Consumer Acceptance of Dual-Purpose Chickens A Mixed Methods Approach

Nanke Brümmer, Wiebke Petersen and Inken Christoph-Schulz
Thünen Institute of Market Analysis, Braunschweig

Abstract

The killing of day-old male chicks of laying breeds is common practice and is widely discussed within society. There are few alternatives available to replace this practice. One possibility is the use of dual-purpose chicken breeds. The use of these chicken breeds would have implications not only for the entire supply food chain but also for consumers. Their meat and eggs have a different appearance, and the resulting products would be more expensive. Furthermore, little is known about consumers' opinions of dual-purpose chickens at present. For this reason, it is essential to explore consumer acceptance of dual-purpose chickens. Mixed methods with a combination of qualitative and quantitative methods proved to be an appropriate approach to learn more about this matter. The results of six focus groups with an exploratory character served as the basis for an online survey with 1,502 respondents in Germany. The data was analysed with the aid of a factor analysis that identified seven factors explaining consumers' attitudes towards dual-purpose chickens. A cluster analysis segmented the respondents into three cluster groups: opponents (37.5%), supporters (23.4%), and indifferents (39.1%). The indifferents represent the largest group of respondents and are therefore an important target group when it comes to potential marketing strategies of products from dual-purpose chickens. The results illustrate the importance of analysing consumer acceptance with regard to emerging issues and before a new product is introduced to the market.

Key Words

dual-purpose chickens; consumer acceptance; focus groups; factor analysis; cluster analysis

1 Introduction

In Germany more than 40 million male chicks are killed after hatching annually. The killing of day-old chicks is common practice in the commercial production of laying breeds because the fattening of layer-type males is unprofitable (RAUTENSCHLEIN, 2016). It is a practice that is used in conventional as well as organic farming. Sex determination in the egg, fattening of layer-type males, and dual-purpose breeds are alternatives to this killing. Breeders of dual-purpose chickens face the problem that meat growth and the number of eggs are not comparable to that of specialized chicken breeds (KÖNIG et al., 2012). This means that the hens lay fewer and smaller eggs and the cockerels put on less meat and need more time and feed to grow. Consequently, eggs and meat from dual-purpose chickens have an unfamiliar appearance to consumers and are more expensive than products from current specialized chicken breeds.

Consumer acceptance of dual-purpose chicken breeds is fundamental for further efforts of breeders, farmers and finally also for potential marketing strategies of products from dual-purpose chickens. The purpose of this study is to gain initial insights into consumer perspectives on dual-purpose chickens because there is a great need for research regarding the emerging debate on killing day-old chicks and possible alternatives. Therefore, this study treats the extent to which the culling of day-old male chicks is perceived as a problem by consumers and how well known the concept of dual-purpose chickens is. In addition, factor and cluster analyses were performed to explore consumer attitudes toward and acceptance of dual-purpose chickens and subsequently identified segments. This study's objective is to find out whether and under which conditions consumers consider dual-purpose chickens as an acceptable alternative to the culling of day-old chicks, and which consumer groups have a supportive attitude towards dual-purpose chickens. The article is structured as follows: In Section 2 the background of the topic and relevant literature are presented. In Section 3 the methods are described. The results of the focus groups and factor and cluster analyses follow in Section 4. The paper concludes with the discussion of the results in Section 5.

2 Background and Literature Review

Since the 1950s the industrialisation and prosperity of society has led to a growing demand for animal

products. The increasing demand for chicken meat and eggs as well as new options in sexing at hatch resulted in a specialization in chicken breeding. Today, there are genotypes for meat and other genotypes for egg production (LEENSTRA et al., 2010; GRASHORN, 2013). As a result, the fattening of layer-type males is unprofitable due to their less efficient meat production and their inability to lay eggs. For this reason, it is common practice that male layer-types are culled as day-old chicks in conventional and in organic farming (RAUTENSCHLEIN, 2016).

In Germany, the consumption of chicken meat and eggs is still increasing slightly. In 2016, the average consumption of poultry meat was 12.5 kg per person (BLE, 2017a). Additionally, Germans consumed on average 235 eggs in 2016 (BLE, 2017b). Concurrently, animal husbandry is at the focus of public criticism. Especially the housing of laying hens and the broiler production are evaluated more sceptically than other animal productions systems (VERBEKE and VIAENE, 2000; VANHONACKER and VERBEKE, 2009; SOSSIDOU and ELSON, 2009; HENG et al., 2013; FAUCITANO et al., 2017). Due to the critical aspects of modern farming practices, such as stocking density, antibiotics and farm size, society is becoming increasingly aware of the killing of day-old chicks (BRUIJNIS et al., 2015). The debate in Germany intensified in May 2016 when a court in North Rhine-Westphalia decided that the killing of male chicks is in line with the existing animal welfare legislation (SÜDDEUTSCHE ZEITUNG, 2016). The reason given for this is the fact that the fattening of layer-type males is economically inefficient and technical solutions for sex determination before hatch are not yet practicable (BECKMANN, 2016). The practice of killing day-old chicks raises moral concerns not only among consumers but is also an issue on the political agenda. That is why the German Ministry of Food and Agriculture is funding research in the field of sex determination in the egg as well as in the field of dual-purpose chickens with the objective of stopping the killing of male chicks (BMEL, 2017).

Dual-purpose chickens are one alternative to the killing of day-old chicks. They can both: produce meat and lay eggs. The hens lay fewer eggs than current specialized laying hens, and the cockerels put on less meat than broilers and require more time and feed to grow; this results in a higher demand for resources (e.g. land, water) (KOENIG et al., 2012; DAMME, 2015). Moreover, the eggs and meat from dual-purpose chickens look different and are more expensive than products from specialized chickens. In most cases, the eggs are smaller (mainly size S and M) and are not only brown or white. The meat of the cockerels has a firmer consistency and a darker colour (GRASHORN, 2013; RAUTENSCHLEIN, 2016). Additionally, the proportion of breast meat, which enjoys great popularity in Germany, is much smaller than in broilers. Therefore, dual-purpose chickens are less suitable for the marketing of cuts such as chicken breasts (KAUFMANN et al., 2016).

