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Swiss consumers' willingness to pay and attitudes regarding dual-purpose poultry and eggs

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ABSTRACT Chick culling is an efficient and cost-effective method in modern poultry farming, but it raises ethical concerns. Dual-purpose poultry (DP), in which males are fattened and females are used for egg production, is currently the most realistic alternative to culling, as in ovo sexing is not yet viable for practical application. Consumers' acceptance of DP products and their willingness to pay (WTP) for them have not been studied yet, and we expect that both aspects are closely related to the acceptance of and WTP for products from systems claiming beyond-conventional animal welfare, such as organic products. Results from a survey conducted among 402 consumers at 8 Swiss supermarkets revealed that the practice of chick culling

was largely unknown (75% of respondents). Generally, respondents' knowledge about poultry production was low. The DP alternative was preferred to chick culling, but no preference emerged between DP and in ovo sexing. Furthermore, the WTP for DP products was proportionally lower for chicken than for eggs, probably because of the different price elasticity between these products. A regression analysis was used to determine the factors influencing consumers' WTP for DP products. Consumers' WTP was positively related to knowledge about poultry production, habits tied to purchasing organic or free-range poultry products, and familiarity with DP products. Therefore, a combination of the DP alternative with an organic label is recommended.

Key words: dual-purpose, willingness to pay, sexing, welfare, consumer survey

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INTRODUCTION

Due to the genetically programmed negative correlation between reproductive and fattening performance in poultry (Barbato, 1999), the modern poultry industry relies on birds genetically selected to be highly productive in either egg or meat production, but not both. To date, the industry is not equipped to determine the gender of embryos before incubation. Therefore, both female and male embryos are incubated until they hatch. In the specialized layer lines, carcass and breast-meat cuts from males are not marketable due to the poor meat production of these birds, so only females are raised to be laying hens, and males are culled.

The culling of male chicks from layer lines in the EU, done either by maceration or asphyxiation (EU Council Directive 93/119/EC), has raised several ethical issues among consumers, including instrumentalization of animals for food production, sustainability, and

animal-welfare issues (Aerts et al., 2009). This is the case, regardless of the production method used (conventional, free-range, or organic), because all production methods involve culling. In ovo sexing is a promising alternative to the culling of male chicks (Vizzier Thaxton et al., 2016). With this technique, gender can be determined before incubation (or within the first d of incubation), and male embryos then would be discarded, avoiding the production of undesired layer male chicks. In ovo sexing is, however, not yet available to the industry. A feasible alternative is the use of dual-purpose poultry (DP). With DP, females are kept to produce eggs and males to produce meat. The modern DP process selectively crosses layer and broiler lines. This crossing produced birds with an important sexual dimorphism. Females are small and produce a satisfying amount of eggs, whereas males have a growth like that of extensive broilers and can be used for meat production (Icken and Schmutz, 2013; Mueller et al., 2015). Drawbacks of DP include the size of eggs, which are generally smaller than those of specialized laying hens, and smaller breast-meat proportions in carcasses compared with extensive broilers (Mueller et al., 2016, 2017). Nevertheless, DP is the only satisfactory, currently available

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alternative to culling male chicks. Nevertheless, due to the reduced average performance compared with high-producing lines, higher prices on products from DP systems are necessary to compensate for higher production costs. To ensure a significant market share for DP poultry products, it is important to understand consumers' acceptance and perception of these products.

Only a few studies so far have examined consumers' acceptance of DP meat and eggs. In a Dutch survey, 15.9% of respondents selected DP as the preferred alternative to chick culling (Gremmen and Blok, 2016). This share of consumers buying DP products would represent more than twice the share of organic eggs consumed out of the total egg consumption in the Netherlands in 2009 (Product Boards for Livestock, Meat and Eggs, 2010). Therefore, the relevance of DP as an alternative to chick culling has elicited the need to investigate consumers' perceptions of DP products and their willingness to pay (WTP) for them.

In Switzerland, organic DP eggs (seasonally also organic DP chicken) have been marketed since January 2014 in a pilot project by one Swiss supermarket chain. Since January 2016, the status of DP eggs officially changed to permanent offer, and DP chicken remains seasonally available in several stores in this supermarket chain. DP eggs and meat are available only in organic varieties. DP eggs cost about 24% more than regular organic eggs, which cost 41% more than conventional Swiss eggs (prices observed in supermarkets in January 2016). Greater ethical value and animal-welfare standards are the most important sales arguments for DP products (SRF, 2014). To date, DP is only a niche market, representing 0.4% of organic egg production in Switzerland in 2014 (Gloor, 2015). It may expand in the event of a ban on chick culling or a strategic turn in the organic egg sector, which happened in Austria (Bio Austria, 2016).

Due to the high price of DP products, it is essential to investigate consumers' acceptance and to understand the factors influencing consumers' WTP for these products. The awareness that male chicks are culled when they hatch seems to be the most important reason that consumers have shown interest for DP products. A recent online survey in the Netherlands reported that 55% of 1,022 respondents were aware of the culling of day-old chicks (Gremmen and Blok, 2016). To our knowledge, no such data are available for the Swiss population. Additionally, other psychosocial factors may predict consumers' acceptance and WTP for DP products, such as their attitudes toward naturally produced foods. Again, no data are available for the specific case of DP products.

