.93	5	<0.001	0.21
Pet(s) at home	56.6ab	60.5abc	54.3b	45.2b	78.3c	82.4ac	26.44	5	<0.001	0.16
Live with partner	70.6a	59.9b	56.7ab	69.9ab	50.7b	50.0ab	22.09	5	0.001	0.15
University degree	23.8a	34.0b	21.3ab	28.8ab	14.5a	32.4ab	17.78	5	0.003	0.13
Live in metropolitan area	56.1a	69.4b	66.1ab	52.1ab	65.2ab	58.8ab	17.29	5	0.004	0.13
Top-three income quintiles	64.1a	75.5b	71.7ab	65.8ab	58.0ab	73.5ab	15.18	5	0.010	0.12
Employed	47.6a	60.5b	56.7ab	46.6ab	49.3ab	55.9ab	13.97	5	0.016	0.12
Age (years)										
<25	9.0a	14.6a	14.2a	4.1a	8.7a	20.6a	13.66	5	0.018	0.12
25–34	10.4a	24.1b	17.3ab	9.6ab	13.0ab	20.6ab	27.69	5	<0.001	0.17
35–49	24.8a	27.6a	35.4a	16.4a	33.3a	35.3a	12.30	5	0.031	0.11
50–64	28.6ab	22.1ab	16.5b	38.4a	30.4ab	17.6ab	17.54	5	0.004	0.13
≥65	27.2a	11.6b	16.5ab	31.5a	14.5ab	5.9ab	38.87	5	<0.001	0.20
Children in household	24.5a	32.0a	33.1a	20.5a	23.2a	29.4a	9.23	5	0.100	0.10
Practice a religion	45.1a	48.3a	49.6a	47.9a	42.0a	35.3a	3.49	5	0.624	0.06
Born in Australia	76.0a	72.4a	76.4a	74.0a	81.2a	79.4a	3.12	5	0.682	0.06
The main meat source is supermarket	79.9a	82.0a	74.8a	74.0a	82.6a	79.4a	4.64	5	0.461	0.07
Main meat source is butcher	16.7a	15.3a	22.8a	23.3a	14.5a	20.6a	5.98	5	0.308	0.08
Beef consumption							12.58	10	0.248	0.08
<Once per week	12.9a	12.2a	13.4a	19.2a	17.4a	17.6a				
1 or 2 times per week	55.6a	62.9a	57.5a	60.3a	46.4a	52.9a				
≥3 times per week	31.6a	24.8a	29.1a	20.5a	36.2a	29.4a				
Chicken consumption							10.97	10	0.360	0.07
<Once per week	6.6a	5.1a	8.7a	9.6a	11.6a	8.8a				
1 or 2 times per week	49.5a	51.4a	51.2a	53.4a	39.1a	61.8a				
≥3 times per week	43.9a	43.5a	40.2a	37.0a	49.3a	29.4a				
Pork consumption							20.20	10	0.027	0.10
<Once per week	49.0ab	51.7ab	42.5b	43.8ab	63.8ab	73.5a				
1 or 2 times per week	43.2a	39.8a	47.2a	50.7a	31.9a	26.5a				
≥3 times per week	7.8a	8.5a	10.2a	5.5a	4.3a	0.0a				
Lamb consumption							12.18	10	0.273	0.08
<Once per week	46.8a	50.3a	44.9a	50.7a	55.1a	67.6a				
1 or 2 times per week	45.6a	39.8a	43.3a	42.5a	40.6a	26.5a				
≥3 times per week	7.5a	9.9a	11.8a	6.8a	4.3a	5.9a				

Table 7.   Chi-squared tests of the associations among consumer clusters (C1–C6), livestock-management knowledge and beliefs regarding consumer/farmer implications of improved farm animal welfare (*n* = 1009)

Cramer's V, Cramer's V coefficient, unless otherwise indicated; indicates strength of association. In each row, values followed by the same letter are not statistically significantly different (at $P = 0.05$)

