

UNRAVELING THE IMPACT OF BROILER PRODUCTION SYSTEM CHARACTERISTICS ON PERCEPTIONS OF ANIMAL WELFARE: A CONSUMER SEGMENTATION

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Abstract – This research unravels which aspects of broiler production systems contribute most to perceptions of animal welfare, and how this differs between consumers. Using a conjoint design with paired comparisons, respondents were asked to evaluate broiler production systems that were described in terms of seven animal welfare attributes. The results from a hierarchical linear model with random slopes indicated that differences between the attribute levels contributed to explaining the perceived animal friendliness of livestock systems, and that the regression weights differed between consumers. The results of a segmentation study indicated that these differences particularly related to the degree of emphasis put on the attributes by different consumer segments, but that consumers in all segments believed that production system characteristics influenced the level of animal welfare. To some extent, segment membership was related to knowledge about broiler production systems and familiarity with livestock farming. The obtained insight into which welfare aspects, in consumers' minds, most strongly contribute to animal welfare, and the existence of differences between consumers, can be helpful in the development and positioning of welfare concepts in the market, and to improving information provision on product labels, such that it meets the needs of consumers.

Key Words – Broiler production, conjoint analysis, hierarchical linear model, cluster analysis.

I. INTRODUCTION

Although several studies have looked at consumer willingness to pay for meat that has been produced with higher levels of animal welfare [1], and how consumers trade-off animal welfare aspects against other attributes, such as product quality and price [2], there is limited insight into the relative importance of different welfare-related aspects of livestock systems for the perceived animal friendliness of these systems. Vanhonacker

et al. [3] assessed to what extent discrepancies existed between the importance attached to different aspects of animal welfare and the perceived performance of current livestock systems on these aspects. With respect to the housing dimension, aspects related to stocking density, available space, and outdoor access were identified as having strong potential for improvement. Also in the area of transport and slaughter there was a discrepancy between perceived importance and perceived performance. Finally, aspects related to natural behavior were perceived as important, but currently not sufficiently taken into account. Building on this study, the current study aims to unravel which aspects of broiler production systems most strongly influence perceived animal friendliness, and to what extent this differs among consumers. We are particularly interested in consumer differences regarding the size of the effects and differences in the emphasis consumers put on specific welfare aspects. The size of the effects might be related to the degree to which consumers believe that animals can suffer [4], whereas the pattern of the effects might be related to consumers' knowledge of and familiarity with livestock production systems. A more in-depth understanding of the relative importance of different animal welfare aspects in contributing to perceptions of animal welfare might be helpful in developing and positioning of welfare concepts.

II. MATERIALS AND METHODS

Sample

Two-hundred and nine (209) students (124 women and 85 men) at Wageningen University participated on a voluntary basis. They received a financial compensation for their time. Data were collected in February 2012.

Design

Respondents were asked to compare livestock systems that were described in terms of seven animal welfare attributes, where each attribute could take on different levels (Table 1). The selected attributes reflected those applied in animal welfare certification schemes (i.e., “Better Life” from the Dutch Society for the Protection of Animals), and where a discrepancy was observed between the perceived current state in conventional production systems and the desired state. A fractional factorial conjoint design was applied, which included 27 calibration profiles (set A). Respondents performed graded paired comparisons in which they had to indicate to what extent they perceived one broiler system (profile set A) as more or less animal friendly than another broiler system (profile set B) on a scale from -10 (profile A more animal friendly than profile B) to +10 (profile B more animal friendly than profile A). The profiles of set B were constructed through a cyclic design, where the attribute levels of the profiles in set B added one to the level of the profiles of set A.