Previous research on consumers' acceptance of and WTP for meat and poultry in general, as well as for special products (e.g., organic poultry), may provide valuable indications of consumers' behavior toward DP products. This research suggests that perceptions of animal welfare depend on various factors. First, greater knowledge of agriculture (or farm experience) is

correlated with less concern about animal welfare (Kendall et al., 2006; van Honacker et al., 2008). Second, the demand for animal-friendly production methods seems to vary considerably among different consumer segments (de Jonge et al., 2015). Consumers with the greatest interest in improved animal welfare in broiler production expressed a greater level of shame over consuming conventional meat and considered conventional methods less animal friendly and less environmentally friendly than did consumers with little or moderate interest in animal welfare.

The perception of organic chicken as being safer to consume and more natural (more healthful) than conventional chicken is a more important purchase incentive than the higher animal-welfare standards often associated with organic chicken (Van Loo et al., 2010). Moreover, for consumers who regularly purchase organic chicken, meat-quality aspects such as taste, appearance, and healthfulness were the most important criteria (Van Loo et al., 2010), although perceptions of higher quality might result from consumers' expectations rather than from any higher quality per se (Napolitano et al., 2013). In addition, regular organic consumers' WTP for such products was more than twice as high as that of occasional organic consumers (Van Loo et al., 2011).

Since animal welfare is not something consumers can observe at the point of purchase (except when buying directly at the farm), trust in provided information, such as labels and brands, is an important criterion in purchase decisions. Labels and brands provide added value only if they are well known. Indeed, unfamiliar labels are untrustworthy (Enneking, 2004; Pouta et al., 2010; Van Loo et al., 2011). In a study by Van Loo et al. (2011), regular-organic consumers were willing to pay a premium of 244% of the conventional price for USDA-labeled organic chicken. De Jonge et al. (2015) reported a WTP of 238% of the conventional price for meat with the highest animal-welfare standards in non-organic quality. And yet, the latter WTP was still 6% below the market price.

Another value-adding criterion is place of production. Nationally and locally produced meat (not only poultry) is generally perceived as being of higher quality than foreign meat (Pouta et al., 2010; Font i Furnols et al., 2011). Consequently, WTP is also greater for local meat (Bolliger and Réviron, 2008).

The aim of the present study is to examine consumers' WTP for and acceptance of DP eggs and chicken in Switzerland. We hypothesized that the factors influencing WTP for a product touting greater animal-welfare standards also could be relevant to WTP for DP products. We also hypothesized that consumers' knowledge about agriculture, demographic variables (e.g., education), consumption habits (e.g., quantity of meat consumed, favored type of production method), and consumers' familiarity with DP products were the most influential factors in WTP for DP products. Beyond this hypothesis testing, acceptance of DP

and preferred alternatives, such as in ovo sexing, were explored.

MATERIALS AND METHODS

Procedure

Consumers' perception, acceptance of, and WTP for DP products were examined using a questionnaire (available online as Supplementary Material). Respondents were recruited among customers at partner grocery stores belonging to one of the 2 largest grocery chains in Switzerland (i.e., COOP). Eight grocery stores participated, 4 in the French-speaking region of Switzerland and 4 in the German-speaking region. For each language region, we collected data from 2 grocery stores in rural areas and from 2 large shopping malls near major Swiss cities. For the urban locations, 2 stores were located in the conurbation of Zurich (German-speaking part of Switzerland, 1.334 million inhabitants; Swiss Statistics, 2016a), one was located in the conurbation of Lausanne (French-speaking region, 409,295 inhabitants), and another was located in the center of Fribourg (French-speaking region, conurbation of 105,406 inhabitants). For the rural locations, stores were located in Einsiedeln (German-speaking region, 15,077 inhabitants), Sins (German-speaking region, 4216 inhabitants), Delémont (French-speaking region, 29,527 inhabitants), and Payerne (French-speaking region, 11,693 inhabitants). Out of the 876 COOP stores in Switzerland (COOP, 2016), these 8 were chosen because they are spread across the Swiss plain (the most populated region of Switzerland), are easy for interviewers to access with public transportation, and have enough space to set up a table and chairs in relatively quiet areas.

Two interviewers visited each grocery store (on weekdays to avoid crowded Saturday shopping activity) in January and February 2016. The questionnaires were available in both French and German. To cover questions about both chicken and eggs without extending the length of the questionnaire, respondents were randomly chosen to answer a questionnaire about either chicken or eggs. Question formulations were identical in both versions.

After paying for their purchases, all customers were asked (when it was a group, such as a family, only those who paid for purchases were asked)—without restriction, but within the possibilities of the 2 interviewers—whether they were willing to complete a 10-minute questionnaire about their opinions on poultry products on a tablet computer. The objective of this sampling method was not to obtain a representative sample of the Swiss population, but to collect information from a sample of respondents at the point of purchase. The questionnaires were programmed in Qualtrics Research Suite (Qualtrics, Provo, Utah). Respondents were asked to complete the questionnaire alone, unless they asked for assistance from the interviewers. Respondents who

completed the questionnaire received a gift worth about CHF 3 (approximately \$3 in January/February 2016).

