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Full Length Research Paper

Grading of table eggs as a marketing strategy for Nigerian smallholder farmers

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The major challenges of marketing livestock products are appropriate pricing, preservation and storage. The usual practice on smallholder poultry farms is to sell eggs unsorted. This result in loss of income, decreased marketability and increased wastages. This study aimed at assessing the profitability of sorting eggs and its implication on the farmer's revenue. A total of 100 trays of unsorted eggs derived from layers of different age groups were weighed and measurements of its width and length were taken. The eggs were then sorted and graded using the American classification system into peewee (P), small (S), medium (M), large (L), extra large (X) and jumbo (J) sizes. About 15% increase in revenue was realized after sorting and grading. With the classification of eggs into fairly homogenous sizes, it was possible to appropriately price the eggs and consumers' preference for sorted eggs increased marketability of eggs. It was concluded that sorting and grading of eggs could ensure appropriate pricing of eggs, reduce wastage and ultimately increase accruable income to the smallholder farms.

Key words: Egg, sorting, pricing, wastage.

INTRODUCTION

The egg, a major product of poultry is one of the most nutritious and complete foods known to man. Being the cheapest per unit source of animal protein, eggs are more readily affordable by the populace than other sources of animal protein. As it is with other agricultural products, eggs too are affected by inclement weather which is prevalent in the humid tropical countries, however, lack of infrastructural development characteristic of these countries adversely affect egg preservation, storage and transportation (USAID, 2006). Egg grading generally involves the sorting of products according to quality, size, weight and other factors that determine the relative value of the product (USDA, 2005). It entails the grouping of eggs into lots, having similar quality and weight. The grade of an egg is determined by factors like its quality, soundness and weight, but the factor with the lowest grade determines the overall grade of the egg (Jacob et al., 2002). However, unlike in the developed countries where eggs are sorted and graded before being sold to the public, majority of eggs produced in Nigeria are mostly from smallholder farms usually in peri-urban areas where there are limited or no facilities for the preservation and storage of these eggs. Such farmers tend to dispose the eggs daily as it is collected from the birds, without any recourse to sorting or grading of the eggs, consequently leading to inefficient and inappropriate pricing of eggs by the marketers with its associated economic losses and increased wastages.

The objectives of this study were to investigate the factors affecting egg weight, relationship between egg grade and hen's age and analyze the economic implications of sorting eggs into fairly homogenous groups based on weight.

MATERIALS AND METHODS

Experimental site

Eggs used in this study were obtained from Ibukun Farms Limited, a commercial poultry farm on the fringes of Lagos State, near Ogun State, Nigeria (6° 39' 40.23" N, 3° 16' 45.70" E). The eggs were laid

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Table 1. Basic descriptive statistics of egg weight and egg dimensions*.

Age group (weeks)	N	Mean weight (g) ± SE of mean	Mean length (mm) ± SE of mean	Mean width (mm) ± SE of mean
A (22-32)	596	49.94 ± 0.20^{d}	53.86 ± 0.09^{d}	40.91 ± 0.06^{d}
B (33-43)	599	56.35 ± 0.18^{c}	56.17 ± 0.09^{c}	42.53 ± 0.05^{c}
C (44-54)	564	57.01 ± 0.28^{bc}	56.65 ± 0.11^{b}	42.77 ± 0.07^{bc}
D (55-65)	596	58.63 ± 0.23^{a}	57.27 ± 0.11^{a}	43.16 ± 0.08^{a}
E (66-76)	596	58.05 ± 0.19^{ab}	57.43 ± 0.10^{a}	42.90 ± 0.05^{ab}
Combined	2951	55.99 ± 0.11	56.27 ± 0.05	42.45 ± 0.03

*Means with different superscript on the same column differs significantly (P<0.01).

by flocks of the Harco Black commercial layers which were at five stages of the laying cycle.

Experimental unit

Hens of fairly similar age were housed and reared within the same pens in the farm, and the five age groups sampled in the study were A (22 to 32 weeks), B (33 to 43 weeks), C (44 to 54 weeks), D (55 to 65 weeks) and E (66 to 76 weeks).

Experimental design

Despite the intent to have a balanced completely randomized design by sampling twenty trays (comprising thirty eggs) from each of the five age groups, broken/cracked eggs during transportation and measurement were eliminated and a total of 2,951 eggs were eventually studied. A stratified sample of twenty trays of eggs were collected from each of the five different age groups.

