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INVESTIGATION OF THE RELATIONSHIP BETWEEN COMMON MEASURES OF ALBUMEN QUALITY AND FUNCTIONAL CHARACTERISTICS OF ALBUMEN

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Introduction

For many years the quality of sound eggs has largely been defined by the height of the inner thick albumen because it is easily measured, relates well to the freshness of the egg, and declines predictably with time in storage. At the time that measures based on albumen height became widely used, it is likely that freshness was of primary interest. Although albumen height measures the freshness of an egg, it is biased by the strain and age of the hen. This criticism can be overcome by measuring the pH of the albumen because it increases predictably with time in storage, independent of the strain or age of the hen.

Eggs or egg products are used by the food industry in many products because of the emulsification properties of the yolk and the heat coagulation and foam forming ability of the albumen. The egg processing industry is likely more interested in these functional qualities of eggs than it is in albumen height or other measures of freshness. This project investigated the importance of genetic strain and age of hen, and storage on albumen height, pH, and whipping volume of the albumen.

Trial

Eggs were collected from unselected Brown Leghorn (BL), ISA Brown (ISAB), and Babcock B300 (BAB) hens when they were

32, 50, and 68 weeks of age. At each time that eggs were collected, they were sampled within 2 hours of being laid and after storage for 5 and 10 days at room temperature. A total of 2,123 eggs were obtained for sampling. At sampling, each egg was weighed and broken onto a flat surface. The albumen height was measured, and the albumen pH was recorded. The yolk and dry shell were weighed, and the weight of the albumen was determined by the difference. The albumen was collected into a graduated beaker, weighed and whipped with a commercial beater for 80 seconds. Whipping volume was determined as the volume of the albumen related to the weight of the albumen that was whipped.

Results

The changes in egg, yolk, shell, and albumen weights changed as expected with age of the hen and with storage (Table 1). Egg weight and that of the three egg components increased with increasing age of the hen. Egg and albumen weights decreased with storage, while yolk weight increased. Eggs from the BL were smaller than those of the commercial lines, but had proportionately larger yolks.

Albumen height decreased with age of the hens and with storage and was much lower for BL hens. Albumen pH was relatively constant between strains and with changes in

age, but it increased with storage. Albumen whipping volume increased slightly with age

Table 1. Means of Egg Weight, Egg Component Weights, and Albumen Quality Measures

	Egg Wt (g)	Yolk Wt (g)	Shell Wt (g)	Albumen Wt (g)	Albumen Ht (mm)	pH	Whipping Volume (mL/g albumen)
Age							
32 weeks	59.62 ^c	15.16 ^c	5.86	38.68 ^c	6.47 ^a	8.71 ^b	5.68 ^b
50 weeks	62.72 ^b	17.50 ^b	5.94	39.29 ^b	5.76 ^b	8.64 ^c	5.70 ^b
68 weeks	64.82 ^a	18.35 ^a	5.90	40.63 ^a	4.76 ^c	8.85 ^a	5.89 ^a
Storage							
0 d	62.70 ^a	16.32 ^b	5.91	40.57 ^a	8.45 ^a	7.78 ^c	5.15 ^c
5 d	62.05 ^b	16.86 ^a	5.90	39.36 ^b	4.96 ^b	9.12 ^b	5.89 ^b
10 d	61.01 ^c	16.91 ^a	5.88	38.22 ^c	4.10 ^c	9.26 ^a	6.17 ^a
Line							
BL	52.45 ^c	15.56 ^c	4.75 ^c	32.20 ^c	4.81 ^c	8.84 ^a	6.03 ^a
ISAB	66.69 ^a	17.00 ^b	6.65 ^a	43.08 ^a	5.55 ^b	8.67 ^c	5.67 ^b
BAB	64.45 ^b	17.26 ^a	6.04 ^b	41.18 ^b	6.77 ^a	8.70 ^b	5.60 ^c

a-c Means within a main effect with different letters are different ($P \leq 0.05$).

and substantially with storage, and eggs from BL hens had better whipping qualities than those from the two commercial lines.

Correlation coefficients (Table 2) between the three measures of albumen quality show that a high pH was associated with low albumen height. Most of this association is because storage increases albumen pH and decreases albumen height. Albumen height and whipping volume were also negatively associated, and within each storage time, the measures were unrelated, or nearly so, suggesting that most of the association was due to changes with storage. Higher albumen pH was related to better whipping volume; the moderate correlation coefficients within each age and line were likely because both measures change with storage.

Conclusions

Differences between eggs from unselected BL and commercial hens suggest that albumen height has formed part of commercial selection programs, and that this has had a negative effect on the foaming ability of the albumen, as measured by whipping volume. These data demonstrate

Table 2. Correlation Coefficients Between Albumen Height, Albumen pH, and Albumen Whipping Volume

	Height: pH	Height: Volume	pH: Volume
All	-0.73	-0.29	0.35
Age			
32 wk	-0.85	-0.23	0.30
50 wk	-0.61	-0.25	0.42
68 wk	-0.85	-0.33	0.33
Storage			
0 d	-0.32	-0.11	-0.05 (NS)
5 d	-0.48	-0.02 (NS)	0.07 (NS)
10 d	-0.52	-0.02 (NS)	0.11
Line			
BL	-0.83	-0.50	0.33
ISAB	-0.62	-0.35	0.51
BAB	-0.88	-0.58	0.56

NS (all correlation coefficients are significant ($P \leq 0.01$) unless followed by NS)

that freshness, as measured by albumen height, may in fact be associated with reduced values for albumen whipping volume, which is an important functional characteristic of albumen.

For more information on this project contact Fred Silversides at: silversidesf@agr.gc.ca

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