UK consumers' willingness-to-pay for laying hen welfare.

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3.

Choice A

Choice B

No Choice

Choice C

Did you know?

White feathered hens lay white shelled eggs, and brown feathered hens lay brown shelled eggs

Like hair colour in humans, egg shell colour is a result of genetics - environmental factors e.g. welfare, have no effect

There are no nutritional differences between egg colours

There are however, some other differences between egg colours...

+ Injurious feather pecking (IP) is a serious problem experienced in the majority of UK non-caged production systems, i.e. barn, free-range and organic production
+ IP encompasses severe feather pecking and cannibalistic pecking, frequently resulting in pain, skin damage and plumage loss to hens, whilst also bearing significant economic losses to producers
+ As a result, beak trimming is routinely undertaken in the majority of brown egg-laying flocks: trimming of the sharp tip of the beak is undertaken on day old chicks using an infra-red beam
+ It is thought beak trimming increases sensitivity of the beak, which can result in pain when feeding, and less natural exploratory behaviour
+ In Europe, beak trimming is often more severe than in the UK
+ Organic systems do not permit beak trimming
+ Some strains of white-laying birds can be less aggressive than brown-laying birds and rarely exhibit displays of injurious feather pecking
+ Utilising white-laying hens can help remove the need for routine beak trimming
+ White egg layers are also more efficient at converting inputs (feed) into output (eggs)

	White	Brown
Nutrition	No difference	
Taste	No difference	
Behaviour	Less aggressive	More aggressive
Injurious Feather Pecking?	No	Yes
Beak trimming?	No	Yes
Efficiency of production	Higher	Lower

Table 1: The DCE attributes and their associated levels

Attribute	Levels
Price	£0.50, £1.00, £1.25, £1.50, £2.00
Colour	White, Brown
Production System	Colony Cage, Free-Range, Organic
Size	Medium, Large
Freshness	3 days, 5 days, 7 days - until use-by date

Table 2: Socio-demographic characteristics of the survey sample (n=147)

	Sample	UK Population
Age		
18-34	0.28	0.28
35-54	0.31	0.35
55+	0.41	0.37
Gender		
Male	0.43	0.49
Female	0.57	0.51
Average family size (incl. children)	2.6	2.3
Share of families with children	0.26	0.41
Income Distribution (gross annual)		
Under £20,000/year	0.37	0.24
£20,000-£29,999/year	0.15	0.30
£30,000-£39,999/year	0.14	0.20
£40,000-£49,999/year	0.08	0.12
£50,000-£59,999/year	0.06	0.07
£60,000-£69,999/year	0.02	0.03
£70,000-£79,999/year	0.04	0.02
£80,000 and above	0.06	
Don't know/prefer not to say	0.07	
Education Level		
Secondary education (left before formal qualification)	0.34	0.23
Secondary education (GCSE or equivalent)	0.29	0.28
Secondary education (A- level or equivalent)	0.13	0.12
Further education (apprenticeship, HND or equivalent)	0.27	0.10
Higher education (bachelor's degree or equivalent) and postgraduate qualifications	0.20	0.27
Other	0.07	
Primary Shopper		
Yes	0.72	
Shared responsibility	0.24	
No	0.04	

Note: Figures for the UK population 2018 averages were taken from the Office for National Statistics data (https://www.ons.gov.uk). Population Education figures are taken from the 2011 Census and only include England and Wales.

Table 3: Mixed Logit Results before and after respondents were presented with an educational Excerpt.