Questionnaire

The questionnaire can be found in the online Supplementary Material. It started with questions about respondents' *consumption frequency* of fresh chicken, processed chicken products, and eggs, using a 5-point response scale: *daily* (5), *several times per week* (4), *several times per month* (3), *several times per year* (2), and *rarely or never* (1). *Purchase habits* were assessed by asking respondents whether they usually purchased fresh chicken generated from *conventional production* (0) or *organic or free-range production* (1), with the option *I do not know* (0). The coding was based on the assumption that respondents answering *I do not know* most likely bought conventional products, which present a much larger choice of cuts and cheaper prices than organic or free-range products. Questions about purchase habits were similarly asked concerning processed chicken products and eggs. Three items focused on the importance of Swiss origin for each of the 3 products (fresh chicken, processed chicken products, and eggs; see Table 1, items 1 to 3) using a 5-point Likert scale ranging from *absolutely not important* (1) to *very important* (5).

Respondents' *knowledge about poultry production* was assessed with 7 items that were each answered with *true*, *false*, or *I do not know* (see Table 2). Altogether, there were 4 incorrect and 3 correct items. The sum of the correctly responded items per respondent was used in all analyses.

Furthermore, attitudes toward the health benefits of consuming chicken and eggs were covered by 3 items (Table 1, items 4 to 6), the importance of food naturalness was covered by 3 items (Table 1, items 7 to 9), and the inclination to pay a premium for superior-quality attributes was assessed by 5 items (Table 1, items 10 to 14). Four items assessed respondents' attitudes toward sustainable food consumption (Table 1, items 15 to 18). Each item was a statement, with responses taken using a 5-point Likert scale ranging from *I do not agree at all* (1) to *I fully agree* (5).

Next, respondents were asked to read a short text about problems with chick culling at hatch, and the DP alternative was introduced: "*Nowadays, eggs are produced by specialized layer-type hens, whereas chicken is produced from specialized meat-type broilers. As a consequence of this specialization, about 2.5 million male layer chicks are culled shortly after hatch in Switzerland each year due to their incapacity to lay eggs and their poor fattening ability. The dual-purpose poultry proposes a solution to this issue. The hens lay eggs, and the cockerels are fattened for chicken production. However, dual-purpose poultry utilizes feed less efficiently to produce eggs and meat, lays smaller eggs than the specialized layer-type hybrids and has smaller meat cuts*

Table 1. Mean scores¹ for individual items and results of factor analysis, including attitudes toward food and poultry (n = 400).

Item	Mean score ± standard deviation	Factor 1: <i>Premium payer</i>	Factor 2: <i>Naturalness</i>	Factor 3: <i>Swissness</i>	Factor 4: <i>Health benefits</i>
1. I buy raw chicken produced in Switzerland.	4.17 ± 1.22			0.91	
2. I buy processed chicken produced in Switzerland.	4.34 ± 1.13			0.85	
3. I buy eggs produced in Switzerland.	4.47 ± 1.10			0.87	
4. Chicken/eggs are important for health.	3.40 ± 1.29				0.87
5. Chicken/eggs are an important protein source.	3.64 ± 1.25				0.86
6. Chicken/eggs are more valuable than vegetables and grains.	2.50 ± 1.32				0.65
7. I am cautious about the naturalness of food.	4.40 ± 0.87		0.64		
8. I avoid food with preservatives.	3.92 ± 1.16		0.55		
9. Natural food is better for my health.	4.56 ± 0.76		0.65		
10. I would pay more for more animal welfare.	4.38 ± 0.99	0.85			
11. I favor animal-friendly products.	4.20 ± 1.10	0.70			
12. Product quality is sufficient whatever the grocery.	3.93 ± 1.27	0.42			
13. I would pay more to help protect the environment.	4.33 ± 1.06	0.85			
14. I would pay more for environmentally friendly fed poultry.	4.31 ± 0.97	0.57			
15. I conduct a lifestyle that aims to protect the environment.	4.07 ± 0.95		0.70		
16. I favor sustainability labels.	3.96 ± 1.08		0.62		
17. The more animal friendly, the more sustainable.	4.14 ± 1.00		0.60		
18. I would consume less chicken/eggs to protect natural resources.	3.55 ± 1.34		0.59		
Eigenvalue		6.76	2.31	2.08	1.61
Standardized Cronbach's alpha		0.81	0.81	0.91	0.75
Mean score of the factor ± standard deviation		4.23 ± 0.70	4.09 ± 0.69	4.33 ± 1.06	3.18 ± 1.05

¹Scores were assessed on 5-point Likert scales ranging between *I do not agree at all* (1) and *I fully agree* (5).

Table 2. Statements used to assess respondents' knowledge of poultry production and percentages of correct answers (n = 402).