Statement	Belief	C1 (%)	C2 (%)	C3 (%)	C4 (%)	C5 (%)	C6 (%)	χ^2	d.f.	*P*-value	Cramer's V
Livestock-management knowledge score (≥median)		53.9a	60.2a	33.1b	58.9a	68.1a	67.6a	35.53	5	<0.001	0.19[A]
I feel sufficiently informed about	Disagree	38.8a	38.4a	15.7b	30.1ab	46.4a	44.1a	110.30	10	<0.001	0.23
farm animal welfare	Neither agree/disagree	38.3a	27.2b	73.2c	28.8ab	23.2ab	14.7ab				
	Agree	22.8ab	34.4c	11.0b	41.1c	30.4ac	41.2ac				
Farm animal welfare in Australia	Disagree	44.9a	19.7b	19.7b	78.1c	23.2b	5.9b	359.26	10	<0.001	0.42
concerns me so much that it	Neither agree/disagree	35.0a	21.4b	73.2c	16.4b	15.9b	2.9b				
influences my food purchases	Agree	20.1a	58.8b	7.1c	5.5c	60.9b	91.2d				
To improve farm animal welfare,	Disagree	20.4a	11.6b	9.4ab	42.5c	23.2abc	11.8ab	169.19	10	<0.001	0.29
we must be willing to pay	Neither agree/disagree	38.6a	25.2b	73.2c	30.1ab	14.5b	17.6ab				
a higher price for food	Agree	41.0a	63.3b	17.3c	27.4ac	62.3b	70.6b				
Good animal welfare will cost more	Disagree	28.9a	33.7a	13.4b	37.0ac	56.5c	61.8c	114.67	10	<0.001	0.24
and put farmers out of business	Neither agree/disagree	46.4a	34.0b	75.6c	24.7b	23.2b	23.5ab				
	Agree	24.8a	32.3a	11.0b	38.4a	20.3ab	14.7ab				

[A]Phi coefficient; indicates strength of association.

Table 8.   Chi-squared tests of the associations between consumer clusters (C1–C6) and farming background or experience (*n* = 1009)

Phi coefficient indicates strength of association. In each row, values followed by the same letter are not statistically significantly different (at $P = 0.05$)

Statement	C1 (%)	C2 (%)	C3 (%)	C4 (%)	C5 (%)	C6 (%)	χ^2	d.f.	*P*-value	Phi
My parents, relatives or close neighbours have livestock on their farm	20.9a	17.3a	14.2a	21.9a	27.5a	11.8a	8.10	5	0.151	0.09
I grew-up on a farm with livestock	18.2a	12.9a	10.2a	21.9a	17.4a	14.7a	8.80	5	0.117	0.09
I have worked on a farm with livestock	20.9a	16.7a	16.5a	28.8a	20.3a	23.5a	6.99	5	0.211	0.08
I have visited a farm with livestock in the last 2 years	28.2ab	29.3ab	15.7b	34.2a	29.0ab	32.4ab	11.47	5	0.043	0.11

'certified humane', 'RSPCA approved farming', 'no added hormones' and 'antibiotic-free' (see Table 1). C2 consumers were also more likely to agree with the following statements: 'I feel sufficiently informed about farm animal welfare', 'farm animal welfare in Australia concerns me so much that it influences my food purchases', and 'to improve farm animal welfare, we must be willing to pay a higher price for food'. Consumers in C2 were also significantly more likely than those in C1 to report that their views on FAW have been influenced by each of the sources shown in Table 2. Consumers in C2 versus C1 were also more likely to report performing each of the activities listed in Table 3, with the exception of 'read newspaper articles, listened to radio programs, or watched television programs about livestock or poultry farming', which was performed by about one-half of consumers in both clusters.

Overall, there were no significant differences between C1 and C2 with respect to background or experience with farming (Table 8), or knowledge regarding livestock-management practices in Australia (Table 7).