	Before Educational Extract			After Educational Extract		
Choice	Coefficient	95% Conf. Interval		Coefficient	95% Conf. Interval	
ASC	2.05***	0.37	3.73	2.50***	0.79	4.22
	(0.86)			(0.87)		
Price	-0.66***	-1.03	-0.29	-0.43***	-0.80	-0.07
	(0.19)			(0.17)		
Freshness	0.51***	0.34	0.68	0.53***	0.36	0.70
	(0.09)			(0.09)		
Size: Large	0.67***	0.36	0.98	0.63***	0.30	0.96
	(0.16)			(0.17)		
Production System						
Free-range	2.39***	1.91	2.87	2.31***	1.82	2.81
	(0.24)			(0.25)		
Organic	1.69***	1.29	2.09	1.66***	1.25	2.06
	(0.20)			(0.21)		
Egg colour						
Brown	0.87***	0.47	1.27	0.34	-0.08	0.77
	(0.20)			(0.21)		

Note. ***, **, *, Significance at 1%, 5%, 10% level.

Table 4: Estimated WTP space amounts in British Pounds (£) for a box of six British eggs before and after the educational extract.

	WTP in British Pounds (£)	
	Before Educational Extract	After Educational Extract
Freshness	0.21	0.28
Production system: Free-range	1.57	1.53
Production system: Organic	1.27	1.11
Size: Large eggs	0.18	0.22
Colour: Brown	0.36	-

Table 5: Percentage of respondents using specific egg attributes to inform their choice before and after the educational extract.

		Before	After
Eggshell colour	Never	48.3	35.37
	Sometimes	38.1	42.86
	Always	13.61	21.77
Freshness	Never	12.93	16.33
	Sometimes	50.34	49.66
	Always	36.73	34.01
Price	Never	14.97	17.01
	Sometimes	41.5	43.54
	Always	43.54	39.46
Size	Never	17.69	23.13
	Sometimes	53.74	52.38
	Always	28.57	24.49
Production Systems	Never	10.2	14.29
	Sometimes	36.05	34.69
	Always	53.74	51.02

UK consumers' willingness-to-pay for laying hen welfare.

Abstract

Purpose: This study investigates UK consumer perception and willingness-to-pay (WTP) for egg attributes associated with laying hen welfare namely with beak-trimming practices and injurious feather pecking (IP). The aim is to examine any change in WTP after improved consumer awareness.

Design/methodology/approach: Building upon existing literature, we designed an online survey in which the method of Discrete Choice Experiment (DCE) was employed. The study includes two identical DCEs with the second being introduced after respondents were presented with an educational excerpt about beak-trimming practices, on farm IP occurrence and the docile nature of white egg laying hens – reducing IP.

Findings: The Mixed Logit Regression model demonstrated that consumers' WTP for egg attributes associated with beak-trimming and IP decreased in the second DCE (12.6% for organic and 2.55% for free-range). For eggshell colour, the analysis revealed a shift from a preference to brown eggs to indifference between eggshell colours.

Originality/value: Overall, UK consumers have a preference in higher hen welfare resulting in a decrease in WTP once they are aware of welfare losses in current systems; however, more insights are required in terms of the promotion of white shelled eggs as a means of reducing IP on UK farms.

Keywords: animal welfare, discrete choice experiment, mixed logit, WTP space, egg attributes

JEL classifications: C25, C83, D12, Q18

1. Introduction

Commercial egg production systems and consumer perception of egg attributes vary globally. Husbandry systems include the production of cage, barn, free-range and organic eggs; of which the dominance greatly varies between countries (Hammeishøj, 2011). For example, an estimated 85% of US egg production is by conventional cage systems (United Egg Producers, 2017) whereas in Switzerland, where a ban on conventional caged egg production has been imposed since 1992, free-range egg production dominates with a 39% share of the market followed by a 17% share of organic egg production (Kohler and Reusser, 2019). In addition to production systems, a major point of differentiation within this is eggshell colour. Research

has revealed that eggshell colour has no impact on nutritional value or taste; the difference is purely on the pigment deposition on eggs through the hen's oviduct (Munn, 2013). However, much research documents international differences in shell colour production and consumer preference. According to Guyonnet (2012) on the one hand, Europe, Oceania and some parts of Asia, brown eggs dominate, accounting for 100% of consumption in Ireland, Portugal, Thailand and New Zealand and 98% of production in Australia. On the other hand, they reveal that in the Americas, Africa and most of Asia, white shelled eggs dominate, accounting for 93% of production in the USA, 95% in Mexico, and 100% of Iranian and Nigerian production (Guyonnet, 2012).