Item	Correct answers (%)
In Switzerland, cage housing is allowed at commercial poultry farms. ¹	33
In Switzerland, the male brothers of the laying hens are raised to produce meat. ¹	25
In Switzerland, female broilers are raised to produce meat and eggs. ¹	22
Soybeans are fed to poultry in both conventional and organic farming.	21
Laying hens are most often slaughtered after one year of egg production.	50
In Switzerland, poultry are fed only with products that could not be used in the food chain. ¹	50
An animal-friendlier production costs more.	73
Overall average	39

¹Incorrect item that was reverse-coded before the analyses.

than the specialized meat-type hybrids. Eggs and chicken from dual-purpose poultry are already available in some Swiss grocery stores." Subsequently, respondents reported whether they already knew about DP chicken and whether they already had bought DP chicken products. Each answered *yes* (1) or *no* (0). The sums of the answers to these 2 items were used as the variable *Familiarity with DP*.

Two photos were shown to respondents: one of a regular organic chicken (or eggs) and the other of a DP chicken (or eggs; Figure 1). Regular organic products were chosen as a visual comparison because DP products are currently offered in stores only in organic quality. Furthermore, conformation differences between fast-growing broilers and DP are tremendous and reflect only the trivial differences between fast- and slow-growing broilers (Mueller et al., 2015). The organic market uses only slow-growing broilers in Switzerland.



Figure 1. Photographs presented to the respondents to compare dual-purpose poultry products (left) with regular organic products (right).

The WTP for DP products was measured as follows: "Please indicate how much you would be willing to pay for 1 kg of chicken breast from dual-purpose poultry compared to other types of chicken meat," respectively, for a 6-pack of DP eggs compared with other types of chicken eggs. Respondents could choose a value on a scale from CHF 0 to 80 for 1 kg chicken breast (Figure 2) and from CHF 0 to 8.0 for a 6-pack of eggs (US \$1 is equivalent to about CHF 1). On the scale, the actual prices of regular chicken or

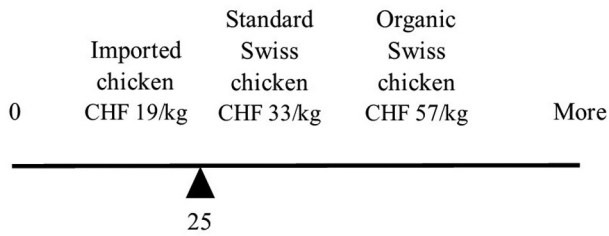


Figure 2. Ruler, runner, and references as presented to the respondent in the questionnaire. The score below the runner precisely indicates the value chosen on the ruler.

eggs—including their descriptions—in the grocery store were given as references. Reference prices were CHF 19/kg for imported chicken breast, CHF 33/kg for conventional Swiss chicken breast, and CHF 57/kg for organic Swiss chicken breast. Reference prices for 6 eggs were CHF 1.4 for imported eggs, CHF 3.4 for conventional eggs (aviary housing), and CHF 4.8 for organic eggs.

The perception of DP was assessed with 10 items, gauging moral acceptability and expected eating quality (see Table 3). Each item was a statement using responses on a 5-point Likert scale, ranging from *I do not agree at all* (1) to *I fully agree* (5).

Another potential alternative to chick culling at hatch is sex identification in the egg within the first d of incubation, known as egg sexing or in ovo sexing (Galli et al., 2017). The respondents were informed about this alternative: “*In the future, it might be possible to identify the embryo as female or male before placing the egg in the incubator, so the eggs containing a male embryo could be discarded.*” Subsequently, the respondents indicated their preferences between culling at hatch and egg sexing on the one hand, and between egg sexing and DP on the other hand, on 5-point Likert scales.

Finally, respondents were asked about the following demographic factors: gender; year of birth; living in a strict vegetarian household (never eating meat); living in a city, suburb, or countryside; education level; and the presence of any children under 18 in the household.

Data analysis

All data analyses were conducted using SAS 9.3 (SAS Institute, Cary, NC). Results are given as arithmetic mean ± standard deviation. An exploratory factor analysis was conducted using the FACTOR procedure with the Varimax rotation method to identify factors underlying the different items concerning the perception of chicken and eggs, DP chicken and eggs, and related factors (see Questionnaire section). Standardized Cronbach’s α coefficients were obtained using the alpha option in the CORR procedure. Pearson’s correlation coefficients were calculated between the factors extracted from the factor analysis and other important variables about purchase habits and demographics. Finally, a regression analysis using the GLMSELECT procedure was conducted with these same extracted factors and variables to evaluate the leverages of WTP for DP products.

RESULTS

Sample

A total of 402 questionnaires was collected (207 about chicken and 195 about eggs). Demographic details about the respondents are presented in Table 4. Only 2% of the respondents had a strict vegetarian household, so this aspect was not considered beyond this point. Self-reported consumption frequency of chicken and eggs by respondents was, on average, on a weekly to monthly basis (3.0 ± 0.9 with median = 3.0 and 3.3 ± 0.9 with median = 3.0, respectively, on a 5-point scale, whereby score 3 corresponded to *several times per month* [see Questionnaire section]). Processed chicken products were consumed less frequently (2.1 ± 1.1 with median = 2.0). Raw chicken was purchased by 56% of respondents from free-range or organic farming preferably to conventional farming. Similarly, 76% of respondents said they bought free-range or organic eggs most often.