LEENSTRA et al. (2011) conducted a study focussing on the public opinion on alternatives to the killing of day-old chicks in the Netherlands. With the aid of focus groups and an online survey, they found out that 58% of the respondents were not aware of the killing of day-old chicks. By means of a documentary film, the participants were informed about the alternatives and were then asked for their opinions. With regard to the utilization of dual-purpose chickens, the results show that the use of dual-purpose chickens was seen positively, but also unrealistic on grounds of the two-fold increase in prices for eggs and chicken meat. A ranking consisting of five potential alternatives showed that the dual-purpose chicken was ranked second directly after the sex determination in the egg. The study has also revealed the complexity of the situation that consumers as well as experts face when evaluating different alternatives to the killing of day-old chicks with only limited information.

In a study of BRUIJNIS et al. (2015), the killing of day-old chicks and both the alternatives sex determination in the egg and dual-purpose chickens were ethically evaluated. To facilitate this, they identified four stakeholder groups with the assistance of experts: society, egg-sector, day-old chicks and the environment. They used an ethical matrix in order to evaluate the perspectives with reference to the ethical principles well-being, autonomy and justice. The findings show that the killing of day-old chicks is problematic from an ethical point of view. Furthermore, the two alternatives raise new ethical dilemmas, such as conflicts between animal-friendly and environmentally-friendly production systems. Therefore, there is currently no morally sound solution to the problem. According to BRUIJNIS et al. (2015), novel innovations that are free from dilemmas are required in this field.

3 Methodological Approach and Data

According to CRESWELL and CLARK (2011), mixed methods combine both qualitative and quantitative

methods with the objective of obtaining a deeper understanding of the research topic than only one method alone could provide. The combination of two methods can contribute to the evaluation of a topic from different perspectives, and they can each compensate for the weaknesses of the other method (DENSCOMBE, 2008). Especially when the subject matter is new, sequencing qualitative and quantitative methods can help to understand and identify the research topic from the outset and quantify the results in a subsequent step (RITCHIE et al., 2014).

In our case, qualitative data was obtained via focus groups in a first step in order to explore the new topic of dual-purpose chickens. Focus groups are an empirical research method which focus on group dynamics and interactions between participants (KÜHN and KOSCHEL, 2011). According to MORGAN (1997: 6) "focus groups are a research technique that collects data on group interactions on a topic determined by the researcher". The objective of focus groups is to create an atmosphere that fosters an almost natural conversational setting with diverse opinions and statements (LAMNEK, 2005). Furthermore, as a result of the responses to other participants the conversational setting leads to deeper insights into motivations and justifications, and stimulates new thoughts (FINCH and LEWIS, 2003). In June 2016, six focus groups, each with six to eight participants, were conducted in Berlin, Munich and Cloppenburg (town located in an intensive poultry-farming region in Lower Saxony). The respondents were recruited by a private market research company. Respondents with a professional background in agriculture, the food industry, or market research were excluded from the study. In addition, quotas for age (between 20 and 70 years old), gender (proportion of males and females between 33.3% and 66.6%) and employment (rate: approximately 67%) were implemented to ensure heterogeneous groups. Each discussion lasted for 90 minutes. All participants were consumers of poultry meat and eggs. Discussion topics were preferences for chicken meat and eggs, the perception of chicken farming, known alternatives to the killing of day-old chicks, and the concept dual-purpose chicken including advantages and disadvantages as well as purchase criteria. The discussions were documented by audio and video and after that transcribed verbatim. The transcripts of the focus groups were evaluated content-analytically in accordance with MAYRING (2015). The discussion topic was not announced in advance to avoid participants becoming familiar with the topic and preventing biases. Questions that were directed at the moderator in the course of the discussion were not answered. At the end of discussion, respondents had the opportunity to ask questions. The topic was introduced by presenting a short information text to the participants.

Based on the outcomes of the focus groups, an online survey among chicken and egg consumers was conducted in February 2017. The survey was administered by a private market research company. Requirements were 1,500 respondents meeting specified sociodemographic quotas. In total, 1,502 respondents completed the questionnaire. The sample was widely representative for the German population with regards to gender, region and age except for education, employment status and income. People having a professional background in agriculture or market research and people having participated in a survey on agriculture or nutrition in the last six months were excluded (see Table 1 for more information). Respondents answered questions concerning inter alia their dietary habits, knowledge of chicken husbandry as well as socio-demographics. Additionally, respondents assessed 40 items on a seven-point Likert scale which ranged from 1 "I do not agree at all" to 7 "I totally agree". These items are based on statements made by the participants in the focus groups. The statements focused on general chicken husbandry, purchasing behaviour, trust and in particular dual-purpose chickens and are listed in Table 2 and 3. A choice-experiment was also included in the questionnaire but will not be presented in this paper.

An exploratory factor analysis was performed on the data from the online survey using IBM SPSS Statistics 24 to define the underlying structure in the data matrix (HAIR et al., 2009). In the factor analysis, factors were generated from many single items which were answered similarly (HÜTTNER and SCHWARTING, 2002). The statements were pretested on a sample of 150 respondents in February 2017 to ensure the suitability of the questions used. To assess the adequacy of the final sample for factor analysis, a sampling adequacy test (results: ranging from 0.787 to 0.969), Kaiser-Meyer-Olkin test (result: 0.934) and the Bartlett test of sphericity (result: 0.000) were performed. Subsequently, a principal component analysis was performed using a promax four rotation (HAIR et al., 2009).