Table 1 Selected attributes

Attributes	Attribute levels
Outdoor access	1) No outdoor access, no daylight in the barn
	2) No outdoor access, daylight in the barn
	3) Covered outdoor access , min. $\pm 12 \times 12$ cm/chick
	4) Open outdoor access, 1 m ² /chick
	5) Open outdoor access with natural cover, 4 m ² /chick
Indoor space	1) 21 chicks/m ²
	2) 12 chicks/m ²
	3) 10 chicks/m ²
Breed	1) Fast growing (40-42 days old at slaughter)
	2) Slower growing (56 days old at slaughter)
	3) Slow growing (81 days old at slaughter)
Day-night rhythm	1) Unnatural day-night rhythm, one hour dark at night
	2) Natural day-night rhythm, 6-8 hours dark at night
Enrichment	1) No enrichment
	2) Enrichment (e.g. straw, mull, sand or grain)
Transport	1) Conventional
	2) Shorter than 3 hours
Slaughter	1) Conventional procedure (electric water bath)
	2) Animal friendlier procedure (2 phase CO ₂ gas)

Measures

Subjective and objective knowledge about livestock farming was measured with items based on Vanhonacker et al. [5]. The degree to which people believed animals have feelings and thoughts was measured with items such as “production animals have emotions” on a scale from completely disagree (1) to completely agree (7). In addition, study program, gender, and how often they had visited a farm were assessed.

Data analysis

For both set A and set B, twelve dummy variables were created (for each attribute the number of attribute levels minus one) to describe each profile. For attributes with two levels, the last category was used as the reference group. For attributes with more than two levels, the middle category was used as the reference group. Since the score on the dependent variable represents a difference score (i.e. the degree to which one livestock system was perceived as more animal friendly than the other), the predictor variables should also represent difference scores. Therefore, the dummies created to describe the profiles in both sets were subtracted from each other, and entered in the regression analysis as predictor variables. On the basis of 27 observations per respondent, first a hierarchical linear model with fixed effects was estimated to test if differences between the attribute levels contributed to explaining the perceived animal friendliness of livestock systems. No intercept was included, because the dependent variable represents a difference score with a baseline of zero (no difference). Next, to test if the effect of the predictor variables on the perceived animal friendliness of livestock systems differed between respondents, a random effects model (random slopes) was estimated. The third step in the analysis was to identify how respondents differed regarding the extent to which different attribute levels influenced their perceptions of the animal friendliness of livestock systems, with the aim of deriving a smaller set of homogeneous subgroups of respondents. Hereto, individual-level regression parameters were used as classification variables in a segmentation analysis in Latent Gold [6]. The most suitable number of segments was identified on the basis of Log-likelihood statistics, conditional bootstrap procedures, the classification error, bivariate residuals, and

segment sizes. Differences between segments were evaluated in terms of the size and pattern of the regression parameters, as well as the different descriptive variables related to, for example, their knowledge of animal production systems.

Table 2 Unstandardized parameter estimates of the random slopes model

Attribute	Level	Est. (b)	SE
Outdoor access	1	-1.66***	(0.086)
	2	-1.25***	(0.068)
	4	0.60***	(0.075)
	5	2.04***	(0.12)
Indoor space	1	-1.55***	(0.079)
	3	0.70***	(0.064)
Breed	1	-0.30***	(0.066)
	3	0.40***	(0.056)
Day-night rhythm	2	1.66***	(0.069)
Enrichment	2	1.25***	(0.061)
Transport	2	0.70***	(0.051)
Slaughter	2	1.26***	(0.071)

Standard errors in parentheses; *** $p < 0.01$. The estimated coefficients should be interpreted against the reference group.

III. RESULTS AND DISCUSSION

The results of the fixed effects model show that all attribute levels significantly contribute to explaining respondents' perceptions of the animal friendliness of livestock systems (see Table 2). The lack of outdoor access negatively influenced perceived animal friendliness, particularly when animals did not have daylight in the barn (outdoor access level 1). In addition, an increase in outdoor space per animal (outdoor access levels 4 and 5) contributed to the perceived animal friendliness of the production system. With respect to indoor space the findings are similar: broiler production systems were perceived as more animal friendly when chicks had more indoor space. The use of fast growing breeds was evaluated as negatively contributing to animal welfare as compared to more slower growing breeds, although the effect of breed was relatively small compared to the other attributes. A natural day and night rhythm, the availability of enrichment materials, shorter transport, and a more animal friendly way of culling broilers were all perceived to contribute to animal welfare. Next, a random slopes model was estimated. All variances were significant,

indicating significant variation between respondents regarding the impact of the different attribute levels on the perceived animal friendliness of broiler production systems.