Table 3. Mean scores¹ for individual items and results of factor analysis for dual-purpose poultry (DP; n = 400).

Item	Mean score ¹ ± standard deviation	Factor 1: <i>Expected DP moral quality</i>	Factor 2: <i>Expected DP eating quality</i>
1. DP gives me a good conscience.	3.56 ± 1.19	0.71	
2. DP is better for the environment.	3.29 ± 1.15	0.70	
3. DP is more animal friendly.	3.33 ± 1.16	0.70	
4. I trust DP producers.	3.38 ± 1.15	0.71	
5. The smaller size of DP products is not a problem.	3.80 ± 1.22	0.61	
6. DP tastes better than conventional poultry.	3.12 ± 1.32		0.85
7. DP tastes better than organic poultry.	2.75 ± 1.23		0.88
8. DP is safer than regular poultry.	2.94 ± 1.16		0.75
9. DP is more natural than regular poultry.	3.51 ± 1.22	0.60	
10. DP is more acceptable despite extra feed consumption.	3.35 ± 1.21	0.64	
Eigenvalue	.	3.84	1.67
Standardized Cronbach’s alpha	.	0.81	0.80
Mean score ± standard deviation	.	3.46 ± 0.81	2.94 ± 1.05

¹Scores were assessed on 5-point Likert scales ranging between *I do not agree at all* (1) and *I fully agree* (5).

Table 4. Demographic characteristics of the sample and questionnaire answered (n = 402).

Item	% of sample (unless otherwise stated)
Language	
German	62
French	38
Gender	
Male	45
Female	55
Place of residence	
City or suburban	57
Countryside	43
Age (in y \pm SD)	49 \pm 17
Education	
Low (elementary school)	13
Middle (high school)	54
High (postsecondary education)	34
Children under 18 in the household	28
Strictly vegetarian household	2
Questionnaire answered	
Chicken	51
Eggs	49

Knowledge of poultry production and dual-purpose poultry

On average, respondents correctly answered 2.7 (\pm 1.5) statements out of the 7 statements (i.e., 39%). The proportions of correct answers are listed per item in Table 2. It was generally believed (over 75% of respondents) that no soybeans were used as feed in organic poultry production (incorrect), that female broilers were used for producing both meat and eggs (incorrect), and that males were used for producing meat regardless of their genetic background (incorrect). Respondents' familiarity with DP was low. Only 17% of respondents said they knew about DP before the present survey, 14% of the *chicken* questionnaire sample said they already bought chicken from DP, and 10% of the *egg* questionnaire sample said they already bought eggs from DP.

Acceptability of in ovo sexing compared with chick culling at hatch and dual-purpose poultry

Respondents' answers clearly indicated a preference for egg sexing over chick culling at hatch (3.8 ± 1.5 ; median = 4.0), whereas the preference between egg sexing and DP poultry was unclear (2.7 ± 1.4 ; median = 3.0).

Factor analysis of attitudes toward food, chicken, and dual-purpose poultry

Two exploratory factor analyses were conducted: one on attitudes toward food in general and toward chicken, and another on attitudes toward DP. In the first factor analysis, items about preferences for Swiss products, the importance of naturalness, interest in the health benefits of eggs and chicken, and the inclina-

tion to pay a premium for additional quality attributes were included. From the 18 statements, 4 factors were extracted (Table 1), which explained 47% of the total variance. The 4 factors represented statements on the respective 4 topics of interest: *Premium payer*, *Naturalness*, *Swissness*, and *Health benefits*. We labeled the first factor *Premium payer* because it reflects respondents' willingness to pay a premium for additional quality attributes such as animal-welfare quality or an environmentally friendly feed. The factor *Naturalness* covered both egoistic health concerns (Table 1, items 7 to 9) and altruistic environmental-friendliness concerns (Table 1, items 15 to 18). The factor *Swissness* defined the inclination to buy Swiss poultry products. Finally, the factor *Health benefits* reflected respondents' desire to include chicken and eggs in a healthful diet. Regarding the second factor analysis, which included 10 items about attitudes toward DP, 2 factors were extracted (Table 3). They were named after the 2 expectable superior qualities for DP: *Expected moral quality* (e.g., ethical, environmentally friendly) and *Expected eating quality* (e.g., taste), which explained 55% of the total variance. The internal reliability of each of the 6 extracted factors was high (Cronbach's $\alpha > 0.75$). Therefore, we calculated the mean score per respondent for each of the 6 factors and used these in further analyses (Table 1 and 3).