Based on the extracted factors, a cluster analysis was performed to assign respondents to different clusters. Clusters are defined as a group of objects or persons with similar characteristics (CLEFF, 2015; KUß, 2007). With regard to our analysis, these characteristics were the standardised factor levels for each

Table 1. Sample characteristics

	absolute	relative (%)	Germany (%)
Sample size	1,502	100	-
Sex			
Male	760	50.6	49.0
Female	742	49.4	51.0
Median of age group	45 - 54	21.6	44.3
Income			
Median of households' net monthly income (in Euro)	1,700 – 1,999	10.3	-
Place of residence			
North Germany	281	18.7	16.1
West Germany	470	31.3	35.3
East Germany	318	21.2	19.8
South Germany	433	28.8	28.8
School education level			
Currently attending an education institution	15	1.0	3.6
Without a school-leaving qualification	5	0.3	3.7
German Hauptschule (9 school years)	369	24.6	32.9
Polytechnic secondary school (10 school years)	136	9.1	6.7
German Realschule (10 school years)	433	28.8	22.7
Qualification to study at college or university	544	36.2	29.5
Employment			
Employed	799	53.2	61.9
Unemployed	703	46.8	38.1
Median size of place of residence	20,000 – 100,000	23.8	-
Number of persons in the household			
Mean	2.18	-	-
Persons having a child or children	244	16.4	19.7
Experience with agriculture (e.g. farm holidays or farm visits)	687	45.7	-
Ownership of pets	716	47.7	-

Source: own calculation; STATISTISCHES BUNDESAMT (2015, 2016, 2017a, b)

respondent (resulting from the factor analysis). Initially, a hierarchical cluster analysis was conducted with a random subset of 99 respondents of the total sample of 1,502 respondents. In a first step, a single linkage analysis was performed to identify and eliminate outliers. As a consequence of our analysis, two respondents were identified as outliers and eliminated from our sample. Then, Ward's method was applied to identify the potential number of clusters. By analysing the dendrogram and the elbow graph, three clusters that define respondents' structure were identified. Then, all respondents were clustered using a K-means cluster analysis taking the cluster centres from the hierarchical analysis as the initial seed points. In this manner, respondents with homogenous attitudes with regard to dual-purpose chickens were grouped in one cluster, whereas respondents with significantly different attitudes were interpreted as other cluster groups. Bivariate analyses were used to detect further details of the found segments. A discriminant analysis confirmed the validity of the clusters found (BACKHAUS et al., 2011). To increase the understanding of the thus-formed clusters, the mean values of the clusters were statistically analysed using cross-tabulation and the chi-square test for socio-demographic variables and knowledge of chicken husbandry.

4 Results

4.1 Focus Groups

The main results of the focus groups relate to the topics purchase criteria for chicken meat and eggs as well as consumption habits, general perceptions of chicken farming practices, and more importantly, the concept of dual-purpose chickens. The topic killing of day-old male chicks was addressed in every focus group without being mentioned by the moderator. Most of the participants stated that they had previous knowledge of this practice. This could be attributed to the fact that the topic was present in the media at that time because of the court ruling dealing with the killing of male chicks. Regardless, many discussants expressed their disgust towards the killing of day-old chicks. Statements such as 'imagine, they were humans. Shredding the boys and feeding them to animals. That's terrifying' or 'they kill all the men' underline that humanisation of farm animals also plays a role when it comes to this topic. Most of the discussants agreed that the killing of chicks is clearly unacceptable from a moral point of view and they demanded that the practice be discontinued. Others claimed that the chickens would be killed anyway and that it does not matter if sooner or later. Discussing the reasons for killing day-old chicks, it was assumed that 'it's for profit reasons' and 'they don't have enough meat growth'. Additionally, it was mentioned that consumers could not change the situation because they would be powerless compared to the industry. When asked for alternatives, few were known to the

participants. Sex determination in the egg was one alternative that was referred to several times. Some participants also mentioned the fattening of layer-type males as a potential alternative to the killing of day-old chicks, whereas the use of dual-chicken breeds was not mentioned at all. When the participants were asked if they have any idea of what is meant by the term 'dual-purpose chicken', very few could think of anything. The participants responded for example: 'I have no idea what could be meant. Do they have two heads?' or 'It sounds like they were produced in a factory'. The discussants agreed that the naming is inappropriate and causes misleading associations. Since the focus of this study is on consumers' acceptance of dual-purpose chickens, at this stage of discussion the concept of this chicken breed was explained to the participants with the following text: "Dual-purpose chickens are a breeding line in which both the male and the female animals can be used. The males are kept for meat production and the females still lay enough eggs to be kept as laying hens. The eggs of the hens are slightly smaller than "customary" eggs, and fewer eggs are laid per year. This is reflected in a higher price. The male chickens have a longer fattening period than "typical" broilers. For this reason, much more feed is needed, and the meat is correspondingly more expensive".

The reactions towards dual-purpose chickens were mostly positive, but concerns were also raised. The positive aspects that were named were primarily ethical and moral aspects, which include that the life of the males is saved. Others presumed that the meat quality could be better due to a longer fattening period and slower meat growth. The most frequently named negative aspect was the higher price for meat and eggs from the dual-purpose chickens. Some participants described a dilemma between saving the life of male chicks and having to pay more for chicken meat and eggs. Other aspects that were named in this context were the presumption that the fattening of the cockerels would be economically inefficient. Only one discussant remarked that too many resources would be used to produce meat. Another important point that was stressed by some discussants was the fear that genetic engineering would be used to breed dual-purpose chickens. The discussions clarified that for many participants the prevention of killing day-old chicks is not enough, and that they would only buy products from dual-purpose chickens if the husbandry conditions are improved as well. As examples for better husbandry conditions 'good feed', 'no antibiotics', 'much more space' and 'litter' were named. Another important point that was mentioned was a good taste with emphasis on the meat. As expected, the price also played a role when it comes to dual-purpose chickens. The majority of the discussants stated that they would pay a surcharge for meat and eggs on the grounds of 'sympathy with the chicks' or 'to eat meat with a good conscience'. Paying a higher price for meat, which could reduce the general consumption of meat, was seen as a solution by several discussants. Few participants said that they would not be able or willing to pay a surcharge for eggs and meat from dual-purpose chickens. The participants were given the information that the surcharge for eggs would per around 5 cents per egg and that the chicken meat would be 50% more expensive.

4.2 Online Survey

4.2.1 Factor Analysis

Seven factors were identified by conducting an explanatory factor analysis. These account for 55.12% of the overall error variance. Based on HAIR et al. (2009), Cronbach's alpha is consistent and reliable for each factor ($\alpha > 0.6$). The seven factors which describe consumers' attitude towards dual-purpose chickens are:

1. Quality awareness,
2. Rejection of culling day-old chicks,
3. Preference for low prices,
4. Favouring organic farming,
5. Favouring conventional farming practices,
6. Criticism of modern chicken husbandry, and
7. Support for dual-purpose chickens.

