

EGG QUALITY IN WHITE LEGHORNS, WHITE PLYMOUTH ROCKS AND NEW HEMPSHIRE UNDER EGYPTIAN CONDITIONS

By

M.A. KHEIRELDIN¹, M.A. GHANY² AND A.M. EL GAMMAL³

SUMMARY

Egg components and internal qualities were tested in monthly samples of eggs from White Leghorns, White Plymouth, Rocks and New Hampshire under Egyptian conditions. The results obtained are summarised as follows:

1. Egg weight tended to decrease in hot weather and was found to be positively associated with albumen percent and negatively related to yolk percent. Breed as well as monthly differences in egg weight were highly significant.

2. Shell percent showed a gradual decrease with advancement of laying especially during the summer months.

3. Yolk indexes and Haugh units were relatively high at the start of laying and showed a rather irregular decline afterwards. The lowest levels were observed during January, with high rate of production; and in July, during highest air temperature.

4. The incidence of blood spots and meat clots greatly differed between breeds. White Leghorn eggs showed the fewest, while New Hampshire showed the most. Differences between breeds were greatest in summer months.

It is concluded that to avoid a decline in egg quality during summer, more appropriate housing and feeding facilities should be available. Breeding programs for the development of breeds and strains resistant to unfavourable weather must also receive more attention.

INTRODUCTION

Introduction of foreign breeds of fowl to Egypt for improving meat and egg production was greatly encouraged during the last decade. Studies were initiated to measure the pattern of production in the newly imported breeds under local environment. Results dealing with fertility and hatchability were published by Helmy (1958), Omara (1959), Ghany (1960) and El-Boushy (1961), while results in growth performance were reported by Ragab *et al* (1956), Mostageer (1958), Rizk and El-Ibiary (1960) and Ghany *et al* (1966). Egg production was investigated by Amer (1956 - 1959) and Samkari (1962). The present study was undertaken to deal more specifically with egg quality of these imported breeds. Romanoff and Romanoff (1949) Warren *et al* (1950) and Baker and Curtis (1958) found egg quality differences due to breeds, season, age and sexual maturity

1, 3. Animal Production Dept. Fac. of Agric. Assuit Univ., Assuit, U.A.R.

2. Animal Production Dept. Fac. of Agric. Cairo Univ., Cairo, U.A.R.

MATERIALS AND METHODS

The experimental work was carried out at the faculty of Agriculture, Assuit University, during 1962 and 1963. Eight monthly shipments of fresh-laid market eggs were supplied from Kaha Poultry Station, each shipment including a breed sample of 100 eggs for White Leghorns, White Plymouth Rocks and New Hampshires. The laying birds were floor housed and were kept under similar managerial conditions. Ration used is shown in Table 1. Eggs were cooled on arrival to 50° - 60° f. and individual measurements were taken in the following day. Eggs were then weighed to the nearest 0.1 gram before being broken on a flat glass surface. Measurements were recorded for yolk index as described by Sharp and Powl (1930) and modified by Funk (1948) and for Haugh Units (as recommended by Haugh 1937) and modified by Brant and Shrader (1952). Blood and meat spots were visually classified by colour appearance. Yolk, as well as shell, were carefully freed from the attached albumin and weighed to the nearest 0.1 gram. Albumin weight was calculated by differences.

RESULTS AND DISCUSSION

1. Egg Weight and Components :

Average monthly egg weights and percentages for yolk, albumin and shell are presented in Table 2. Eggs were small in October, mainly in relation to sexual maturity, then tended to increase soon thereafter. The heaviest egg weight for the three breeds was attained in March, with the approach of hot weather, eggs tended to become smaller especially those from white Leghorns. The sharpest decline occurred in July. Fluctuations in egg weight due to seasons and environmental temperatures were reported by Jolly (1924) Lorenz and Almquist (1936), Yeates *et al* (1941), Hays (1944), Hutchinson (1953) and Ragab and Assem (1953). Breed and Strain differences also were observed by Funk and Kempster (1934) and Ghany *et al* (1962). Wilson (1948, 1949) related the decline in egg weight to a decline in feed consumption and rise in body temperature of layers in a hot weather.

Yolk percent was exceptionally high in October then tended to fluctuate rather irregularly thereafter. The percent albumen increased soon after October but tended to decrease during hot months. The percent of shell clearly reduced with the advancement of laying. Those results generally agree with findings reported by Bennion and Warren (1933). Wilhelm (1940), Kamar (1955) and Huston and Carmon (1961).

Egg weight was found to be positively correlated with albumen content, (Table 3). A negative association was found between egg weight and percent yolk. There was an even stronger negative relationship between percent yolk and percent albumen. Those results confirm those reported by Asmundson (1931) and Skala and Swenson (1962).