Perception of dual-purpose chicken and eggs

Respondents' moral and eating-quality perceptions of DP were investigated using 10 statements answered on 5-point Likert-scales (Table 3). The average score for each statement was between 2.75 (\pm 1.23; median = 3) and 3.80 (\pm 1.22; median = 4), with a mean of 3.46 (\pm 0.81), for *Expected moral quality* and a mean of 2.94 (\pm 1.05) for *Expected eating quality*, with both close to the scale's midpoint of 3. The most pronounced opinion, with an average of 3.80 (\pm 1.22; median = 4), was obtained for the statement *It does not inconvenience me if the eggs and chicken are smaller, as long as I know they are from dual-purpose poultry* (eating-quality perception), showing a high level of acceptance of smaller sizes of chickens and eggs.

Willingness to pay for dual-purpose poultry products and its predictors

Willingness to pay. On average, respondents declared a WTP of CHF 37.4 (\pm 13.1) for 1 kg of DP chicken breast and CHF 4.39 (\pm 1.31) for a 6-pack of DP eggs (Figure 3). The mean WTP values were 13 and 29% greater than the observed prices for conventional Swiss chicken breast and eggs, respectively, but 34 and 9% lower than the observed prices for organic products.

Regression analyses. Thirteen independent variables were included in each of the regression

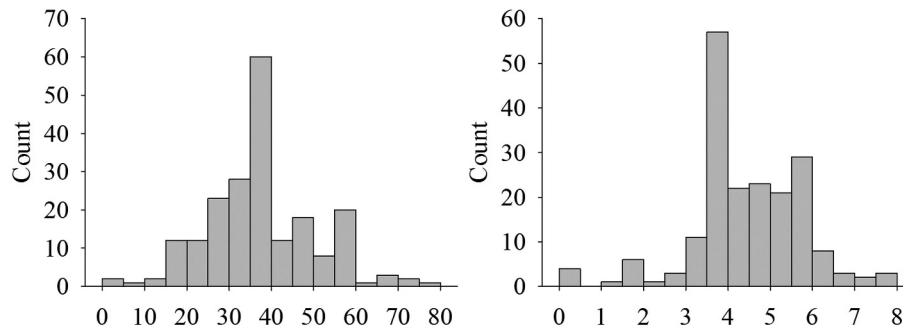


Figure 3. Distribution of the willingness-to-pay for 1 kg chicken breast meat (left, n = 205) and for a 6-pack of eggs (right, n = 195) from dual-purpose poultry (in CHF).

Table 5. Correlations among all factors (n = 400 to 402).

Item	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. WTP chicken ¹	0.20	-0.01	0.02	-0.09	0.04	0.31	0.19	0.26	0.21	-0.07	0.28	0.31	0.16	0.04	0.08
2. WTP eggs ¹	0.07	0.10	0.10	- 0.22	-0.03	0.29	0.24	0.23	0.26	-0.13	0.27	0.18	0.28	0.08	0.09
3. Age	1	-0.03	- 0.18	- 0.11	-0.02	0.10	0.08	0.17	0.11	0.03	0.21	0.21	0.05	0.02	<0.01
4. Gender		1	-0.06	-0.08	-0.03	0.11	0.15	-0.04	0.16	0.01	0.23	0.11	0.07	0.03	-0.09
5. Education			1	0.03	-0.03	0.12	0.22	0.06	0.01	-0.05	0.02	0.05	0.02	-0.02	-0.04
6. Consumption frequency chicken				1	0.25	- 0.11	- 0.11	-0.06	-0.07	0.15	- 0.18	- 0.15	-0.04	-0.04	0.12
7. Consumption frequency eggs					1	-0.06	0.01	0.05	0.06	0.23	-0.02	0.01	-0.01	-0.05	0.07
8. Purchase habits chicken						1	0.52	0.19	0.28	-0.03	0.34	0.34	0.04	-0.07	-0.01
9. Purchase habits eggs							1	0.13	0.27	<0.01	0.29	0.33	0.06	- 0.15	- 0.11
10. Knowledge about poultry production								1	0.17	-0.04	0.09	0.18	0.08	- 0.10	-0.03
11. Swissness									1	-0.05	0.35	0.32	0.14	<0.01	-0.08
12. Health benefits										1	0.04	-0.05	0.11	0.16	0.13
13. Naturalness											1	0.51	0.21	0.21	-0.02
14. Premium payer												1	0.21	0.02	-0.07
15. DP ² moral quality													1	0.36	0.09
16. DP ² eating quality														1	0.11
17. Familiarity with DP ²															1

Correlations in bold are significant; *P*-value < 0.05.

¹n = 205 for willingness-to-pay (WTP) chicken, and n = 195 for WTP eggs.

²Dual-purpose poultry.

analyses (SAS 9.3, GLMSELECT procedure) to evaluate which factors predicted respondents' WTP for DP. All correlations between dependent and independent variables are presented in Table 5. Two regression analyses were conducted, the first for WTP for DP chicken (n = 205) and the second for WTP for DP eggs (n = 195; Table 6). *Purchase habits* were positively related to WTP, meaning respondents usually buying free-range or organic-poultry products were willing to pay more for DP products than respondents who usually buy conventional poultry products. *Knowledge about poultry production* was positively related to WTP for DP eggs, but this factor was only marginally related to WTP for DP chicken (Table 6). Additionally, being familiar with DP products raised the WTP for them. Differences were found between DP eggs and DP chicken in the factors associated with WTP. There were more factors with significant regression coefficients for WTP for DP eggs than for WTP for DP chicken. *Health benefits* were negatively related to WTP for DP eggs, whereas *Naturalness* and *Expected DP quality* had significant positive associations with WTP for DP eggs, but not with WTP for DP chicken.