Table 2 shows each statement of the first three factors according to their factor loadings. Factor 1 is interpreted as *quality awareness* and describes important quality attributes of animal production such as process quality in chicken husbandry including the husbandry, feeding, transport and slaughtering of the animals, human dietary values and consumer trust. Factor 2 is the *rejection of culling day-old chicks*, which relates to the ethical concerns of culling and the desire of consumers to stop this practice. Factor 3, *preference for low prices*, reveals financial barriers of higher prices for products from dual-purpose chickens and emphasises the importance of low prices for meat and eggs.

Table 3 illustrates each statement of factor 4 to 7 with their factor loading. Factor 4, *favouring organic farming*, reflects the endorsement of organic chicken farming, including the aspects trust, health and consumers' responsibility towards organic animal husbandry. Factor 5 *favours conventional farming prac-*

tices, which describes the importance of the appearance of chicken meat and eggs as well as the acceptance of current farming practices. Factor 6, *criticism of modern chicken husbandry*, criticises farmer's profit orientation which results in the reduction of animal welfare conditions and the general distrust of conventional chicken husbandry. Factor 7 is the *support for dual-purpose chickens*, which indicates a favourable attitude towards dual-purpose chickens with regard to the environmental impact, the appearance and the higher price of dual-purpose chicken products.

Table 2. Factor loadings for factor 1 'Quality awareness', factor 2 'Rejection of culling day-old chicks' and factor 3 'Preference for low prices'

	Factor loading						
	Factor 1 α=0.848	**Factor 2** α=0.850	**Factor 3** α=0.843	**Factor 4** α=0.723	**Factor 5** α=0.698	**Factor 6** α=0.679	**Factor 7** α=0.625
A healthy diet is very important to me.	**0.780**	-0.063	-0.052	0.136	0.019	-0.041	-0.254
The quality of chicken meat is very important to me.	**0.761**	-0.034	-0.248	-0.022	0.145	0.044	-0.189
If the chicken's life is stress free, the quality of meat and eggs is better.	**0.677**	0.088	0.072	0.030	-0.070	0.109	-0.050
I wish for more family farms.	**0.576**	0.026	0.065	0.082	-0.078	0.080	0.105
I don't want to feel guilty when eating meat.	**0.556**	0.099	-0.128	-0.041	0.099	0.130	-0.011
Chickens are living beings and should not suffer under husbandry conditions.	**0.536**	0.271	0.112	0.016	-0.025	0.186	-0.023
I think having connections to farmers can improve trust in their work.	**0.525**	-0.137	0.027	0.177	-0.060	-0.131	0.221
When keeping dual-purpose chickens, their husbandry conditions must be improved as well.	**0.509**	0.087	0.046	-0.117	-0.045	0.251	0.213
The culling of day-old chicks is acceptable because the chicks are used as zoo feed.	0.040	**-0.986**	0.020	0.133	0.029	0.096	0.130
The culling of day-old chicks is acceptable because the life of a broiler is not pleasant anyway.	-0.063	**-0.930**	-0.027	0.192	0.084	0.075	0.069
I don't care if male chicks are being killed directly after hatching because they will be killed sooner or later anyway.	-0.023	**-0.925**	0.040	0.081	0.084	0.156	0.020
The culling of day-old male chicks of laying hens for economic reasons must stop.	0.211	**0.724**	0.144	-0.058	0.023	0.027	0.075
The life of male chicks is more important to me than the higher resource consumption of, e.g., land, feed and water, caused by a longer fattening period of dual-purpose cockerels.	-0.188	**0.604**	-0.033	0.202	0.263	0.085	0.240
If the meat from dual-purpose chickens were to be 50% more expensive than conventional chicken meat, I could not afford it (e.g. 7.50 Euro instead of 5.00 Euro for 500g chicken breast fillet).	0.026	0.076	**0.896**	0.313	-0.006	0.005	-0.085
When buying meat, a low price is important to me.	-0.066	0.005	**0.847**	0.016	0.103	0.085	0.033
When buying eggs, a low price is important to me.	-0.089	-0.008	**0.816**	0.033	0.089	0.057	-0.003
I am willing to pay more for meat, if the animals had a better life in return.	0.161	0.053	**-0.498**	0.210	0.112	0.070	0.174
I am willing to pay 50% surcharge for products from dual-purpose chickens, if the cockerels had a longer fattening period compared to conventional broilers.	-0.014	0.055	**-0.465**	0.235	0.071	-0.070	0.327
When I buy meat in the supermarket, I don't have the animal in mind.	-0.057	-0.175	**0.317**	-0.279	0.252	0.035	0.176

α = Cronbach alpha; Bartlett-test = 0.000; Kaiser-Meyer-Olkin (KMO) = 0.934; MSA (measure of sampling adequacy) lowest/highest value = 0.787/0.969
Source: own calculation

Table 3. Factor loadings for factor 4 'Favouring organic farming', factor 5 'Favouring conventional farming practices', factor 6 'Criticism of modern chicken husbandry' and factor 7 'Support for dual-purpose chickens'