Anti-FAW: Cluster 3 vs Cluster 4

Clusters three (C3) and four (C4) comprised 13% and 7% respectively, of the study sample. Consumers in both clusters appear to believe that the needs and/or rights of humans take precedence over those of farm animals. In other words, consumers

in C3 and C4 expressed relatively 'negative' or 'anti-FAW' attitudes as indicated by positive regression scores on the human–animal hierarchy factor. While consumers in C4 were also unconcerned or apathetic about the environmental impact of meat production, those in C3 held a more neutral view regarding concerns about the environment. The only significant socio-demographic differences between C3 and C4 related to gender and age (Table 6). Cluster 4 comprised significantly more males and more consumers aged 50–64 years than did C3. Further, Chi-squared tests showed a significant association between age and cluster membership, with significantly more consumers aged ≥50 years observed in C4 than expected.

No significant differences between anti-FAW clusters were found with respect to self-reported purchase behaviour (Table 1), influential information sources (Table 2) or involvement in FAW-related activities (Table 3). However, a smaller proportion of consumers in C3 than in C4 had knowledge scores at or above the sample median; significantly fewer agreed to feeling sufficiently informed about farm animal welfare (11% vs 41%), and fewer had visited a farm with livestock in the past 2 years. Additionally, consumers in C4 were more likely than consumers in C3 to disagree with the statements 'farm animal welfare in Australia concerns me so much that it influences my food purchases', and 'to improve farm animal welfare, we must be willing to pay a higher price for food'. Overall, C3 had the most ambivalent responses to the

statements regarding consumer/farmer implications of improved FAW (Table 5), with significantly more consumers in this cluster (than in all other clusters) responding with 'neither agree nor disagree'.

Concerned-FAW: Cluster 5 vs Cluster 6

Clusters 5 and 6 comprised 7% and 3% respectively, of the study sample. Both clusters had a concerned-FAW attitude, as indicated by negative regression scores on the human–animal hierarchy factor. While consumers in C6 were also concerned about the environmental impact of meat production, those in C5 held a more apathetic view about the environment. No statistically significant differences were found between the two FAW-concerned clusters with respect to socio-demographic variables, knowledge regarding livestock-management practices, farming background or experience, influential information sources or involvement in FAW-related activities. However, significant differences were found with self-reported purchase behaviour (Table 1) and responses to the statements regarding consumer/farmer implications of improved FAW (Table 7). Specifically, consumers in the environmentally concerned cluster (C6) were more likely than those in C5 to report previously purchasing meat products labelled as 'organic' (85% vs 54%, $P < 0.05$), and were 30% more likely to agree with the statement 'farm animal welfare in Australia concerns me so much that it influences my food purchases' (91% vs 61%). In both FAW-concerned clusters, almost one-half of the consumers did not feel sufficiently informed about FAW.

Concerned-FAW vs anti-FAW: C5 and C6 vs C3 and C4

Significant socio-demographic differences between the concerned-FAW and anti-AW clusters (C5 and C6 vs C3 and C4) were limited to pet ownership and gender. More consumers in the concerned-FAW clusters owned pets and significantly more consumers were male in C4 (anti-FAW) than in other clusters. Additionally, frequency of pork consumption (but no other type of meat) significantly differed between concerned-FAW and anti-FAW clusters, with consumers in C6 significantly more likely to consume pork less than once per week than those in C3.

Compared with the anti-FAW clusters, consumers in the concerned-FAW clusters were significantly more likely to report previously purchasing meat products with the following claims: 'free range', 'humane choice'/'humanely raised'/'certified humane', 'RSPCA-approved farming', and 'no added hormones'. Consumers in C6 were also more likely than those in C3, C4 and C5 to report purchasing 'organic' meat products; and more likely than C3 and C4 to purchase 'antibiotic-free' meat (see Table 1).

While no differences were found between concerned-FAW and anti-FAW clusters with respect to farming background or experience (Table 8), there were significant knowledge differences (Table 7). Of all clusters, C3 was least knowledgeable about livestock-management practices, and had the smallest proportion (11%) of consumers who agreed that they felt sufficiently informed about farm animal welfare.