DISCUSSION

Predictors of willingness to pay for dual-purpose poultry products

Dissimilarities between chicken and eggs. In the regression analyses, 6 variables were significantly related to WTP for DP eggs, but only 3 to WTP for DP chicken, with only *Knowledge about poultry production* and *Familiarity with DP* significant for both chicken and eggs. Two aspects could explain this difference. First, even though the caging system for laying hens has been banned since 1991 in Switzerland (the first country worldwide to ban this practice), only one-third of respondents correctly answered the statement *In Switzerland, cage housing is allowed in commercial poultry farms*. The lack of knowledge about the current welfare of laying hens may have emphasized the positive perception of enhanced welfare initiatives in egg production. Secondly, the intrinsic product differences between chicken and eggs may explain the different predictors. As an egg is rather inexpensive compared with chicken breast, it is easier to pay a 50% premium for the former. Furthermore, a premium price

Table 6. Regression coefficients and adjusted R² obtained from the regression analyses for the willingness-to-pay (WTP) for chicken and for eggs from dual-purpose poultry (DP, n = 205 for chicken, and n = 195 for eggs).

Item	WTP for DP chicken				WTP for DP eggs			
	<i>B</i>	SE	β	<i>P</i> -value	<i>B</i>	SE	β	<i>P</i> -value
Explanatory variables								
Age	0.069	0.0543	0.087	0.206	-0.000	0.0051	-0.011	0.873
Gender								
Male	0.856	1.7046	0.033	0.616	-0.078	0.1797	-0.030	0.663
Female	.	.	.	.	.	.	.	.
Education								
High	-3.953	1.8813	-0.147	0.037	0.203	0.1869	0.073	0.278
Middle	.	.	.	.	.	.	.	.
Low	-4.218	2.5786	-0.112	0.104	0.234	0.2841	0.058	0.411
Consumption frequency	-0.007	1.1889	<0.001	0.995	0.017	0.1058	0.011	0.876
Purchase habits (organic vs. conventional)	4.798	1.8841	0.188	0.012	0.768	0.2500	0.224	0.002
Knowledge about poultry production	1.057	0.5707	0.125	0.066	0.187	0.0568	0.223	0.001
Swissness	1.024	0.9156	0.080	0.265	0.125	0.0868	0.109	0.151
Health benefits	-0.683	0.8445	-0.056	0.419	-0.296	-0.2334	-0.233	0.002
Naturalness	1.881	1.4938	0.105	0.209	0.387	0.1624	0.199	0.018
Premium payer	1.947	1.4315	0.110	0.176	-0.120	0.1565	-0.061	0.446
DP moral quality	1.919	1.2129	0.122	0.115	0.287	0.1097	0.176	0.010
DP eating quality	-0.947	0.9964	-0.076	0.343	0.176	0.0901	0.138	0.059
Familiarity with DP								
Already bought DP	6.611	2.9424	0.154	0.026	0.716	0.3532	0.133	0.044
Already heard about DP	0.032	2.4927	0.001	0.990	0.177	0.2691	0.043	0.511
Never heard about DP	.	.	.	.	.	.	.	.
Adjusted R ²		0.18				0.24		

B = unstandardized regression coefficient for the respective variable; SE = standard error of *B*. β = standardized regression coefficient (i.e., the estimate resulting from the same analysis with predictors that have been standardized around the mean).

for chicken conflicts with its market position as a cheap meat (Kennedy et al., 2004), whereas eggs belong to a different product category with a lesser price elasticity than chicken (Andreyeva et al., 2010). Accordingly, the difference between conventional price and average WTP was proportionally smaller for chicken than for eggs in the present study.

Demographics. Although age showed a positive correlation with WTP for chicken in the present study, regression analysis did not show any significant relation between age, gender, or education with WTP (except for one negative relation from higher education on WTP for DP chicken). Conversely, the meta-analysis of Lagerkvist and Hess (2011) reports that WTP for enhanced animal welfare has a negative relationship with age. The relation between age and WTP for chicken disappeared in the present regression when other variables such as *Purchase habits* were considered at the same time.