	Factor loading						
	Factor 1 α=0.848	**Factor 2** α=0.850	**Factor 3** α=0.843	**Factor 4** α=0.723	**Factor 5** α=0.698	**Factor 6** α=0.679	**Factor 7** α=0.625
I only trust organic chicken farming.	0.023	-0.082	0.139	**0.940**	0.063	-0.147	-0.019
Organic meat and eggs are healthier than conventional products.	0.062	-0.157	0.178	**0.906**	-0.080	-0.120	-0.027
It is important to me that the public meat consumption decreases in long-term.	0.108	-0.093	0.092	**0.638**	-0.110	0.198	-0.035
I consider the animal husbandry conditions when buying meat in the supermarket.	0.018	-0.055	-0.229	**0.576**	-0.014	-0.040	-0.011
The white colour of chicken meat is very important to me.	-0.044	0.083	-0.080	0.202	**0.809**	0.133	-0.358
As a consumer, I cannot change the current situation when buying meat and eggs (intensive chicken farming, killing of day-old chicks).	-0.207	-0.042	0.085	-0.137	**0.587**	0.186	-0.033
When buying eggs, I preferably choose to buy large eggs.	0.051	-0.068	0.017	0.046	**0.581**	0.159	-0.160
Intensive farming is part of the modern world.	0.164	-0.066	-0.072	-0.228	**0.569**	-0.016	0.015
When food scandals occur, I change my purchase behaviour, but in the long-run I fall back into old consumption patterns.	-0.130	0.031	0.216	0.074	**0.473**	0.007	0.226
I am satisfied with products (eggs and meat) from the conventional chicken husbandry.	0.089	-0.016	0.223	-0.222	**0.430**	-0.251	0.069
Conventional chicken farming is not about animal welfare but all about profit for the farmer.	0.184	-0.131	-0.016	-0.231	0.107	**0.753**	0.112
In todays' chicken farming, there is no relationship between the farmer and animal.	0.147	-0.155	0.061	-0.120	0.090	**0.722**	0.002
Chicken farmers are not being controlled sufficiently.	0.133	0.036	0.125	0.117	0.076	**0.643**	-0.035
I trust the declaration of the husbandry system on the packaging of chicken meat and eggs (e.g. organic, free-range).	0.273	0.046	0.121	0.371	0.139	**-0.578**	0.127
Conventional chicken farming is cruel to animals.	-0.047	0.112	0.059	0.332	0.038	**0.533**	0.084
I trust conventional chicken farming.	0.214	-0.018	0.110	-0.072	0.419	**-0.460**	0.071
Broilers grow too fast.	0.237	0.038	0.088	0.107	-0.034	**0.251**	0.217
The additional environmental exposure caused by the longer fattening period of dual-purpose chickens is acceptable.	-0.149	-0.080	-0.092	-0.008	-0.033	-0.016	**0.764**
It is fine for me that dual-purpose chickens do not put on as much meat as broilers.	0.017	0.067	0.163	-0.025	-0.270	0.072	**0.651**
If the male chicks are raised instead of being culled directly after hatching, a higher price for meat and eggs is justified.	-0.076	0.029	-0.335	0.138	0.074	0.036	**0.547**
If the meat of dual-purpose chickens had a more intense taste than the meat of a broiler, I would like that.	0.371	-0.141	-0.087	-0.196	-0.046	0.042	**0.465**

α = Cronbach alpha; Bartlett-test = 0.000; Kaiser-Meyer-Olkin (KMO) = 0.934; MSA (measure of sampling adequacy) lowest/highest value = 0.787/0.969
Source: own calculation

4.2.2 Cluster Analysis

Based on the factor analysis, a cluster analysis was conducted to identify different cluster groups describing respondents' attitudes towards dual-purpose chickens. Three clusters were identified:

1. Opponents,
2. Supporters and
3. Indifferents.

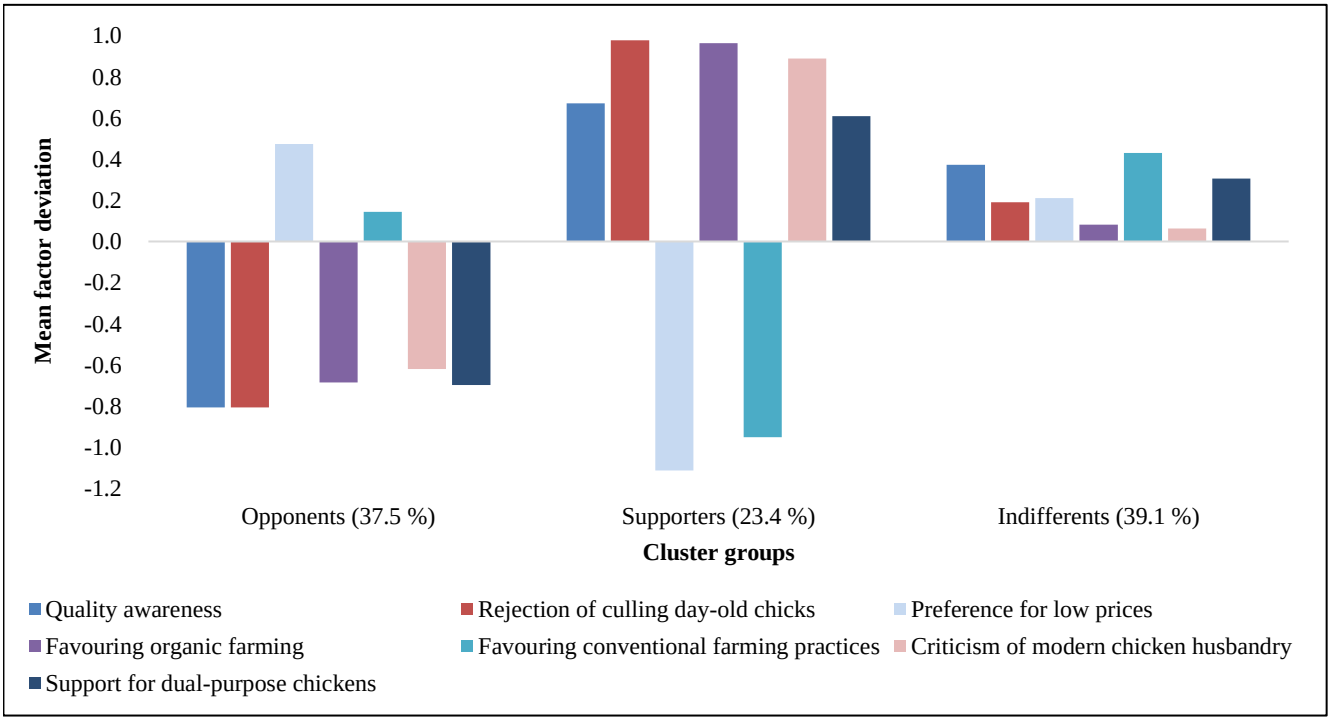
Figure 1 shows the standardised factor scores of each cluster with the baseline describing the total samples' mean of each factor. Each bar illustrates deviations of the factors from the total respondents' average. Bars pointing upwards or downwards express factors being either above or below the average of the total sample, respectively.

The first cluster group *opponents* makes up 37.5% of the total sample. Factor 3 *preference for low prices*, and factor 5 *favouring conventional farming practices* are far above the average of the total sample. The statements relating to factor 3 indicate that respondents of this cluster group prefer lower prices for chicken meat and eggs and make financial barriers responsible for not being able to buy products from dual-purpose chickens more often compared to the total respondents` average. Factor 5 illustrates the higher acceptance of modern farming practices, including the importance of the familiar appearance of chicken meat and eggs. Noticeable are the "below average" factors referring to *quality awareness*, *rejection of culling day-old chicks*, *favouring organic farming*, *criticism of modern chicken farming*, and *support for dual-purpose chickens*. Compared to the average of the total sample, respondents of this cluster see the culling of day-old chicks necessary for economic reasons rather than a problem.