The UK egg production sector is 86% self-sufficient, with 38 million birds producing over 10.7 billion eggs per year to satisfy the UK's appetite for over 12.9 billion eggs consumed per annum (BEIC, 2018). Valued at almost £985 million (BEIC, 2018), recent years have seen strong value and volume growth within this highly efficient and vertically integrated sector as consumer demand for this convenient, versatile and cost-effective food continues to rise (Defra, 2018). According to data from the UK Government's Department for Environment, Food and Rural Affairs (Defra) and the British Egg Industry Council, retail sales represent 55% of the UK egg market with the vast majority of fresh 'Grade A' shell eggs being brown (BEIC, 2018). In terms of production systems, within the retail sector whereby consumers engage directly with a products attributes, free-range egg production dominates accounting for 60%, which includes a 1% of organic production, followed by laying cage, 38%, and barn, 2% (van Horne, 2014).

Consumer knowledge and perception of egg production systems is intrinsically linked to their perception of animal welfare, which in turn plays an increasingly important role in consumer purchasing decisions. As such, the issue of animal welfare is of growing importance and complexity; increasingly blending production science with moral values (Napolitano *et al.*, 2010). Animal welfare has been rated as British consumers' single most important food sustainability issue, with the literature indicating that half of UK consumers rating animal welfare as either 'very important' or 'extremely important' (IGD, 2011). Other studies (Clonan *et al*., 2010; Defra, 2011) have also revealed that UK consumers have rated welfare as 'an important' issue. Furthermore, a study by Mayfield *et al*. (2007) had revealed that 56% of British consumers perceived hen welfare conditions as 'poor'. As such, this has led consumers valuing free-range egg production systems more highly than barn or cage systems, with shelter and access to pasture further increasing consumer preference (Norwood and Lusk, 2011).

The main drivers and facilitators of production system welfare improvements are consumer awareness and higher willingness to pay (WTP) (Bennett and Larson, 1996); both of which have led to a 550% increase in free-range egg consumption over the past 30 years (BEIC, 2016). However, alongside these, legislation also plays a major role. Some regulations facilitate consumer awareness such as UK labelling requirements of all shell eggs to be labelled with the method of production, the origin, the 'freshness' and the egg size which is categorised by weight (Defra, 2012); and others have an effect on the production side such as the 13-year phase out banning barren battery cages in favour of higher welfare enriched colony cages, which came into effect in 2012 (EU, 2012).

Another area of legislative interest within the UK is beak-trimming: the process of using an infra-red beam to remove the sharp tip of a hen's beaks (BHWT, n.d.). Beak-trimming is undertaken in most commercial flocks to reduce the incidence of injurious feather pecking (IP). IP is an aggression-linked behaviour observed on UK farms (Lambton *et al.*, 2010), encompassing severe feather and cannibalistic pecking, frequently resulting in pain, skin damage, plumage loss and significant economic losses to the industry (Bennett *et al.*, 2016). IP dominates within non-cage, i.e. barn and free-range systems, where greater bird numbers are mixed and remedial actions, such as removal of perpetrators, are harder to implement (Gunnarsson *et al*., 2000; Green *et al*., 2000; Sherwin *et al*., 2010). In non-cage systems, IP is the principle cause of mortality (Rodenburg *et al.,* 2008; Fossum *et al*., 2009; Sherwin *et al*., 2010); resulting in lower egg production (El-Lethey *et al*., 2000; Huber-Eicher and Sebo, 2001) and other significant economic costs (Nicol *et al.*, 2003) such as higher feed requirements (Blokhuis *et al.,* 2007) and lower feed conversion efficiencies (Tauson and Svensson, 1980; Peguri and Coon, 1993).