Both FAW-concerned clusters and C2 were significantly more likely than the remaining clusters to agree with the statements, 'to improve farm animal welfare, we must be willing to pay a higher price for food' and 'farm animal welfare in Australia concerns me so much that it influences my food purchases', with the highest rate of agreement for the latter statement in C6 (Table 7). The concerned-FAW clusters were almost four times as likely as C3 and about twice as likely as the neutral-FAW clusters, to disagree with the statement, 'good animal welfare will cost more and put farmers out of businesses'.

Consumers in both concerned-FAW clusters were also significantly more likely than those in the anti-FAW clusters to report that their views around FAW have been influenced by mass media, 'friends, family and/or colleagues', animal protection campaigns and product information/labelling (Table 2). The concerned-FAW clusters were also more likely to have performed each of the animal welfare-related activities listed in Table 3. The only exceptions were 'read newspaper articles, listened to radio programs, or watched television programs about livestock or poultry farming', which was equally likely in C4 and C6, and 'participated in a protest or demonstration related to farm animal welfare', which was significantly more likely in C6 than C3, but equally likely in the other concerned- and anti-FAW clusters.

It is interesting to note that the concerned-FAW clusters (C5 and C6) were similar to the neutral-FAW/concerned-environment cluster (C2), and the anti-FAW clusters (C3 and C4) were similar to the neutral-FAW/neutral-environment cluster (C1) with respect to purchase behaviour, beliefs regarding implications of improved FAW, influential information sources, and participation in FAW-related activities. These results may suggest that consumers in C1, C3 and C4, not only believe that human rights are 'dominant' to animal rights, but that humans have the ability to control the impact of farm animals on the environment.

Concerned-environment: C2 vs C6

Cluster 2 and C6 were the only two environmentally concerned clusters. No statistically significant differences were found between the two environmentally concerned clusters with respect to socio-demographic variables, knowledge regarding livestock-management practices, or farming background or experience. Reflecting the differences in FAW attitudes between the two clusters, the clusters differed significantly with respect to self-reported purchase behaviour (Table 1), perceptions regarding consumer/farmer implications of improved FAW (Table 7), influential information sources (Table 2) and participation in FAW-related activities (Table 3).

Concerned-environment vs apathetic-environment: C2 and C6 vs C4

Significant socio-demographic differences between the concerned- and apathetic-environment clusters were limited to gender, with C4 being the only male-dominant cluster. No significant differences were found between concerned- and apathetic-environment clusters with respect to livestock-management knowledge or farming background or experience. Consistent with the differences in FAW attitudes across concerned- versus apathetic-environment clusters, significant differences were found with respect to self-reported purchase behaviour (Table 1), perceptions regarding consumer/farmer implications of improved

FAW (Table 7), influential information sources (Table 2) and participation in FAW-related activities (Table 3).

Discussion

The present study is the first to examine the existence of unique clusters of Australian meat buyers, segmented according to their attitudes and perceptions regarding FAW and the environmental impact of meat production. Six unique clusters were identified and characterised to gain new insight into how differing levels of FAW and environmental concern may be linked to other characteristics of the individual. This information can be used to target FAW-related information and/or products to specific consumer segments.

Our findings show that despite recent media reports suggesting unethical treatment of farm animals in Australian livestock industries, a large share of Australian meat buyers remain unconcerned about FAW, with 70% of consumers expressing neutral views. Two distinct clusters with neutral-FAW views were identified, one of which was significantly more concerned about the environmental impact of meat production. This more environmentally concerned cluster comprised younger, more educated and higher-earning consumers, who were more likely to be living alone and residing in metropolitan areas. Notably, despite their cluster-defining neutral-FAW views, these consumers were very similar to the concerned-FAW clusters with respect to being more likely than anti-FAW clusters to purchase meat products with FAW-related credence claims. Thus, despite not holding strongly concerned-FAW views, these consumers still reported purchasing meat products with FAW-related credence claims, suggesting that other factors may be motivating these purchase decisions. One possible motivator may be the desire to construct a more socially desirable identity (Bourdieu 1984); by purchasing meat products with FAW-related credence claims, these consumers may be seeking to create the perception that they are someone who is ethically concerned. Another possibility is that these consumers perceive products with FAW-related credence claims to be of higher quality or have other benefits; this could include benefits related to health or taste, which is consistent with the significant correlation we found between the 'human–animal hierarchy' and 'good FAW benefits meat consumers' factors.