In contrast, the cluster group *supporters*, which is the smallest group and accounts for 23.4%, describes exactly the opposite attitude towards dual-purpose chickens. Factor 1 *quality awareness*, factor 2 *rejection of culling day-old chicks*, factor 4 *favouring organic farming*, factor 6 *criticism of modern chicken husbandry*, and factor 7 *support for dual-purpose chickens* show factor scores that are distinctly above the average. Attitudes of respondents of this cluster relate to the importance of health, quality and animal welfare conditions. The respondents' criticisms of conventional chicken farming practices as well as the practice of culling day-old chicks are above average. Hence, the factors *preference for low prices* and *favouring conventional farming* are below the average of the total sample. Respondents of this cluster group are willing to pay a surcharge for products from dual-purpose chickens if the latter live in improved housing conditions.

The third cluster group *indifferents* represents the largest group consisting of 39.1% of the total sample. All factor scores are slightly above the average of the total sample. In particular, factor 1 *quality awareness*,

Figure 1. Identified cluster groups and their mean factor deviation from the total sample mean



Source: own calculation

factor 5 *favouring conventional farming practices*, and factor 7 *support for dual-purpose chickens* deviate more strongly from the mean. Compared to the average of the total sample, health and quality aspects are more important to respondents of this cluster group. Furthermore, this cluster group is characterised by a rejective attitude towards the killing of day-old chicks as well as a favourable attitude towards dual-purpose chickens compared to the average. However, this cluster group accepts current conventional farming practices and prefers a lower price for chicken meat and eggs at a level above the total sample's average. Ultimately, this cluster group shows an indifferent attitude towards dual-purpose chickens.

4.2.3 Discriminant Analysis and Analysis of Variance

The analysis of variance and discriminant analysis, which exhibits significant differences for all factors and cluster groups, verify the validity of the results. Table 4 shows the classification results of the discriminant analysis: 95.1% of the total sample was classified in the correct cluster groups.

A cross-tabulation was performed to identify correlations between the cluster groups and socio-demographics. Socio-demographic characteristics were categorised into groups to generate nominal scaled variables. Table 5 shows the frequency of each cluster groups' characteristics in percent as well as the correlation and its intensity between the attributes and clusters. Extremely significant, but very weak correlations were identified between the cluster groups and socio-demographics. There is a weak correlation between the cluster groups and gender as well as pet ownership. However, no correlations were found between the cluster groups and age, employment, size of residence, household and persons with children. When interpreting the results with regard to sociodemographic characteristics, it is important to emphasise that the sample is not fully representative and was biased towards a higher education, a considerably lower income and a lower employment rate than in the German population as a whole. Therefore, the following interpretations can only serve as indication for differences between the cluster groups.

Among the *opponents* there are significantly more males (59.6%), and they have a medium (29.3%) to high (38.5%) income. In addition, they have a moderate (35.8%) to high (36.7%) level of education. Noticeable is the low (44.0%) to moderate (42.9%) level of knowledge of chicken husbandry. The *opponents* have significantly fewer pets (39.2%) and less often have experience with agriculture (40.6%) compared to the *supporters*. The *supporters* are more likely to be female (60.7%) and have a high (49.6%) to very high (12.8%) income compared to the other two cluster groups. *Supporters* predominantly have a high level of education (43.9%) and a moderate (56.7%) to high (22.5%) knowledge of chicken husbandry. In addition, they more often have pets (62.1%) and significantly more experience with agriculture (53.8%). The *indifferents* are mostly female (51.3%) and have a high income (40.9%), but a lower income (27.9%) than the supporters. They have a moderate level of education (40.0%) and knowledge of chicken husbandry (52.1%). In addition, they have significantly fewer pets (47.2%) and less often have experience with agriculture (45.8%). All cluster groups predominantly live in the West and South of Germany.

Table 4. Classification of results in absolute und relative frequency

Cluster group	Predicted group membership			Total
	Opponents (1)	Supporters (2)	Indifferents (3)	
1	**542 (96.1%)**	1 (0.2%)	21 (3.7%)	564 (100%)
2	0 (0%)	**334 (95.2%)**	17 (4.8%)	351 (100%)
3	20 (3.4%)	14 (2.4%)	**553 (94.2%)**	587 (100%)

Source: own calculation

5 Discussion and Conclusions

The objective of this study is to analyse consumer acceptance of dual-purpose chickens. The topic culling day-old chicks was very present in the media during the performance of this study and the findings revealed that the practice is rejected for ethical reasons by the majority of the respondents. The government in Germany promotes research projects that explore alternatives to the culling of day-old chicks. In this context, the focus is on sex determination in the egg and the breeding of dual-purpose chickens. Apart from aspects like animal welfare and economic efficiency, consumers' acceptance of the alternatives plays an essential role regarding the market success of the respective alternative. In order to analyse consumers' acceptance of dual-purpose chickens, a mixed methods approach was applied. In an explorative first step six focus groups were conducted with

the objective of learning more about consumers' perception of dual-purpose chickens. The results from the focus groups show that most of the participants were aware of the culling of day-old chicks. However, alternatives were rarely ever known. After giving the participants information about the dual-purpose chicken, they were generally in favour of this chicken type. Some participants raised concerns regarding the economic efficiency and the higher product prices. For others, ethical values predominated. All in all, the results demonstrate that the discussants have specific expectations regarding the husbandry of dual-purpose chickens but also with regard to product characteristics.