The use of infra-red beams administered on day-old chicks is the primary method of beak-trimming in the UK. Such methods have shown reductions in cannibalism-related mortality (Damme, 1999) and reduced plumage damage (Staack *et al.,* 2007) whilst also offering improvements in terms of consumption efficiency (Bennett *et al.,* 2016). Yet, whether these associated behavioural changes are indicative of pain or changes in beak sensitivity (Hughes and Gentle, 1995) remains a contentious issue, although Hughes and Gentle (1995) do acknowledge early treatment is the most effective means of upholding high hen welfare and minimising welfare losses. UK producers uphold these guidelines and beak-trimming is

undertaken at the earliest opportunity - on day old chicks. As a result, and with the procedure still legally defined as a 'mutilation', Defra is clear on eliminating the use of beak-trimming in the UK (BHWT, 2018).

In 2015, Defra established the Beak Trimming Action Group (BTAG) with the purpose to evaluate what effect an introduction of a ban on beak-trimming would have on hen welfare (Mitchell, 2015). The BTAG, through supporting evidence, raised concerns on the immediate impact on hen welfare (BTAG, 2015), on the basis of which, Defra rejected a ban expressing the view that the immediate impact on hen welfare would be detrimental (Defra, 2015) but welcomed the recommendations made by the BTAG review for the development and implementation of improved management techniques (*ibid*). Suggested alternative actions include reducing competition for resources such as feed, water and space; avoiding sudden changes in husbandry; as well as focuses upon litter quality and outdoor range management (Defra, 2018).

On this premise, the Soil Association has been promoting organic egg production (Soil Association, n.d.). They list five key differences that support organic advantages over free-range, three of which are closely related to improved management techniques. These include: the restriction of the flock size to a maximum of 3,000 hens (maximum of 2,000 hens under Soil Association regulations) compared to 16,000 hens under the RSPCA assured standard free-range, and compared to 30,000 hens under intensive-rearing free-range; the provision of a larger outdoor area, with a minimum of 10 square meters of outdoor space per hen compared to four square meters; and, the strict prohibition of beak-trimming supported by an enriched environment that promotes natural behaviour.

Research suggests that although increased consumer understanding of production techniques has led to increased preference for higher welfare eggs, the level of knowledge acquired by consumers varies greatly, and in many cases remains limited. Despite IP's widespread occurrence on UK farms, Bennett *et al*. (2016) found only 36% of consumers were aware that IP was a common problem in laying hens; detailed feedback revealed that free-range purchasers regarded this husbandry system as the 'golden standard' and were subsequently shocked to discover the widespread incidence of IP. This resulted in participants indicating they would shift their purchasing to egg systems with less or no IP incidence (*ibid*).

A further suggestion of the BTAG review was to investigate genetics and to utilize genetic strains with a reduced tendency towards IP (BTAG, 2015). Some strains of white laying hens demonstrate lower aggression, resulting in reduced levels of feather pecking; measured by good levels of feather cover (Hendrix Genetics, n.d). The National Farmers' Union of England and Wales (NFU) recently reported that in Germany, much progress has been made with welfare lobbies successfully persuading the German public that white egg consumption reduces the need for beak-trimming practices (Wozencraft, 2018). Consequently, white layers now represent over 30% of German production (*ibid*), versus just 1% in the UK (Guyonnet, 2012).

In light of the above and with the UK's government clear intention to eliminate beak-trimming, this study aims to establish an understanding of current UK consumers' WTP for egg attributes that are associated with laying hen welfare and, in particular, with IP occurrence and the absence of beak-trimming practice. The study is organized as follows: the next section presents the methodology employed and the data used, followed by the presentation of the results of the study. Finally, we provide a detailed discussion of the results and draw some conclusions and policy implications.

2. Methods

2.1. Survey design and methodology

To understand UK consumer choice and elicit WTP for egg attributes, the stated preference technique of Discrete Choice Experiment (DCE) was undertaken. A survey was formatted and disseminated to a UK representative sample in April 2019 by an online market research company, Toluna UK (uk.toluna.com). Prior to this, a pilot study was conducted in February 2019 (Dunne, 2019), the results of which enhanced the final survey design. The final survey had five sections, including two identical DCEs presented before and after an educational extract detailing animal welfare and efficiency benefits linked with the utilisation of white laying hens and organic production systems. This allowed the evaluation of the impact of the educational exposure through the comparison of DCE results. Data were collated on Microsoft Excel and analysed using Stata 15.