With exception of egg weight and percent meat spots the egg component differences were more related to months than to breeds. (Table 4). Bennion and Warren (1933), Funk and Kempster (1934) and El-Ayadi (1956) reported similar differences.

2. Internal Egg Quality :

Decreases in yolk indeces were associated with advancement of laying and occurrence of hot weather, (Table 5). Haugh units were at a maximum in October with subsequent irregular fluctuations. January and July estimates for either yolk index or Haugh units were particularly low compared with other months. Months seemed to exert more significant influence than breeds in this direction, (Table 4). Hunter *et al* (1936) and Wilhelm and Heiman (1938) reported seasonal differences in yolk index, while Warren *et al* (1950) and Gratts (1936) found similar differences in Haugh units. Breed differences in these measures were also observed by Farnsworth and Nordskog (1955), Strain and Jenson (1956) and Baker and Curtis (1958).

Incidences of blood spots and meat clots were remarkably lower in White Leghorn eggs than in White Plymouth Rocks or New Hampshires. Frequencies of both spots were much higher in all breeds during hot weather. Differences due to both months and breeds were statistically significant (Tables 4 and 5). Nalbendor and Card (1947) and Santer *et al* (1952) found significant seasonal variations in the frequency of meat and blood spots while significant differences between breeds and strains of chickens were reported by Hall (1939), Jull (1951) and Amer (1961). Quinn and Godfrey (1940), Jeffrey (1945) and Stadleman and Cyrus (1952) came to conclude that eggs of heavy breeds of fowl have more meat spots and blood clots than those of white Leghorns. Nalbendov and Card (1944) speculated that there are more hammorages in the reproductive organs during hot temperatures, while Santer *et al* (1952) and Bearnse *et al* (1953), (1960) found that lack of vitamin sources, especially vitamin A, was related to the high frequencies of blood spots and meat clots in summer eggs.

TABLE 1.—Composition of Ration used for layers during the experimental period

Materials	%	Materials	%
Crushed maize	30	Fish meal	3
Rice polish	20	Lime stone powder	2
Wheat bran	20	Bone powder	2
Corticated Cotton seed cake . .	10	Mixd mineral powder	$\frac{1}{2}$
Crushed horse beans	7	Sodium chloride	$\frac{1}{2}$
Crushed soyabeans.	5		

1. Digestible protein 15%.
2. Starch equivalant 67
3. Vitamin and Mineral mixures were added to the ration at 0.1% for each.
4. Trifolium Alexandrinum (Berseem) and Portulaca Oleraceae were available as green fooder during the winter and summer months respectively.

TABLE 2.—Average monthly egg weights goes and percentages of egg yolk, albumen and shells for White Leghorns, White Plymouth Rocks and New Hampshires during the different months of the study

Months	White Leghorn				White Plymouth Rock				New Hampshire			
	Egg Weight	Yolk %	Alb. %	Shell %	Egg Weight	Yolk %	Alb. %	Shell %	Egg Weight	Yolk %	Alb. %	Shell %
October	52.6	34.6	52.1	13.3	56.7	34.1	53.0	12.9	56.5	32.8	54.5	12.7
December	54.9	29.2	58.7	12.1	58.0	28.5	60.2	11.3	60.8	28.7	60.4	10.8
January	53.4	32.2	55.4	12.4	57.2	33.0	54.7	12.3	57.6	32.3	55.9	11.8
March	60.8	29.9	58.4	11.7	61.1	30.9	57.5	11.6	62.8	29.4	59.7	10.9
May	58.3	32.0	56.3	11.7	60.4	31.5	56.7	11.8	61.9	31.6	57.2	11.1
June	56.1	33.0	57.0	10.0	58.9	33.0	57.8	9.2	59.9	33.1	57.0	9.9
July	55.1	33.8	55.6	10.6	57.8	33.8	55.6	10.6	59.7	32.9	56.7	10.6
August	56.1	31.5	57.9	10.6	59.0	32.5	57.3	10.2	60.0	32.4	57.2	10.4
Average	55.9	32.0	56.4	11.6	58.7	32.2	56.5	11.3	59.9	31.7	57.3	11.0

TABLE 3.—Correlation Coefficients Between Egg Weights and Percentages of Albumen and Yolks for W.L., W.P.R. and N.H. Layers

Items correlated	W.L.	W.P.R.	N.H.
Egg weight × Albumen percent	0.632	0.639	0.809*
Egg weight × Yolk percent	-0.524	-0.395	-0.610
Albumen percent × Yolk percent	-0.834**	-0.777*	-0.881**

* Significant at 5% level.