Measurements

Eggs were appropriately marked and tagged with a small tape and identification number to reflect the group from which they were obtained, the tray and the egg number. Egg weight and dimensions (length and width) of eggs were measured using a digital scale (sensitive to 0.00 g) and digital Vernier caliper (sensitive to 0.00 mm) respectively. The eggs were further classified into their respective weight grades using the "weight classes for U.S. consumer grades for shelled eggs" (USDA, 2006) categorization based on their individual weights after measurement.

Statistical analyses

All statistical analyses including descriptive statistics, basic exploratory analyses, t-test and analysis of variance were done using Minitab (2007) statistical software. A non parametric Chi-squared test of independence between egg grades and ages of hens was done and the statistical model describing factors affecting egg weight was given as:

$$Y_{ijkl} = \mu + L_i + W_j + A_k + G_l + (AG)_{kl} + e_{ijkl}$$

Where: Y_{ijkl} = observed weight of the egg, μ = overall mean of egg weight, $L_i = i^{th}$ effect of the covariate of egg length, $W_j = j^{th}$ effect of the covariate of egg width, $A_k = k^{th}$ fixed effect of age group, and e_{ijkl} = residual random error.

This was to statistically model factors that may influence the weight of egg, considering the fact that weight was the primary factor in grading and classifying the eggs. Having classified the eggs into their respective grades based on weight, attempt was made at making comparative economic analyses of the sorted eggs against the unsorted eggs at prevailing market prices. Comparative economic analyses of the pricing was done by using the average unit price for graded eggs to determine the price of the eggs pre-sorted and post-sorted.

RESULTS AND DISCUSSION

The largest variation in measured variables was recorded in egg weight (CV = 10.99%) with a minimum of 35.90 g and a maximum of 85.00 g, while egg width had the least variation (CV = 4.13%) with a minimum of 31.75 and 55.59 mm. This implies that egg weight is the best discriminating variable in this study and thus sorting based on egg weight is justified.

Egg weight

The mean weight of 55.99 g recorded in this study (Table 1) is close to 55.95 g mean egg weight reported by Monira et al. (2003) who worked on Rhode Island Red in Bangladesh, and also the 56.72 g obtained by Bunchasak et al. (2005) who worked on Babcock B-308 laying hen in Thailand. Age group alone accounted for 26.13% of the total variation in egg weight. There was a consistent increase in egg weight as hen age increased up to age group D (55 to 65 weeks) before a slight decline at age group E (66 to 76 weeks). This observation corroborates the report of Gunlu et al. (2003) who reported that egg weight increases with hen's age.

Egg length

Egg length increases steadily with increasing hen's age which implies that as the age of hen increases, the length of egg laid also increases (Table 1). Age group alone accounted for 23.01% of the total variation in egg length. This observation supports the findings of Anderson et al. (2004) and Gunlu et al. (2003).

Table 2. Sorting of eggs and classification by hen's age grade.

Age grade	Peewee	Small	Medium	Large	Extra large	Jumbo	Total
A (22-32)	33	265	246	49	3	0	596
B (33-43)	1	27	300	235	36	0	599
C (44-54)	1	80	201	188	83	11	564
D (55-65)	1	28	199	264	90	14	596
E (66-76)	0	6	248	285	50	7	596
Total	36	406	1194	1021	262	32	2951

Table 3. Comparative costing of sorted and unsorted eggs.

Age group	Egg's total	Unit cost	Income (₦)	Egg grade	Egg's total	Unit cost	Income (₦)
A	592	20	11,840.00	Peewee	36	15	540.00
B	599	22	13,178.00	Small	406	20	8,120.00
C	564	25	14,100.00	Medium	1194	27.5	32,835.00
D	596	27	16,092.00	Large	1021	30	30,630.00
E	596	27	16,092.00	Extra large	262	32.5	8,515.00
				Jumbo	32	35	1,120.00
Total			71,302.00	Total			81,760.00

Egg width

The mean egg width of 42.45 mm obtained in this study (Table 1) is close to the 43.61 mm obtained by Anderson et al. (2004) who worked on the single comb White Leghorn. Age group alone accounted for 21.01% of the total variation in egg width. There is a striking similarity in the distribution of egg weight and egg width suggesting an association between the two variables. The egg width steadily increases from age group A to D before it declines at age group E (66 to 76 weeks). Egg width increases with increasing age of hen and it peaked at about a year old before declining again. This may be due to the fact that the oviduct in pullets tends to be small such that only a small portion of shell can be forced along with the egg content thereby resulting in slimmer egg width which is oblong in shape. Subsequently, as the hen grows older, the oviduct becomes larger allowing a larger width and consequently the egg width increases with age (Van Den Brand et al., 2004).

Decrease in egg weight at later ages of the hen may be due to the decreased calcium deposition for egg shell by the aging hen as a result of the physiological demands on the hen during moulting.