The survey was structured into five sections: Section One investigated consumers purchasing behaviours and collected participants' socio-demographic characteristics. Section Two represented the first DCE scenario in which respondents were asked to imagine they were in a supermarket aisle, and to choose between two egg alternatives or a no-choice option. Each

alternative represented a box of six British eggs with five different listed attributes including: price, eggshell colour, production system, size and freshness (Table 1). The DCE included eight choice tasks which were created on Stata 15 using Hole (2017) D-efficient design, a modification of Fedorov algorithm. An example of the choice set respondents were presented with is given in Figure 1.

Table 1

Figure 1

The no-choice option, later referred by the term alternative specific coefficient for no-choice (ASC), was included to reflect realistic consumer choice options, thus helping to mitigate the effects a forced-choice model may elicit upon results (Veldwijk *et al*., 2014). Section Three comprised an educational extract detailing potential welfare and productivity gains associated with production of white compared to brown eggs and information on the absence of beak-trimming in organic production systems, presented in Figure 2. This information was informed by current welfare and production literature and was presented both through short statements and through a more simplistic table in order to convey the information in a clear, simple manner (Converse and Presser, 1986). Section Four duplicated Section Two in order to re-estimate consumer WTP on an identical choice set. Finally, Section Five included debriefing questions to investigate which attributesat influenced consumer choice before and after the educational extract and questions regarding their future purchasing behaviour.

Figure 2

For the DCE analysis the Mixed Logit model (also known as the Random Parameter Logit model) was employed. This is represented as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

where Vij is a function of observable attributes of the alternatives xij, and of the individual decision maker zi. εij is unknown and treated as random, whilst the probability that individual i chooses alternative k is represented as (Train and Week, 2005):

$$\begin{aligned} P_{ik} &= \Pr\left(U_{ik} > U_{ij}\right) \forall j \neq k \\ &= \Pr\left(V_{ik} + \varepsilon_{ij} > Vij + \varepsilon_{ij}\right) \forall j \neq k \\ &= \Pr\left(\varepsilon_{ij} - \varepsilon_{ij} < V_{ik} - Vij\right) \forall j \neq k \end{aligned} \quad (2)$$

The Mixed Logit model uses average heterogeneity of respondents' preferences to represent attribute coefficients. This is represented as:

$$P_{ij} = f\, L_{ij}\,(\beta)\, f(\beta)\, d\beta \quad (3)$$

whereby the choice probability, P_{ij}, is a weighted average of logit probability evaluated using different values for β, L_{ij}, and $f(\beta)$ is the density determining the weighting (Train, 2009).

One of the aims of this study is to estimate consumer WTP for egg attributes associated with hen welfare. WTP represents the monetary amount consumers' value a product or service, or an attribute of those, and is associated with the level of utility it yields to individuals (Garrod and Willis, 1999). In order to reduce hypothetical bias and reveal true WTP, a 'cheap talk' script was included (Carlsson *et al*., 2005). 'Cheap talk' refers to the inclusion of text that explicitly states the risk of hypothetical bias and asks respondents to complete the survey in a truthful manner reflecting their actual purchasing behaviour (Cummings and Taylor, 1999).

The literature has two prominent methodologies for the estimation of WTP, namely in preference space and WTP space (Train and Week, 2005; Hole and Kolstad, 2012). According to Train and Week (2005) the WTP space method involves the re-structuring of the Mixed Logit model into estimating parameters of the WTP distribution. Therefore, utility function (1) can be re-written as:

$$U_{ij} = -a_i p_{ij} + \beta_{ij}\, w_{ij} + \varepsilon_{ij} \quad (4)$$

Where $Vij = -a_i p_{ij} + \beta_{ij} w_{ij}$, with p_{ij} being the price attribute and w_{ij} all other non-monetary observable attributes. Hole and Kolstad (2012) demonstrate that the variance of ε_{ij} can be assumed that it includes the individual-specific scale parameter μ_i such that $\mu_i^2(\frac{\pi^2}{6})$.