** Significant at 1% level.

TABLE 4.—F values from analysis of variance of differences due to breeds and months in egg characteristics

Characters Factors	Egg weight	Percent yolk	percent albumen	Yolk index	Haugh units	Percent shell	Percent Blood spots	percent Meat spots
Breeds	59.358**	1.898	4.366*	3.092	2.411	5.259*	5.828*	50.913**
Months	22.549**	33.169**	25.854**	16.497**	5.706*	30.714**	8.038**	10.214**

* Significant at 5% level.

** Significant at 1% level.

TABLE 5.—Average of Yolk indexes, Haugh Unites, blood spots percentage and meat spots percentages in eggs from W.L., W.P.R. and N.H. hens during different months

Months	W. L.			W. P. R.			N. H.					
	Yolk Index	Haugh Unites	Blood spots %	Meat spots %	Yolk Index	Haugh Unites	Blood spots %	Meat spots %	Yolk Index	Haugh Unites	Blood spots %	Meat spots %
October	50.5	78.0	1.48	4.17	49.4	76.0	3.75	10.00	50.5	79.0	5.16	28.00
December	48.2	71.0	0.00	1.70	48.9	75.5	0.00	14.10	49.6	72.5	2.60	21.70
January	46.2	65.5	1.03	4.08	45.4	68.0	2.14	4.30	44.1	65.0	3.03	26.30
March	48.3	70.5	4.20	2.06	48.8	74.5	5.21	22.10	46.2	70.5	5.26	27.37
May	46.7	74.5	5.20	18.80	48.5	75.5	18.80	39.80	45.8	70.0	19.50	46.00
June	46.5	72.5	4.00	2.06	47.0	73.0	5.26	23.90	45.6	72.0	6.52	28.20
July	44.2	67.0	2.04	9.50	45.1	70.0	3.19	11.70	44.8	65.5	3.26	23.90
August	44.8	74.0	5.00	16.00	46.3	73.0	16.31	30.00	45.0	71.0	18.50	36.50
Average	46.9	71.6	2.88	7.29	47.4	73.3	6.83	19.56	46.4	70.7	7.98	29.75

Acknowledgements

Thanks are expressed to Dr. M. T. Habib and Dr. M. Y. H. Darwish of the Fac. of Agric., Assuit Univ. for their interest in this work.

REFERENCES

- Amer, M. F. (1956). A contribution to the introduction of standard breeds of poultry to Egypt. M. Sc. Thesis : Fac. of Agric., Ain Shams Univ. U.A.R.
- (1959). A study of egg size in fayoumi and some imported breeds of poultry. Ph. D. Thesis : Fac. of Agric. Ain Shams Univ. U.A.R.
- (1961). Inheritance of meat and blood spots in eggs of fayoumi and some standard breeds. *Poult. Sci.* Vol. 40 : 1341.
- Asmundson, U.S. (1931) The formation of the hen's egg. *Sci. Agric.* 11 : 672.
- Baker, R.C., and Curtis R., (1958) Strain differences in egg shell mottling, internal quality, shell thickness, specific gravity and the interrelationship between them. *Poult. Sci.* 37 : 1086.
- Bearse G.E., C.F. McClary and Sexena, H.C. (1953). Blood Spots incidence and vitamin A. level of the diat. *Poult. Sci.* 32 : 888.
- (1960). Blood spot incidence in chicken eggs and vitamin A level of the diet. *Poult. Sci.* 39 : 860.
- Bennion N.L. and Warren, D.C. (1933). Temperature and its effect on egg size in the domestic fowl — *Poult. Sci.* 12 : 83.
- Brant A. W. and Shrader, H. L. (1952). How to measure the interior quality of the egg. *P. A.* 202, U.S.D.A.
- El-Ayadi, M.N. (1956). Fertility and hatchability as related to quality in Egyptian commercial eggs. *M. Sci. Thesis : Fac. of Agric., Alex. Univ. U. A. R.*
- El-Boushy, A. R. (1961). A study of fertility and hatchability in the fowl. M. Sc. Thesis, Fac. of Agric., Cairo Univ. U.A.R.
- Farnsworth G. M. and Nordskog A. W. (1955). Breeding for egg quality : Genetic differences in shell characteristics and other egg quality factors. *Poult. Sci.* 34 : 16.

