

Relative Importance of External Quality Attributes of Shell Eggs: A Consumer Preference Approach

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Abstract

Three Focus Group Discussions (FGD) and questionnaires (n= 120) from two sensory evaluation sessions were used to identify, rank and compare external quality attributes of shell eggs for their relative importance. Data collected were described and analysed inferentially. The identified attributes were also matched to consumer quality expectations. Quality attributes identified in order of importance were size, cleanliness, colour, uniformity and texture with respective scores of 56, 47, 24, 14 and 8 . An inferential comparison of the attributes however, showed that size and cleanliness were rated higher ($P < 0.05$) than colour, uniformity and texture, with no significant ($P > 0.05$) sub-class differences. Respondents expected large eggs to have more edible material; clean shells to signify freshness and safety, while dark coloured eggs were expected to be more nutritious and to have stronger shells. It is suggested that these attributes could form a basis for the development of a grading system in Nigeria. Also egg retailers could gain some competitive advantage by paying attention to the attributes identified, especially those of higher relative importance like large size and shell cleanliness.

Keywords: Quality attributes, Quality expectations, Focus group discussion, Sensory evaluation

Introduction

In Nigeria eggs are sold unsorted and ungraded (Chukwuka *et al.*, 2011). The need therefore arises to develop a grading system for the common benefit of producers, consumers and other actors involved in the industry. Since quality is central to grading and classification systems of shell eggs (Gerber, 2011) and is its most important price contributing factor (Chukwuka *et al.* (2011), it is therefore necessary in developing a grading system for eggs, to explore the idea of egg quality extant in that community. Quality according to Hutchings (2002) is that which directs food selection and it is governed by the

total appearance of the product and the utility expectations derivable from its utilization.

A huge proportion of eggs in Nigeria are sold in their shell while and since the consumer's first impression of any egg purchased is based on their perception of shell quality (Okoli and Udedibie, 2000), understanding consumer attitude to quality attributes will be of great value.

Previous studies on egg quality in Nigeria were mainly related to storage (Okoli and Udedibie, 2000; Okoli and Udedibie, 2001; Okeudo *et al.* , 2003), bird nutrition (Anyanwu *et al.*, 2008; Garba *et al.*, 2010) or Strain comparison (Ojedapo *et*

al., 2009; Jibir *et al.*, 2010). Only few like Uwagboe *et al.* (2009) and Mako *et al.* (2009) relate to consumers and their preferences, even those were limited by firstly being surveys employing descriptive tools. Secondly, they are concerned with predetermined quality attributes, which according to Blijlevens *et al.* (2009) do not often correspond to consumer's perception, but rather to what the researchers deem as important. It will thus be of great value to know how consumers perceive quality attributes of shell eggs so that they can be classified in order of importance (Hernandez, 2007).

The present study was intended to remove some of the limitations of previous studies in Nigeria by firstly identifying egg quality attributes from the consumer's perspective, comparing their relative merits and determining consumer expectations on these attributes. Secondly the study adopted psycho-physical testing with actual eggs instead of investigating in the abstract. Additionally whole crates (the conventional package in which eggs are marketed in Nigeria) were used as units of reference. The objectives of the research were to: identify external egg quality attributes, compare them for relative merit and determine consumer quality expectations.

Materials and Methods

Source of data

Data for the present study was generated from 120 sensory evaluation questionnaires, FGDs and notes from the preliminary session of the sensory evaluation (language development session), where group discussions with respondents were held to determine and

agree on attributes and their descriptive terms. The sensory evaluation was a two session preference test in which subjects were asked to comment on their preference for crated eggs. Attributes were identified from the comments section of the sensory evaluation questionnaires and validated by the FGDs and the two language development sessions of the sensory evaluation. Quantitative data was sourced from the questionnaires. The respondents were 60 undergraduate students of agriculture, between the ages of 25- 30 years.

Data extraction

Quality attributes were identified by recording incidences of their occurrence in the respondents' comments. Attributes were tabulated according to their types namely; search, experience and credence. Search attributes are attributes that can be evaluated by the consumer at the point of purchase and prior to consumption. Experience characteristics are those that can only be established after experiencing the product, while credence attributes are those that the consumer may value but cannot discern when purchasing a product or even after normal use. They are thus a matter of credibility and trust. All experience and credence attributes were excluded from the model so that only search attributes, with objective and clearly identifiable properties were used. In this way five attributes namely; size, cleanliness, colour, uniformity and texture were selected based on their frequencies of occurrence.

The frequency with which each of the five selected attributes turn up in the subjects' comments was used to rank

them. The attributes were then allocated ordinal scores based on the sequence by which they appear in each subject's comment. The order of mention was assumed to be the relative importance a subject attaches to the attributes. Adopting a modified choice theory, a score of '5' was allocated to an attribute if it is the only one or the first of two or more characteristic mentioned by a subject, '4' was allocated if an attribute was the second to be mentioned, '3' if it was the third, '2' if it was the fourth, and '1' if it was the last or if the attribute was not mentioned at all.

Data analyses

Identified attributes were tabulated and ranked according to their frequency of occurrence in the subjects' comments. Comments on quality expectations were simply matched to their respective attributes. Relative importance of attributes was determined by treating

attribute scores as ordinal data and comparing them using the GLM univariate procedure, with significant means separated using Games-Howell test, having obtained a significant Levene statistic. All data were analyzed using SPSS, (2007).

Results and Discussion

Attribute identification

Attributes identified by the frequencies with which they occur, ranks and their respective scores are shown in Table 1. Quality characteristics preferred in order of importance were: Large individual egg size, shell cleanliness, dark coloured shell, uniformity in tray, and shell smoothness, with respective scores of 56, 47, 24, 14 and 8. Quantitatively, however size and cleanliness as a group were rated higher ($P < 0.05$) than colour, uniformity and texture, with no significant within-group differences.