They then illustrate that a division of the utility function (4) with the individual-specific scale parameter allows the creation of a new error term that has a variance equal to $\pi^2/6$ and has an IID distribution (Hole and Kolstad, 2012). Thereafter, taking into account that WTP is given by the division of the non-monetary coefficient by the monetary coefficient, the utility function (4) can be re-written into the WTP space model:

$$U_{ij} = \lambda_i[p_{ij} + \gamma_{ij} w_{ij}] + \varepsilon_{ij} \quad (5)$$

It is considered that this method provides more realistic estimations compared to the preference space model (Hole and Kolstad, 2012) and consequently provides evidence for realistic recommendations and insights to policy-makers and stakeholders (Sauthoff *et al.*, 2017). The coefficients in WTP space was estimated by using maximum simulated likelihood with the Stata 15 command mixlogitwtp (Hole, 2016).

2.2. Data

A total of 147 complete responses were recruited by Toluna, which formed a UK representative sample. The quota was based on age, gender and income. The completion rate was 92%, with 13 respondents dropping out at various stages of the survey and subsequently excluded from the analysis. A summary of the socio-demographic characteristics of the respondents is given in Table 2.

Table 2

The sample's age distribution is closely aligned with the UK age distribution, with the median sample age being slightly older at 47 years while the UK median age is 40 years. The sample is slightly over-representing females but is closely aligned with the population income distribution. The UK median gross income has been estimated as £28,400 (ONS, 2018) while

the sample's median gross income is estimated at £22,500. The respondents' qualification distribution is closely aligned with the UK qualification distribution. The average family size is 2.6 with 26% of the respondents having dependent children in their households. Finally, the majority of the respondents are the primary shoppers of the household or hold shared responsibility.

3. Results

The ~~majority~~ largest proportion of the respondents were frequent consumers of eggs with 43% indicating they consumed eggs more than twice a week and 37% indicating they consumed eggs once or twice a week. Only 15% of the respondents stated that they consumed eggs once or twice a month and 4.8% indicated that they only consumed eggs a handful of times a year.

The parameter estimates of the Mixed Logit models before and after the educational extract are reported in Table 3. ~~Responses~~ Results of significance before and after the educational extract appear to be ~~near identical~~similar with the exception of the results of eggshell colour. In both DCE results the price, the freshness, the production system and the size were found to be statistically significant at the 1% level of statistical significance whereas eggshell colour was only initially found to be an important factor. In addition, in both models the ASC was found to be statistically significant indicating that respondents were more likely to choose the no option choice.

Table 3

In both instances price had a negative coefficient, representing consumer preference to maximise utility at the lowest cost. Freshness had a positive coefficient, representing consumer preference of eggs that had a longer until used-by date. Size had a positive coefficient indicating consumers' preference of large eggs over medium sized eggs. In terms of production system, in both DCEs respondents preferred free-range eggs over colony caged eggs, and organic eggs over colony caged eggs. Eggshell colour initially had a positive coefficient indicating respondents' preference of brown over white eggs, however this was not found to be significant in the second DCE.

In terms of consumers' WTP, the estimates are reported in Table 4. The attribute that was deemed as the most valuable, in monetary terms, in both DCEs was the production system of free-range where respondents WTP was £1.57 in the first instance and £1.53 in the second, a 2.55% decrease. Consumers also revealed a decreased WTP in the second DCE for organic eggs. In the first instance respondents WTP was £1.27, which decreased to £1.11 in the second DCE, a 12.60% decrease. Respondents WTP for fresher eggs and for large eggs increased in the second DCE, with initial WTP for fresher eggs being £0.21 and subsequently increasing to £0.28, a 33.33% increase. WTP for large eggs increased from £0.18 to £0.22, a 22.22% increase. Finally, for eggshell colour, respondents' initial WTP was £0.36 for brown shelled eggs however, in the second DCE they had no preference between eggshell colour and therefore no revealed WTP.