Overall, small shares of consumers were either concerned-FAW (10%) or anti-FAW (20%). Our findings also showed that just one-third of Australian meat buyers appear to be concerned about the environmental impacts of meat production, with the majority (61%) expressing neutral views. The extent to which concerns about the environment correspond with knowledge of environmental impacts cannot be determined from our data but should be explored in future studies. Notably, the environmental impact of meat production was not a concern of either of the two anti-FAW clusters. This suggests that consumers who are unconcerned about FAW are also unlikely to be concerned about the environmental impact of meat production. This finding is consistent with other literature linking environmental concerns with FAW concerns (Kendall *et al*. 2006).

The general lack of association between FAW views and frequency of meat consumption, together with the steady increase in per capita meat consumption in Australia over the past two decades, is consistent with previous research showing that FAW views do not always translate into action, as individuals may view FAW from both a citizen and consumer perspective (Schröder and McEachern 2004). For example, from a 'citizen' view point, individuals may be concerned about FAW and believe that animals are deserving of a good life; however, as consumers faced with meat purchase decisions, they may avoid making any connection between meat and live animals being raised for meat (Schröder and McEachern 2004). This could partially explain why a lower frequency of meat consumption is not consistently seen in the concerned-FAW clusters. However, we did find that concerned-FAW clusters were more likely than were anti-FAW clusters to report having previously purchased meat products with FAW-related credence claims, which suggests that some consumers may consider FAW when making meat purchase decisions.

Overall, the finding that concerns about FAW are not directly linked with decreased meat consumption in general, suggests that there are stronger food-choice motivators at play when it comes to meat-consumption decisions. Yet, it is important to note that a limitation of the present study is that our analysis does not put into perspective where FAW and environmental concerns sit in relation to other factors motivating food choices (e.g. nutrition). Thus, while we have identified consumer clusters with differing levels of FAW and environmental concern, the importance of these concerns relative to other factors in the overall meat-purchase decision-making process is not known.

Consistent with European, UK and US literature, our findings suggest that the FAW views of Australian consumers are significantly associated with gender (Herzog *et al*. 1991; Te Velde *et al*. 2002; Taylor and Signal 2005; Kendall *et al*. 2006; Signal and Taylor 2006, 2007) and pet ownership (Paul and Serpell 1993; Paul 2000; Taylor and Signal 2005; Boogaard *et al*. 2006; Kendall *et al*. 2006). The only male-dominant cluster identified in our study appeared to be both dispassionate about FAW and unconcerned about the environment, suggesting that males are more likely than females to show lack of concern for both FAW and the environment. Pet ownership was significantly more likely in concerned-FAW clusters than in the anti-FAW clusters (~80% vs 50%), suggesting that owning a pet contributes to a greater concern for FAW. However, different from previous FAW studies (Boogaard *et al*. 2006; Signal and Taylor 2006), we did not find farming background or experience, or living in metropolitan versus rural areas to be associated with concerned- versus anti-FAW views in our Australian sample.

Another noteworthy association was between FAW views and knowledge, with the largest anti-FAW cluster being the least knowledgeable about livestock-management practices. Notably, this cluster was also the most ambivalent with respect to views regarding the consumer and farmer implications of improved FAW. These consumers may, therefore, not be very receptive to information regarding FAW, which could be a barrier to increasing FAW/livestock-management knowledge. This ambivalence should, therefore, be considered when designing and implementing FAW-related education and marketing campaigns. Additionally, further research would be needed to determine whether this anti-FAW view can, in fact, be influenced through information provision and increased

knowledge of FAW/livestock-management issues, or whether it is more of a conviction, as it is considered in Dutch society (Boogaard *et al*. 2006), and, therefore, not easily amenable to change.