To further specify this variation, segmentation analysis was conducted. Models ranging from two to seven classes were estimated. The five segment model performed best: it was stable, it had the lowest misclassification rate (9.1%), and the highest entropy R-squared (0.85). In addition, the bivariate residuals were considerably smaller for the five-segment solution compared to the other solutions. Across segments we find that most attribute levels significantly contribute to the perceived animal friendliness of broiler production systems, and that – in all segments – the effects are in the same direction. So respondents tend to agree that the different attributes have implications for animal welfare. However, the segments differ regarding the emphasis they put on different attributes, except for the attribute indoor space. The segments will be discussed below.

Segment 1 (38.3%)

Respondents in this segment often take a middle position compared with other segments, in terms of their regression weights. The attribute transport is perceived as relatively less important ($b=0.57$, $SE=0.057$).

Segment 2 (22.0%)

The importance of outdoor access in determining the animal friendliness of broiler systems is low compared to other segments. Respondents in this segment attach much importance to the breed attribute, particularly the perceived animal friendliness of a slow growing breed ($b=0.84$, $SE=0.14$). In addition, transport ($b=1.13$, $SE=0.14$) and slaughter method ($b=1.78$, $SE=0.13$) are relatively important.

Segment 3 (18.2%)

Respondents in this segment do not attach much importance to day-night rhythm ($b=0.98$, $SE=0.09$) and enrichment ($b=0.98$, $SE=0.069$). Similar to segment 2, they attach much importance to slaughter method ($b=1.90$, $SE=0.22$).

Segment 4 (11.0%)

Respondents in this segment attach relatively high importance to outdoor access ($b_{level4}=1.43$,

$SE_{level4}=0.30$; $b_{level5}=3.23$, $SE_{level5}=0.66$). They perceive a fast growing breed as less animal friendly ($b=-0.97$, $SE=0.20$), although they perceive no difference between the slower growing and the slow growing breed ($p=0.66$). A natural day-night rhythm is seen to contribute to animal welfare ($b=2.75$, $SE=0.27$), and transport ($b=0.39$, $SE=0.089$) and slaughter ($b=0.28$, $SE=0.14$) are relatively less important to base animal friendliness on.

Segment 5 (10.5%)

Respondents in this segment attach most importance to outdoor access. In particular, they, more strongly than other segments, perceive that lack of outdoor access is detrimental to animal welfare ($b_{level1}=-4.08$, $SE_{level1}=0.18$; $b_{level2}=-3.12$, $SE_{level2}=0.24$). Further, respondents attach importance to enrichment ($b=1.90$, $SE=0.29$). Transport is seen as less influential ($b=0.43$, $SE=0.16$).

We find that management practices, as reflected in the selected attributes, influence the perceived animal-friendliness of production systems in all segments. This suggests that respondents in all segments attribute a mind to animals, which is supported by the data ($F(4,203)=1.97$, $p=0.10$; $M=4.66$; $SD=1.16$). Further, it was expected that the different emphasis that was put on attributes by consumers in different segments would be related to knowledge about animal production systems and familiarity with livestock farming. We found partial evidence for this. Objective knowledge did not differ between the segments ($F(4,204)=0.30$, $p=0.87$). However, subjective knowledge (i.e. the extent to which people believed they knew more about how broiler chickens are reared compared to the average person) did differ between the segments ($F(4,204)=2.51$, $p=0.043$): People in segment 5 displayed a higher level of subjective knowledge ($M=5.32$, $SE=0.27$) than people in segment 3 ($M=4.37$, $SE=0.22$). In line with this we found a significant association between segment membership and familiarity with livestock farming ($\chi^2(12)=25.3$, $p=0.013$), where people who had never been on a farm were more likely to belong to segment 3, and people who had visited a farm more than 3 times, or who (had) lived on a farm, were more likely to belong to segment 4 or 5. The distribution of study program and gender was not

significantly different between the segments, respectively $\chi^2(16)=17.48$, $p=0.36$ and $\chi^2(4)=3.15$, $p=0.53$.

IV. CONCLUSION

The results of this study can contribute to optimizing existing welfare concepts and the development of new welfare concepts that match with the preferences of consumers. Currently, labels on meat products produced with higher animal welfare standards often only contain a logo of the welfare certification scheme. However, the logo could be extended with specific information about animal welfare aspects that are perceived as important to consumers, which might increase animal-friendly consumption.

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