Influence of hens' age on egg grade

Expectedly, majority (92%) of the Peewees recorded in this study came from age group A (22 to 32 weeks), while all the Jumbo eggs were from age groups C, D and E (Table 2). The Jumbo and Peewee eggs accounted for 1% each of the entire study while 'large and medium' eggs contributed 35 and 40% respectively. Small and extra large eggs contributed 14% and about 9% respectively (Table 2). The 'Chi-squared test' of independence revealed that grade of egg is dependent on hens' age ($P<0.001$). This implies that eggs graded as 'large, extra large and jumbo' are mostly from old layers which had very few cases of peewee and small eggs which is in consonance with earlier reports of Van Den Brand et al. (2004).

Factors affecting egg weight

The statistical model that best fits egg weight accounted for 86.69% of the total variation in egg weight, with egg length, egg width and age group respectively accounting for 61.49, 25.09 and 0.11% of the observed variation. All the three factors investigated had highly significant ($P<0.001$) influences on egg weight with the egg length being the largest source of variation. The fixed effect of age group though significant ($P<0.001$) contributed the least of the three sources of variation in egg weight.

Comparative economic analysis of sorted and unsorted eggs

This comparative analysis does not take into consideration

the additional cost to be incurred if eggs were to be sorted in terms of man hours or equipment necessary for the sorting. It only aims to see if there is any appreciable margin on investment if eggs were sold sorted or unsorted. The unsorted pricing regime had a mean ± SE of ₦24.19 ± 0.05, while the sorted or graded regime had a mean ± SE of ₦27.71 ± 0.07. The higher variability in the mean prices of sorted eggs was due to the fact that the eggs were sorted into clearly delineated heterogeneous grades (Table 3). “A t-test of the two pricing regimes was highly significant (P<0.001) indicating that the difference in the two incomes is large enough to warrant this additional exercise of egg sorting. From the calculation earlier mentioned, it is obvious that sorting the eggs into their respective grades would fetch more (14.68%) income from their sale. These results revealed an improvement in accruable income, and it is sufficient to justify sorting of eggs into fairly homogenous sizes before sale to the consumers”.

CONCLUSIONS AND RECOMMENDATIONS

Results obtained from this study revealed that there is significant financial benefit in sorting eggs by weight in the Nigerian market. Since sorting of eggs is not without its advantages of creating an avenue for orderly marketing, complete consumption by reducing waste, elimination of under pricing and over pricing the product by consumers and traders respectively, elimination of bias or confusion, and most importantly, it eliminates uncertainty with respect to quality values. The procedure for sorting could also be automated to reduce the tedium associated with individual egg weighing and re-classification. The conclusions are not based on the reported results!!!! It is recommended that the policy of egg grading as it operates in the developed nations should be encouraged and farmers educated on the significance and importance of egg grading. This is even more necessary if we expect to
export our products to compete with those from these developed nations.

“To this end, it is recommended that the task of egg sorting and grading should be encouraged and promoted amongst the smallholder farms in order to maximize returns on their investment”.

REFERENCES

Anderson KE, Tharnington JB, Curtis PA, Jones FT (2004). Shell characteristics of eggs from historic strains of single comb White Leghorn Chicken and the relationship of egg shape of shell strength. Int. J. Poul. Sci., 3(1): 17-19.

Bunchasak C, Poosuwan K, Nukrawe R, Markvichitr K, Chwthesam A (2005). Effect of dietary protein on egg production and immunity response of laying hens during peak production period. Int. J. Poult. Sci., 4(9): 701-708.

Gunlu A, Kiriki K, Cetin O, Carip M (2003). Some external and internal quality characteristics of patridge (*A. graeca)* eggs. Food Agric. Environ., 1(3 and 4): 197–199.

Jacob PJ, Miles RO, Mather FB (2000). *Egg Quality*, Animal Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. p 12.

Minitab (2007). Minitab Statistical Software. Minitab Inc. Quality Plaza, 1829 Pine Hall Rd, State College PA 16801-3008, USA.

Monira KN, Salahuddin M, Miah G (2003). Effect of breed and holding period on egg quality characteristics of chicken. Int. J. Poult. Sci., 2(4): 261-263.

USAID (2006). Nigeria economic performance assessment. United States Agency for International Development. p. 47.

USDA (2005). United States Department of Agriculture, Food Safety and Inspection Services.

USDA (2006). United States Department of Agriculture, *Egg Grading Manual*.

Van Den Brand H, Paramentier HK, Kemp B (2004). Effects of housing system (outdoor vs cages) and age of laying Hens on egg characteristics. Br. Poult. Sci., 45(6): 745-752.