Of particular concern is the finding that few Australian meat consumers feel sufficiently informed about FAW (11–42% across clusters). Mass media, followed by animal-protection campaigns and product information/labelling were most often reported as sources that influenced FAW views over the past few years. These sources could, therefore, be effective methods of disseminating objective FAW information to help consumers feel more informed about FAW issues, and, specifically, more capable of making informed meat-purchase decisions. On the basis of our findings, the anti-FAW clusters may be the most difficult to reach via these sources as only one-in-four reported mass media as influential, and fewer considered the other sources influential. Different strategies may also be required when targeting the two neutral-FAW clusters, with a higher proportion of consumers in the younger and more educated neutral-FAW cluster finding each of the specified information sources influential.

Overall, the lack of knowledge regarding livestock-management practices found in our study, together with the large proportion of consumers who feel insufficiently informed about FAW, suggests that current FAW views may be driven less by facts and more by perceptions (or misperceptions). One limitation of the present study is that the survey did not ask respondents whether they have actively sought out information about FAW or whether they would be interested in receiving information about FAW and what/who would be the most trusted source of this information. Identifying whether and what types of online sources of FAW information would be influential was also not explored in the present study. These are questions for investigation in future research. Notably, findings from the 2014 Animal Tracker Australia survey suggested that the majority of Australian adults believe the least credible sources of information regarding FAW are businesses and corporations, and the most credible sources are NGOs authorised to inspect and enforce animal legislation, farmers and agriculturalists, animal protection/advocacy groups, academics and scientists, and farm-industry associations (Humane Research Council 2014). However, the results reported were for the total Animal Tracker Australia survey sample and not segments with differing FAW attitudes; thus, the value of those findings for targeting unique consumer segments is limited.

Additionally, the findings from the present study regarding environmental concern warrant cautious interpretation due to the use of a single-item environmental-concern scale. While single-item scales have been shown to be valid measures in the social science literature (Robins *et al*. 2001; Abdel-Khalek 2006), further research is required to validate the single-item scale used in the present study. It is also important to note that similar to previous studies that have examined food-related environmental beliefs (Lea and Worsley 2008), our environmental-concern item considers meat production in the broad sense, rather than asking consumers about concerns regarding specific meat types (e.g. chicken, pork, beef or lamb). Further research would be needed to determine whether consumer concerns about the environmental impact of meat production vary by meat type.

Another limitation is the issue of self-selection bias, which is a common concern when conducting survey research. For example, consumers completing the survey may be more interested in the topic being studied (in this case, animal welfare). Further, while quota sampling was used to obtain a sample that was representative of Australian meat buyers with respect to key socio-demographic characteristics, other factors (e.g. psychographic factors such as personal values) may be associated with variation in animal-welfare attitudes (Boogaard *et al*. 2006; Worsley and Lea 2008). Thus, a randomly selected sample may have yielded different findings.

A further consideration to note is that respondents self-reported their purchase and consumption behaviour, which could not be validated through the survey instrument. This raises the concern that reported behaviour may differ from the actual behaviour, particularly among different groups of respondents, thus driving some of the apparent variations. This is an issue for potential control in a future study.

Conclusions

Overall, the results of the present study suggest that FAW is not a polarising issue among Australian meat buyers, with the majority of meat buyers holding neutral views. However, despite holding neutral views, some still purchase meat products with FAW-related credence claims, possibly due to attributing other benefits to products with these claims. The overall lack of knowledge regarding FAW issues and livestock-management practices highlighted in our study suggests that targeted information campaigns may help some consumers make more informed meat-purchase decisions, especially when faced with a multitude of credence claims. The different characteristics of the six unique consumer clusters may assist with targeting campaigns to specific groups of consumers.

Acknowledgements

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