Table 4

The debriefing questions were focused on investigating which attributes participants considered when choosing an alternative. Their responses before and after the educational extract are presented in Table 5.

Table 5

Most respondents (48.3%) initially reported that they never considered the eggshell colour when choosing between alternatives. However, after the educational extract the ~~majority~~ largest proportion of respondents (42.86%) shifted to sometimes considering this attribute, with those who always considered this attribute increasing by 8.16% reaching 21.77%. Freshness and size were attributes which respondents did not report a change in their usage before and after the educational extract, with the largest proportion ~~majority~~ indicating that they sometimes used it in both DCEs. Respondents revealed a small shift ~~in the majority~~ from always (43.54%) considering price before the educational extract to sometimes (43.54%) considering price after the educational extract. In terms of production systems, the ~~majority~~ largest proportion of respondents ~~was retained in that respondents~~ retained their indication that they always considered this attribute when choosing between alternatives. However, the ~~majority~~ proportion was reduced by 2.72% after the educational extract and the respondents that never used this attribute was increased by 4.09%.

The final question of the survey was focused on future purchases depending on eggshell colour. The majority (51%) indicated that they had no preference between eggshell colour, while only 4.09% stated they would actively purchase white shelled eggs and 9.52% stated they would actively purchase brown shelled eggs. When asked if they were likely to purchase white shelled eggs, 21.09% indicated that they were likely to purchase them while 13.61% indicated they were unlikely to purchase white shelled eggs.

4. Discussion

This study was conducted to further our understanding of UK egg consumer choice and WTP and therefore was built upon existing literature and in particular on the findings of Parrott (2001) and Bennett *et al*. (2016). The DCE survey included the egg attributes that consumers indicated as most important in Parrott (2001), namely method of production, freshness/date, price and size, with the additional inclusion of eggshell colour. Eggshell colour was included as a proxy of evidence of reduced IP allowing us to further investigate consumer attitude toward IP reduction, in line with Bennett *et al.* (2016), and based on international evidence of lower mortality rates of white egg laying strains compared to brown egg laying strains (Häne *et al*., 2000). ~~while~~The method of production was distinguished between colony cage, free-range and organic systems, which allows for the investigation of consumer attitude towards beak-trimming practices.

The findings of the present study corroborate existing literature results (Norwood and Lusk, 2001; Bennett *et al.,* 2016) of consumers preferring free-range production systems over caged systems. In addition, following educational exposure to animal welfare factors, consumers' WTP somewhat decreased for both free-range and organic systems. This is in line with the results of Bennett *et al.* (2016) where the majority of their respondents indicated that they wouldn't change their purchasing behaviour but would increase their WTP to lessen the IP occurrence. As is, the exposure to information of on farm IP occurrence revealed that respondents re-evaluated their 'faith' in free-range and organic systems.

Within the educational extract, in addition to IP occurrence information, organic production was explicitly mentioned as the only UK production system with a clear ban of beak-trimming practices. This could potentially explain the larger decrease in consumer WTP for organic eggs (12.60%) compared to free-range eggs (2.55%) as consumers could have associated the absence of beak-trimming with more severe IP. Therefore, this could be considered as

empirical evidence of consumers' concerns regarding hen welfare and in particular of their preference of lessening IP severity over the absence of beak-trimming practices.

