THE RELATIONSHIPS BETWEEN SELECTED EGG QUALITY TRAITS AND EGG SIZE

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ABSTRACT

The relationships between selected egg quality traits and sizes of eggs were studied in a part of the South Western Nigeria with a view to investigating the variation in egg quality traits as egg size changes. 320 market eggs and 40 freshly-laid eggs collected from a poultry farm were used for the study in which egg weight, specific gravity, haugh units, percent yolk, percent albumen, shell thickness and percent shell measurements were obtained. Quality traits for small and large-sized eggs were observed as: Egg weight (53.34 vs 67.07 g), shell thickness (0.375 mm Vs 0.377mm), Percent shell (9.60 Vs 8.94), specific gravity (1.073 Vs 1.069), haugh unit (67.65 Vs 61.38), Percent albumen (62.28 Vs 64.35) and percent yolk (28.13 Vs 26.71), respectively. Egg size was observed to correlate positively with percent albumen ($P<0.05$) and shell thickness ($P>0.05$). It, however, correlated negatively with all other quality traits measured. Regression models between eggsize and the various quality traits were also established. It was concluded that small-sized eggs could be of better quality in terms of the traits measured.

Keywords: Egg size, Haugh unit, Albumen, Yolk, Egg shell.

INTRODUCTION

Egg quality relates to those characteristics of an egg that affect its acceptability to the consumer (Stadelman. 1977). These characteristics include the condition of shell and contents of eggs which give the greatest satisfaction to the consumer (Jull, 1972). As domestic egg production becomes more mechanized, increasing number of shells get broken as eggs move from the hen to the consumer (Hamilton, 1982). The quality of the shell in terms of shell strength and ability of eggs to withstand breakage in the course of their movement through the marketing channels is of great significance to egg marketers and consumers alike. Albumen quality, which refers to the physical properties of the albumen, has been stressed by many workers (Wells, 1968; Curtis *et al; 1985b;* Izat *et al.*, 1986). According to Wells (1968), it is generally assumed that consumers prefer an egg in which the albumen holds together well, especially for frying and poaching. The haugh unit (Haugh, 1937), an expression relating egg weight to height of thick albumen, is the most widely used method in determining albumen quality.

The Nigerian egg trade is characterised by the grading of eggs according to size only, and an average consumer in Nigeria and most developing countries is ready to pay a premium on large sized eggs. Little attention is, however, paid to the quality related traits of these eggs. This study was conducted with a view to determining the relationships between selected egg quality traits and size of market eggs.

MATERIALS AND METHODS

Collection of Eggs:

A total of 360 eggs used in this experiment were purchased from eight different markets and one poultry farm. 40 eggs, 20 small and 20 large-sized, as graded by the sellers, were purchased from each of the markets and the poultry farm.

Measurements of Egg Characteristics:

Egg weights were measured individually to the nearest 0.01 g using a sensitive electronic balance. Egg specific gravity was measured for individual eggs using the floatation tehnique (Sooncharenying and Edwards, 1989) which involves the floatation of individual eggs in 12

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saline solutions of increasing specific gravity (increment of 0.005) ranging from 1.050 to 1.105).

Individual eggs were broken-out, on a flat glass plate. Height of the thick albumen was measured, to the nearest 0.01 mm, using a tripod micrometer. Haugh units of individual eggs were later calculated using the formula of Haugh (1937) as cited by Stadelman (1977). The yolk was separated from the albumen using a plastic egg separator and yolk weights were measured on an electronic balance. The yolk weight was later expressed as a percentage of whole egg weight and recorded as percent yolk for individual eggs.

Egg shells were air-dried for 24 hours in the egg trays and individual shell weights were measured. Shell weight was later expressed as a percentage of whole egg weight and recorded as percent shell for individual eggs. Shell thickness was measured for individual dry shells using a micrometer screw guage.

Albumen weight, for individual eggs, was calculated by subtracting the yolk and dry shell weights from the whole egg weight. Albumen weight was later expressed as a percentage of the whole egg weight and recorded as percent albumen for individual eggs.

Statistical Analyses

Means (± Standard error) of measured quality traits for small and large-sized eggs were obtained as well as the the correlation coefficient (R) between the various egg quality traits and egg weight, as a measure of egg size. Statistical significance of correlations was established using the t-test (Steel and Torrie, 1980).

Regression analysis was carried out while coefficients of determination were also computed.

RESULTS

Mean values (± standard error) of quality traits for small and large-sized eggs are presented in Table 1.

The relationship between the selected quality traits and size (weight) of farm-fresh and market eggs, using correlation and regression analysis are shown in Table 2 & 3 respectively. A low positive correlation ($P>0.05$) was recorded between shell thickness and size (weight) of both the farm-fresh and market eggs, with size accounting for 1.9% and 0.3% of the variations in shell thickness, respecively. While percent shell negatively correlated ($P>0.05$) with size in farm-fresh eggs accounting for 16% of the variations, a significant ($P<0.05$) negative correlation was observed between these two variables in market eggs, with size accounting for 24% of the variations in percent shell. Specific gravity was negatively correlated ($P>0.05$) with size of eggs of the two categories. Haugh unit negatively correlated with egg size. The correlation was significant ($P<0.05$) only in market eggs, with size accounting for 14.5% and 23.5% of the variations in haugh unit of fresh and market eggs, respectively. The egg weight, however, positively and significantly correlated ($P<0.05$) with percent albumen in farm- fresh and market eggs accounting for 25% and 35.6% of the variations, respectively. A low negative correlation ($P>0.05$) was observed between percent yolk and egg size of the two categories, with size accounting for 15.3% and 6.5% of the variations in percent yolk, respectively.