Knowledge about poultry production and familiarity with dual-purpose poultry. There was a positive relationship between respondents' *Knowledge about poultry production* and their WTP, whereas *Familiarity with DP* was not clearly related to WTP. Accordingly, there was no significant correlation between *Knowledge about poultry production* and *Familiarity with DP*. This indicates that awareness about DP is not related to respondents' general knowledge about poultry production. It also may be that respondents wrongly declared having heard of or having already eaten DP products. This is reflected in the share of respondents who declared having already bought DP chicken (14%), which is higher than the share of respondents declaring having already bought DP eggs (10%). The reliability of

the former is especially questionable because of the difficulty to find DP chicken in stores at the beginning of 2016. Currently, the vast majority of chicken meat is sold in supermarkets, and only about 2,000 DP chickens were sold in supermarkets in 2015 (D. Santschi, project leader for COOP supermarket, personal communication). Therefore, the probability that 56 of our respondents already bought DP chicken, as it is the case here, is very low. The respondents presumably conflated organic chicken or chicken bought directly at the farm with DP chicken. Regarding DP eggs, they have been available in some Swiss supermarkets since January 2014, and some farmers also offer them in their on-farm shops. Therefore, the aforementioned 10% of respondents who reported already having bought DP eggs is more credible.

Purchase habits. The other important factor positively related to WTP for DP products was respondents' WTP for organic (or free-range) poultry products. This corresponds with the results of research by de Jonge et al. (2015), which found that consumers interested in enhanced animal welfare were more likely to consume organic than conventional products. Indeed, WTP of respondents purchasing mostly organic (or free-range) poultry products was higher than that of respondents purchasing mostly conventional poultry products. This supports the supermarket's current practice of offering DP exclusively in organic quality. The actual price of organic poultry products is higher than the price of conventional products (by 41 and 73% for eggs and chicken breast, respectively). This large price difference in the products habitually purchased may explain the effect on WTP. Furthermore, the purchase of organic (or free-range) poultry products

reflects an interest in alternative production methods, and consumers may see similarities between DP and organic (or free-range) farming. Interestingly, the factor *Premium payer* had no relation with WTP, probably because of the discrepancy between the hypothetical willingness to pay a premium and actual WTP.

Representativeness of the Swiss population and study design

The present survey prioritized sampling locations (where the purchase choices actually took place) over the sample's representativeness of the Swiss population. Our sample represented the average age of the Swiss population, but it included more women, more people with a medium level of education (e.g., vocational school and high school), and slightly fewer people with low education levels (obligatory school only) than the Swiss average (Swiss Statistics, 2016b,c). The higher proportion of females in our sample was probably because women are more often responsible for food purchases than men in Switzerland. The importance of the Swiss origin of chicken meat (*Swissness*) among respondents is consistent with findings by Bolliger and Révion (2008), in which 60% of their Swiss respondents bought Swiss chicken, and 90% would have preferred chicken of Swiss origin to imported chicken if offered at a similar price.

The present data about WTP should be carefully interpreted because we assessed them in a hypothetical situation, i.e., respondents had only to indicate their WTP, but did not actually have to purchase DP chicken meat or DP eggs for that price. This may have resulted in higher WTP than in a real market situation.

Opportunities to improve consumers' perceptions and willingness to pay for dual-purpose poultry

Respondents' scant average knowledge about poultry production and its positive effect on WTP suggest that DP systems would profit from an increase in consumers' awareness about poultry-production methods in general. The positive correlation between habitual purchase of organic (or free-range) products and WTP for DP products indicates the relevance of DP systems in the organic segment. The organic segment currently applies the same chick-culling practices as the conventional segment, which is why combining the DP system with organic standards would follow high animal-welfare standards in organic production as an "all inclusive" alternative, in which specific knowledge about production practices is not required because no other product guarantees better animal welfare. This is what happened within the Austrian organic-egg sector (Bio Austria, 2016). Introducing additional ethical attributes such as specific animal-welfare standards also was suggested by Zander and Hamm (2010) as a way to

gain and secure market share for organic products. A simple way to inform consumers about DP production would be to label corresponding food products. Since most consumers lack sufficient knowledge about current organic labels (e.g., what they stand for and how they are certified; Schleenbecker and Hamm, 2013), we are reluctant to recommend the introduction of a DP production label. The information about the new welfare standards, which includes DP production, should appear in text form on the product, instead of on a new unfamiliar label (see Pouta et al., 2010). The positive effect of *Familiarity with DP* suggests that letting consumers experience DP products (e.g., through an in-store marketing action or free trial) could increase marketing success. Based on the observed effect of *Knowledge*, an information campaign on DP also may be effective and could very well be coupled with an in-store action. Finally, the ethical issues raised by chick culling soon may lead to a general ban on this practice in organic, as well as in conventional, poultry production. According to a meta-analysis by Lagerkvist and Hess (2011), WTP for DP would suffer from such a general ban because the specific welfare attribute of DP would then become a legal standard.

CONCLUSIONS

Leverages of WTP for improved welfare in other studies also were relevant for WTP for DP in this study, confirming our hypothesis. The WTP for DP eggs depended on more factors than WTP for DP chicken, but basic common leverages were identified. Knowledge about agriculture, the type of product usually purchased, and familiarity with DP appeared to be the most important factors for WTP for both DP chicken and DP eggs, whereas demographic factors had a negligible influence. A comparison of WTP for DP chicken and DP eggs shows that the latter are more likely to be successful on the market, as higher production costs must be covered by higher product prices.

SUPPLEMENTARY DATA

Supplementary data are available at [Poultry Science](#) online.

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