In terms of the absolute value of consumer WTP, free-range eggs remained higher than organic eggs in both sets of DCE, however, the amounts elicited for both husbandry systems remained in line with current market prices. The initial WTP for six British fresh large organic brown eggs was estimated at £2.02, while the current average market price of six British organic large eggs is £2.73 and the highest retail price has been recorded at £3.50 (Soil Association, 2019). The estimation of consumers' WTP after the educational extract was £1.61, £1.12 below average market price. For free-range eggs, consumers' initial WTP for six British fresh large free-range brown eggs was estimated at £2.32, with the average retail price of six British free-range large eggs in the market being £1.21 (BFREPA, 2019) and the current highest retail price recorded at £2.90 (price taken from Ocado.com, November 14, 2019). The second DCE revealed a decreased amount with consumers' WTP estimated at £2.03, which is £0.82 above current average market price but £0.87 below current highest price.

The higher WTP for free-range eggs could be attributed to other factors not taken into account in this DCE such as UK consumers' belief that eggs produced by this husbandry system have a better taste compared to eggs produced by caged hens (Parrott, 2004). In addition, the fact that the decrease in their WTP in the second DCE was very small compared to organic could be attributed to the information included in the educational extract as, within it, respondents were informed that beak-trimming practices in UK free-range systems are often less severe than those carried out in the EU, implying that UK free-range husbandry provides higher hen welfare than EU counterparts.

In terms of eggshell colour, this study used this attribute as a proxy informing respondents in the educational extract about the differences between the behaviour and characteristics of white egg laying hens and brown egg laying hens. The first DCE corroborated existing literature that suggest WTP for white eggs is likely to be lower than that of brown eggs (Hutchings, 2011; Bejaei *et al.*, 2011; Jibir *et al.,* 2012). The initial DCE revealed that consumers WTP for brown eggs over white eggs was £0.36. This is despite the fact that in the debriefing questions the majority indicated that they never used this attribute when deciding. Perhaps more insights are required on whether they instinctively chose brown over white eggs. However, after the educational extract, consumers were indifferent between eggshell colour. We suggest that this

should not be taken as evidence that consumers will never shift their consumption to white shelled eggs as a means to lessen IP occurrence but rather that other factors such as taste and nutritional value had a higher impact on consumer choice. Within the educational extract, respondents were informed that there is no difference in taste or nutritional value between brown and white eggs.

The final two attributes investigated within this study was freshness and size. Both were listed as important attributes in Parrott (2001) and within the present study. The importance of freshness concurs with results from existing literature (Gerhardy and Ness, 1995; Gerini *et al.*, 2016) as this attribute is also synergistic with other egg attributes such as taste and nutrition (Karoui *et al.*, 2005; Surai and Sparks, 2001). In terms of egg size, respondents revealed a preference for large size eggs. This concurs with popular belief that British egg consumers are 'obsessed' with large eggs (Ryan, 2018). In fact, due to this belief, the British Free-Range Egg Producers Association (BFREPA) has launched a campaign (November 2018) to promote medium and mixed weight eggs; the present study provides empirical evidence for the need of this campaign.

5. Conclusion and Policy Implications

The results of the present study reveal that UK consumers have a preference in higher hen welfare and once they are informed about the occurrence of IP on UK farms, they re-evaluate their WTP. Our results reveal that once exposed to information about IP occurrence and beak-trimming practices, they reduced their WTP for production systems. In terms of white shelled egg consumption and the promotion of it as a means to reduce IP on UK farms, the present study did not establish a WTP for white shelled eggs and therefore, more insights are required, in particular in consumer perceptions of hen aggression, nutritional value, taste and any other factors that are associated with white shelled egg consumption. Hence, currently, a German approach of promoting to consumers white shelled eggs as a means of reducing IP on UK farms may not be effective.

Overall, our findings suggest that consumers will support efforts to reduce IP occurrence and perhaps a subsequent policy of eliminating beak-trimming practices, however our findings suggest that they are not expected to shift their free-range consumption to organic consumption. Therefore, promoting organic production over free-range to eliminate beak-trimming practices is potentially not a solution that consumers will support at present. More education on organic

systems is required for consumers to understand the welfare benefits. On the other hand, free-range husbandry systems will have to develop and implement improved management techniques as suggested by BTAG. The existing literature provides discussions and evidence on such techniques, one of which is the increase in bird usage of outdoor range (Nicol *et al*., 2003).

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