Table 5. Probability of cluster membership by socio-demographics and knowledge about chicken husbandry

Characteristics	Frequency in percent (%)			Correlation* (p-value)	Intensity by Cramer** (v-value)
	Opponents	Supporters	Indifferents		
Sex				0.000	0.157
Female	40.4	60.7	51.3		
Male	59.6	39.3	48.7		
Age group				0.771	0.025
Younger	21.8	21.4	18.9		
Middle	35.6	36.5	38.0		
Elder	42.6	42.2	43.1		
Region				0.002	0.083
North	16.5	20.2	19.9		
West	29,.3	32.2	32.7		
East	25.7	14.2	21.0		
South	28.5	33.3	26.4		
Occupation	52.0	56.1	52.6	0.442	0.033
Income				0.000	0.113
Low	25.7	17.4	27.9		
Medium	29.3	20.2	25.0		
High	38.5	49.6	40.9		
Very high	6.6	12.8	6.1		
Education				0.000	0.084
Low	27.5	18.5	28.8		
Moderate	35.8	37.6	40.0		
High	36.7	43.9	31.2		
Knowledge				0.000	0.137
Low	44.0	20.8	31.5		
Moderate	42.9	56.7	52.1		
High	13.1	22.5	16.4		
Size of residence				0.807	0.032
Village	35.1	35.6	33.2		
Small town	23.8	23.4	24.0		
Medium-size city	19.5	21.4	23.2		
Large city	21.6	19.7	19.6		
Household size				0.794	0.024
Single	30.5	27.6	28.3		
2- 4 persons	65.6	69.2	68.3		
> 4 persons	3.9	3.1	3.4		
Persons having a child or children	17.9	14.8	15.5	0.385	0.036
Ownership of pets	39.2	62.1	47.2	0.000	0.174
Experience with agriculture	40.6	53.8	45.8	0.000	0.101

*Chi-square by Pearson (significance level: extremely significant $\alpha \leq 0.1\%$ ($p \leq 0.001$); highly significant $\alpha = 0.1$-1% ($p = 0.001$ to 0.01); significant $\alpha = 1$-5% ($p = 0.01$ to 0.05); not significant $\alpha > 5\%$ ($p > 0.05$)); **Cramer-V-Correlation: < 0.2 extremely weak; 0.2-0.4 weak; 0.4-0.6 medium weak (BROSIUS, 2011)
Source: own calculation

Based on these findings, a nearly representative online survey with 1,502 respondents was performed in Germany. A total of seven factors that explain the attitudes of consumers towards dual-purpose chickens were identified. Five factors demonstrate the critical and negative attitude of consumers towards modern chicken husbandry and, accordingly, a favourable attitude towards dual-purpose chickens. In contrast, there are two factors related to the endorsement of modern chicken husbandry and the high priority of low prices for chicken meat and eggs. These factors contain negative attitudes towards dual-purpose chickens. Subsequently, three segments were formed: *opponents*, *supporters* and *indifferents* with regard to dual-purpose chickens. In summary, these cluster groups represent typical consumer groups that differ significantly regarding their attitudes towards chicken husbandry, their level of knowledge and their experience with agriculture, as well as in purchase behaviour and sociodemographic characteristics. The results show that among *opponents* there are significantly more males and that they have less knowledge of chicken husbandry and less experience with agriculture than the *supporters*, who are more likely to be female and more often have pets. The group of *indifferents* makes up the largest fraction with 39.1%. Thus, it is the most important consumer group with regard to the marketing of products of dual-purpose chickens. The *indifferents* have an above-average preference for dual-purpose chickens compared to the total sample, on the one hand, and, on the other hand, an above-average supportive attitude for conventional farming practices and affordable chicken meat and eggs. This ambivalent attitude is associated with a high level of uncertainty among the respondents. *Indifferents* are likely to be female and have lower incomes than the *supporters*. Additionally, they have a moderate knowledge of chicken husbandry and a moderate level of education. It can be concluded that within this cluster group there is the greatest potential for reducing uncertainty by means of providing more and better informationon dual-purpose chickens, which may increase consumer acceptance of these.

The results of this study can serve as basis for further relevant discussions regarding the usage of dual-purpose chickens in the fields of policy, economics and research. From an economic point of view, the alternative dual-purpose chicken is currently not an efficient alternative but may instead serve as a niche product, e.g., in the organic production sector. Indeed, there is still a great need for research in this area, since the conflict of objectives between animal welfare, ethics, economic and ecological efficiency has not yet been resolved. In addition, the usage of dual-purpose chicken breeds has an impact on the entire food supply chain. As a consequence, it is important to examine the differentiated perspectives of relevant actors in order to establish a comprehensive and constructive assessment of the acceptance of dual-purpose chickens. In this context, consumer willingness to pay a surcharge plays an important role as they must be willing to bear the higher costs that dual-purpose chickens entail.

Literature

BACKHAUS, K., B. ERICHSON, W. PLINKE and R. WEIBER (2011): Multivariate Analysemethoden. Eine anwendungsorientierte Einführung. 13th edition. Springer Verlag, Heidelberg.

BECKMANN, M. (2016): Über den vernünftigen Grund im Sinne des §1 S. 2 TierSchG bei der Tötung von männlichen Eintagsküken. In: Natur und Recht 38 (6): 384-390.

BLE (Bundesanstalt für Landwirtschaft und Ernährung) (2017a): Deutsche essen 8 kg weniger Fleisch als vor 20 Jahren. In: http://www.ble.de/SharedDocs/Pressemitteilungen/DE/2017/170330_Fleisch.html, retrieved 10.04.2017.

– (2017b): Jeder Deutsche isst 235 Eier pro Jahr. In: http://www.ble.de/SharedDocs/Pressemitteilungen/DE/2017/170317_Eier.html , retrieved 10.04.2017.

BMEL (Bundesministerium für Ernährung und Landwirtschaft) (2017): Eine Alternative zum Töten männlicher Küken. In: http://www.bmel.de/DE/Tier/Tierwohl/_texte/Tierwohl-Forschung-In-Ovo.html, Abruf: 18.01.2017.

BROSIUS, F. (2011): SPSS 19. 1st edition. MITP-Verlag, Heidelberg, München, Landsberg, Frechen, Hamburg.

BRUIJNIS, M.R.N., V. BLOK, E.N. STASSEN and H.G.J. GREMMEN (2015): Moral "Lock-In" in Responsible Innovation: The Ethical and Social Aspects of Killing Day-Old Chicks and Its Alternatives. In: Journal of Agricultural and Environmental Ethics 28 (5): 939-960.

CLEFF, T. (2015): Deskriptive Statistik und Explorative Datenanlyse. Eine computergestützte Einführung mit Exel, SPSS und STATA. 3rd edition. Singer Verlag, Pforzheim.