Table 1: Egg quality attributes identified according to their frequency, ranks and quantitative scores.

Attribute	Preferred Characteristic	Frequency	Rank	Score
Size	Large	56	1 st	2.99 ^a
Shell cleanliness	Clean	47	2 nd	3.20 ^a
Shell colour	Dark brown	24	3 rd	1.74 ^b
Uniformity in tray	Uniform	14	4 th	1.45 ^b
Shell texture	Smooth	8	5 th	1.42 ^b

ab = Means bearing different superscripts along the score column differ significantly ($P < 0.05$)

All the attributes identified have been reported to be important to various consumer segments all over the world, the differences being only in the preferred characteristic. Studies are, however scanty as to consumer preference for cleanliness. This is probably because dirty and stained

eggs are downgraded and hardly allowed into the retail egg market (Jacob, 2000; USDA, 2000; EPF and NZFSA, 2002).

Large egg size was the characteristic most preferred. This is to be expected, as it is natural for consumers to want to maximize utility. It is not unusual

in Nigeria to witness arguments between retailers and buyers over egg size, a problem that would have been solved by grading and selling on per weight basis. Presently there are no grading standards for eggs in Nigeria (Chukuwuka *et al.*, (2011) and shell eggs are sold on per crate basis. Even in places where eggs are sold on per weight basis, like the USA (USDA, 2000) and Japan, preference is for large egg size. Jacob *et al.* (2000) reported that the greatest consumer demand in America is for Large and Extra Large eggs. Hashimoto *et al.* (2011) reported a similar trend in a survey of 273 households in 23 districts of Japan. About 50.7% of the respondents in their work preferred large sized eggs explaining that the volume and price of the egg are moderate indicating that indeed egg size is important and that it is linked to price

Shell colour characteristic most preferred was dark brown. This agreed with the findings of Uwagboe *et al.* (2009) in south western Nigeria. As well as the report of Odabasi *et al.* (2007) that consumers in United Kingdom, Italy, Portugal, Ireland, Southeast Asia, Australia, and New Zealand prefer brown eggs over white eggs. On the other hand White eggs are most in demand among Americans (Jacob *et al.*, 2000; Johnston *et al.*, 2011), and Japanese consumers (Hashimoto, 2011). The preference for brown shelled eggs in New England (Jacob *et al.*, 2000), United Kingdom Australia and New Zealand (Odabasi *et al.* 2007) indicates a cultural dimension to egg shell colour preference considering the common geo-cultural origin of populations in these regions. Uniformity of eggs in tray was found to be an

important quality characteristic corresponding to the grading system of the USDA, where lack of uniformity in size and colour is considered a major egg defect (USDA, 2000). USDA (2000) also reported that mixed colour or uneven sized eggs are discriminated against and that eggs sorted and packed in one colour ("whites" or "browns") sell better than the mixed colour. Contrarily, however, Johnston (2011) found that varying colour shades in cartoned eggs was equally as acceptable as uniform coloured eggs.

On preference for smooth textured eggs, the present study is in agreement with the findings of Jacob (2000) who reported that an egg shell that is smooth is preferred to rough-shelled eggs, which fracture more easily and have poor appearance. In the USA, eggs with extremely rough or uneven shells are downgraded to B quality (USDA, 2000). Similarly Gerber (2011) reported that rough egg shells are considered as defects

Quality Expectations

Respondents in the study linked the five preferred characteristics to diverse quality expectations (Table 2). This is consistent with the report of Hutchings (2002) that total appearance generates expectations. The association of shell colour with nutrition had earlier been reported by Johnston *et al.* (2011), where unlike the present study, panellists believed white-shelled eggs to be more nutritious and to have more flavour. Similarly, respondents in a study conducted by Uwagboe (2009) in South Western Nigeria also expected brown coloured eggs to be harder and stronger.

Table 2: Quality expectations according to preferred characteristics

Attribute	Preferred Characteristic	Expectation
Size	Large	Heavy eggs, more edible material
Shell cleanliness	Clean	Hygienic, fresh and Safe
Shell colour	Dark brown	Nutritious, Strong shell
Uniformity	Uniform	Attractive
Shell texture	Smooth	Attractive

Relating dirty eggs with hygiene and food safety is apparent, as dirt, stains and faecal matter could harbour contaminating pathogens. This is probably why it is regulated (Food Standards Australia New Zealand, 2006; Council of the European Union, 2006; EPF and NZFSA (2002). that eggs intended for retail in the shell must be visibly clean, or otherwise broken and pasteurised before it could be allowed into the human food chain.

It is quite unanticipated that the apparently tenuous idea of dark coloured eggs being stronger than light coloured ones may have a scientific basis. In a study by Carter (1975), a multiple regression analysis of strain differences in random sample tests revealed that egg shell colour, had significant effects on the incidence of cracks and the author concluded that selecting for dark shell colour rather than high shell thickness will increase shell strength. This appears to lend credence to the idea that there may be some instinctive scientific truths to seemingly peculiar notions, considering that the subjects in Uwagboe and the present study were simple consumer panels.

Conclusion

Size and cleanliness are the most important search attributes of shell eggs

and were ranked significantly higher than colour, uniformity in tray and texture.

A cultural dimension to brown egg colour preference is suggested by the common geo-cultural origin of populations in the United Kingdom, Australia and New England.

The relationship between brown shell colour and shell strength was as reported by Carter (1975) and complemented by the present study may be indicative of a link between intuitive notions about eggs and scientific truths.

Egg retailers could gain some competitive advantage by paying attention to shell cleanliness and sorting eggs by sizes, colour and texture.

It is recommended that the identified attributes be included in the development of a future grading system for Nigeria.

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