DISCUSSION

Low positive correlations were observed between egg weight and shell thickness in this study for the two categories of eggs studied. Similar positive correlation was observed between egg weight and shell thickness by workers like Voicey and Hunt (1976) and Hamilton (1982). In Contrast, Jackson et al. (1987) reported that a fixed amount of shell deposited on large eggs would tend to be thinner due to the fact that the quantity of shell deposited either remains constant or increases slightly as hen ages. This was not so in the present study probably due to the fact that the market eggs sampled came from different farms where variations in diet, age of bird, genetic make up of birds, etc, could have affected shell thickness. Negative correlation was observed between percent shell and egg weight. This is supported by workers like Hamilton (1982), Curtis *et al.* (1985a) and Curtis *et al.* (1986) who reported correlation coefficients of -0.520, -.502 and -0.500, respectively. Curtis *et al.* (1986) concluded that the negative correlation between percent shell and egg weight supports the currently held concept that the hen's ability to deposit shell appears to be the shell strength limiting factor, as the hen ages and egg size increases. The negative correlations observed between specific gravity and size in the present study agree with those of Hamilton (1982) who reported a correlation coefficient range of -0.16 to -0.54 between specific gravity and egg weight. This result further reaffirms the negative correlation between percent shell and egg weight recorded in this study since specific gravity and percent shell are known to be directly related (Hamilton, 1982).

The negative correlations observed between haugh unit and egg size in this study agree with Curtis *et al.* (1985^b) who reported a low, but significant negative correlation between haugh unit and egg weight. These results also corroborate those of Izat *et al.* (1986) who reported a significant decrease in haugh unit and a concomitant increase in egg weight as the birds age. The significant negative correlation between these two variables in the market eggs, as against farm-fresh eggs, could be an indication of a faster rate of deterioration of albumen quality of the large eggs when compared with the small ones during storage. From the results, egg weight correlates positively with percent albumen and negatively with percent yolk. This fact was supported by Cook and Briggs (1977) who reported that the proportion of yolk tended to be greater in small eggs than in large ones. The total absolute amount, however, increases as egg size increases. Contrarily, Curtis *et al;* (1986) reported a correlation coefficient of 0.614 between percent albumen and egg size, and concluded that an increase in egg size and percent yolk is associated with a decrease in albumen percentage as hen ages.

CONCLUSION

From the result obtained, the shell quality indicators tend to favour the small-sized eggs. Except for shell thickness, small sized eggs appear to be better in terms of percent shell and specific gravity. The haugh unit, a very important albumen indicator for interior egg quality, was in favour of small-sized eggs in this study. This could be beneficial to the future market of small - sized eggs if preference is to be given to the interior quality trait of eggs. Percent albumen and yolk are compositional attributes whose relative distribution appears to be a function of both egg size and age of the bird.

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Table 1 MEAN VALUES (±STANDARD ERROR) OF QUALITY TRAITS IN SMALL AND LARGE - SIZED EGGS.

QUALITY TRAITS	SMALL	LARGE
Egg Weight (g)	53.34±0.80	67.07±0.83
Shell thickness (mm)	0.375±0.005	0.377±0.005
Specific Gravity	1.073±0.003	1.069±0.002
Percent Shell (%)	9.60±0.13	8.94±0.14
Haugh Unit	67.65±3.20	61.38±3.65
Percent Albumen(%)	62.28±0.68	64.35±0.65
Percent Yolk(%)	28.13±0.68	26.71 ±0.63

Table 2 THE REGRESSION OF SELECTED QUALITY TRAITS ON SIZE OF FARM-FRESH EGGS

QUALITY TRAITS DEPENDENT VARIABLE (Y)	INDEPENDENT VARIABLE (X)	REGRESSION EQUATION	CORRELATION COEFFICIENT (R)	COEFFICIENT OF DETERMINATION (R^2)	SIGNIF. OF R
Shell thickness (mm)	Egg weight (g) (size)	Y = 0.347 + 0.001x	0.137	0.019	n.s
Percent Shell	"	Y = 12.39 - 0.04x	-0.399	0.160	n.s
Specific Gravity	"	Y = 1.105 - 0.001x	-0.347	0.120	n.s
Haugh Unit	"	Y = 111.53 - 0.27 x	-0.381	0.145	n.s.
Percent Albumen	"	Y = 58.06 + 0. 12 x	0.500	0.250	*
Percent Yolk	"	Y = 29.58 - 0.08x	-0.391	0.153	n.s.

* = significant (P<0.05)

n.s. = Not Significant (P>05)

Table 3 THE REGRESSION OF SELECTED QUALITY TRAITS ON SIZE OF MARKET EGGS

QUALITY TRAITS DEPENDENT VARIABLE (Y)	INDEPENDENT VARIABLE (X)	REGRESSION EQUATION	CORRELATION COEFFICIENT (R)	COEFFICIENT OF DETERMINATION (R^2)	SIGNIF OF R
Shell thickness (mm)	Egg weight (g) (size)	Y = 0355 + 0.001x	0.056	0.003	n.s
Percent Shell	"	Y = 12.49 - 0.06x	-0.0490	0.240	*
Specific Gravity	"	Y = 1.083 - 0.001x	-0.135	0.018	n.s
Haugh Unit	"	Y = 117.74 - 0.85 x	-0.485	0.235	*
Percent Albumen	"	Y = 49.03 + 0.24x	0.596	0.356	*
Percent Yolk	"	Y = 31.11 -0.08x	-0.225	0.065	n.s

* = significant (P<0.05)

n.s. = Not significant (P>0.05)