CRESWELL, J.W. and V.L.P. CLARK (2011). Designing and conducting mixed methods research. 2nd edition. Sage Publications, Thousand Oaks, CA.

DAMME, K. (2015): Economics of Dual-Purpose Breeds - a comparison of meat and egg production using dual purpose breeds versus conventional broiler and layer strains. In: Lohmann Information 50 (2): 4-9.

DENSCOMBE, M. (2008): Communities of practice: a research paradigm for the mixed methods approach. In: Journal of Mixed Methods Research 2 (3): 270-283.

FAUCITANO, L., G. MARTELLI, E. NANNONI and T. WIDOWSKI (2017): Fundamentals of Animal Welfare in Meat Animals and Consumer Attitudes to Animal Wel-

fare. In: Purslow, P.P. (ed.): New Aspects of Meat Quality: From Genes to Ethics: 537-568.

FINCH, H. and J. LEWIS (2003): Focus Groups. In: Ritchie, J. and J. Lewis (eds.): Qualitative Research Practice. Sage Publications Ltd., London: 170-197.

GRASHORN, M. (2013): Verwendung der männlichen Küken der Legeherkünfte. In: http://www.wingvechta.de/themen/verwendung_der_maennlichen_legeherkuenfte/verwendung_der_m_nnlichen_k_ken_der_legeherk_nfte.html, Abruf: 15.05.2016.

HAIR, J., W. BLACK, B. BABIN and A. ANDERSON (2010): Multivariate Data Analysis. 7th edition. Pearson, Upper Saddle River, NJ.

HENG, Y., H. PETERSON and X. LI (2013): Consumer Attitudes towards Farm-Animal Welfare: The Case of Laying Hens. In: Journal of Agricultural and Resource Economics 38 (3): 418-434.

HÜTTNER, M. and U. SCHWARTING (2002): Grundzüge der Marktforschung. 6th edition. Oldenbourg Wissenschaftsverlag, München.

KAUFMANN, F., U. NEHRENHAUS and R. ANDERSSON (2016): Das Duale Huhn. Der Verbraucher müsste umdenken. In: DGS 2016 (35): 22-25.

KÖNIG, M., G. HAHN, K. DAMME and M. SCHMUTZ (2012): Utilization of laying-type cockerels as „coquelets“: Influence of genotype and diet characteristics on growth performance and carcass composition. In: Archiv für Geflügelkunde 76 (3): 197-202.

KÜHN, T. and K. KOSCHEL (2011): Gruppendiskussionen. Ein Praxis-Handbuch. VS Verlag für Sozialwissenschaften, Wiesbaden.

KUß, A. (2007): Marktforschung. Grundlagen der Datenerhebung und Datenanlalyse. 2nd edition. Gabler Verlag, Wiesbaden.

LAMNEK, S. (2005): Gruppendiskussion. Theorie und Praxis. UTB, Weinheim.

LEENSTRA, F., P. van HORNE and M. van KRIMPEN (2010): Dual purpose chickens, exploration of technical, environmental and economic feasibility. In: Proceedings XIIIth European Poultry Conference, Tours, France.

LEENSTRA, F.R., G. MUNNICHS, V. BEEKMAN, E. can den HEUVEL-VROMANS, L.H. ARAMYAN and H. WOELDERS (2011): Killing day old chicks? Public opinion regarding potential alternatives. In: Animal Welfare 20 (1): 37-45.

MAYRING, P. (2015): Qualitative Inhaltsanalyse. Grundlagen und Techniken. Beltz Verlag, Weinheim.

MORGAN, D.L. (1997): Focus Groups as Qualitative Research. Sage Publications, Thousand Oaks, CA.

RAUTENSCHLEIN, S. (2016): Einsatz des Zweinutzungshuhns in Mast und Eierproduktion: Ansätze für ein integriertes Haltungskonzept. In: Rundschau für Fleischhygiene und Lebensmittelüberwachung (RFL) 68 (8): 276-278.

RITCHIE, J., J. LEWIS, C. MCNAUGHTON NICHOLLS and R. ORMSTON (2014): Qualitative Research Practice. A Guide for Social Science Students and Researchers. 2nd edition. Sage Publications, London.

SOSSIDOU, E. and H. ELSON (2009): Hens' welfare to egg quality: A European perspective. In: World's Poultry Science Journal 65 (4): 709-718.

STATISTISCHES BUNDESAMT (2015): Ergebnisse des Mikrozensus 2011: Bildungsstand. In: https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/BildungForschungKultur/Bildungsstand/Tabellen/Bildungsabschluss.html, Abruf: 02.04.2017.

– (2016): Bevölkerung und Erwerbstätigkeit. Haushalte und Familien. Ergebnisse des Mikrozensus. Wiesbaden.

– (2017a): Bevölkerung und Erwerbstätigkeit. Bevölkerung mit Migrationshintergrund. Ergebnisse des Mikrozensus. Wiesbaden.

– (2017b): Wirtschaftsrechnungen 2015. Laufende Wirtschaftsrechnungen – Einkommen, Einnahmen und Ausgaben privater Haushalte. Wiesbaden.

SÜDDEUTSCHE ZEITUNG (20.05.2016) (2016): Darum müssen Millionen Küken sterben. In: http://www.sueddeutsche.de/wirtschaft/kueken-darum-muessen-millionen-kueken-sterben-1.2999918, Abruf: 22.01.2018.

VANHONACKER, F. and W.A.J. VERBEKE (2009): Buying higher welfare poultry products? Profiling Flemish consumers who do and do not. In: Poultry Science 88 (12): 2702-2711.

VERBEKE, W. and J. VIAENE (2000): Ethical challenges for livestock production: Meeting consumer concerns about meat safety and animal welfare. In: Journal of Agricultural & Envrionmental Ethics 12 (2): 141-151.

Acknowledgements

This study is part of the research project “SocialLab – Nutztierhaltung im Spiegel der Gesellschaft”. The project is funded by the Federal Ministry of Food and Agriculture (BMEL) by decision of the German Bundestag. Within the innovation funding the project is managed by the Federal Office for Food and Agriculture (BLE).

Contact author:
NANKE BRÜMMER
Thünen Institute of Market Analysis
Bundesallee 63, 38116 Braunschweig, Germany
e-mail: nanke.bruemmer@thuenen.de