- Funk E. M.** (1948). The relations of the yolk index determined in natural position to the yolk index as determined after separating the yolk from the albumin. *Poult. Sci.* 27 : 367.
- Funk E. M. and Kempster, H. L.** (1934). Egg weight in the domestic fowl. *Missouri Agric. Exp. Sta. Bull.* 332.
- Ghany M. A.** (1960). Fertility and hatchability of some foreign and native of poultry in the Liberation Province. Proc. First Near East Meeting on Anim. Prod. Cairo.
- , **Badreldin A.L. and Obeidsh A.M.A.** (1962). Seasonal variation of egg production in relation to time of sexual maturity under Egyptian conditions. *U.A.R. Jour. Anim. Prod.* 2 : 151.
- , **Kheireldin M.A. and Mostafa M.B.** (1966). Seasonal and breed differences in growth, feed efficiency, mortality rate and profitability of chickens under Egyptian environmental conditions. *U.A.R. Jour. Anim. Prod.* (In press).
- Grotts R.F.**, (1956). Seasonal variation in egg quality. Thesis, Univ. of Missouri. Poult. Dept.
- Hall G.O.**, (1939). Breed variations among egg characters. *Poult. Sci.* 18 : 282.
- Haugh R.R.**, (1937). The Haugh unit for measuring egg quality. *U.S. Egg Poultry Mag.* 43 : 552.
- Hays F. A.**, (1944). Variability of egg weight in Rhode Island Reds. *Massachusetts Agric. Exp. Sta. Bull.* 411.
- Helmy S.A.**, (1958). Fertility, embryonic mortality and hatchability in poultry as effected by genetical, environmental and physical factors. Ph. D. Thesis, Fac. of Agric. Cairo Univ.
- Hunter, J.A.A., Van Wagon and Hall, A.O.** (1936). Seasonal variation in interior quality of Single Comb White Leghorn Eggs. *Poult. Sci.* 15 : 115.
- Huston T. M. and Carmon, S. L.** (1961)—The influence of high environmental temperature on specific gravity and albumin quality of hen's eggs. *Poult. Sci.* 40 : 1060.
- Hutchinson J. C. D.**, (1953). Effects of hot climate on egg weight. *Poult. Sci.* 32 : 492.
- Jeffery, F. P.**, (1945). Blood and meat spots in chicken eggs. *Poult. Sci.* 22 : 230.
- and **C. E. Walker** (1950). The relationship between egg shell colour and incidence of coloured meat spots. *Poult. Sci.* 29 : 245.

- Jull M. A., (1924). The relationship of parts of the egg to total egg weight *Poult. Sci.* 3 : 77.
- , (1951). "Poultry Husbandry". McGraw-Hill Co. N.Y.
- Kamar G. A. R. (1954). Development and physiological aspects in the reproduction of domestic fowl. M. Sc. Thesis. Fac. of Agric. Cairo Univ.
- Lorenz F. W. and Ahnquist, H. J. (1936). Seasonal variation in egg quality. *Poult. Sci.* 15 : 14.
- Mostageer A. M., (1958). Some economical characteristics in different breeds and crosses of fowl. M. Sc. Thesis, Fac. of Agric. Cairo Univ.
- Nalbandov A. V. and Card, L. E. (1944). The problem of blood clots and meat spots in chicken eggs. *Poult. Sci.* 23. : 170.
- , (1964). The problem of blood clots and meat spots in chicken eggs: its importance in poultry flocks and a study of nutritional factors involved. *Poult. Sci.* 26 : 40.
- Omara B. (1959). A comparative study of hatchability, embryo mortality and malposition in the Fayoumi and three standard breeds of chickens. M. Sc. Thesis. Fac. of Agric. Alex. Univ.
- Quinn J. P. and Godfrey A. B., (1940). Inheritance and variation of blood spots in chicken eggs. *Poult. Sci.* 19 : 359.
- Ragab, M. T. and Assem, M. A., (1953). Effect of atmospheric temperature and day light on egg weight and yield of Fayoumi and Baladi fowls. *Poult. Sci.* 32 : 1021.
- , Asker A. A. and Samak, E. (1956). Effect of crossing Fayoumi fowls with Light Sussex and R. I. R. Fac. of Agric. Cairo Univ. Bull. 96.
- Rizk Y. G. and El-Ibiary H. M., (1960). Meat yield in the 16 weeks old Fayoumi, Leghorn and R.I.R. chicks. *Alex. J. of Agric. Res.* V. 8 No. 1.
- Ramanoff A. L. and Ramanoff, A. J. (1949). "The Avian Egg". J. Wiley and Sons Inc. N.Y.
- Samkari M. K., (1962). A comparative study of some economical characteristics in R. I. R. Fayoumi, Baladi and their crosses, M. Sc. Thesis, Fac. of Agric., Cairo Univ.
- Gauter E. A., Stadleman W. J. and Carver, J. S. (1952). Factors affecting the incidence of blood spots and their detection in hen's eggs. *Poult. Sci.* 31: 1042.
- Sharp P. F. and C. K. Powell, (1930). Decrease in the internal quality of hen's egg during storage as indicated by the Yolk. *Ind. Eng. Cham.* 22 : 909.

- Skala J. H. and Swanson M. H., (1962). Studies of variation in initial quality of chicken eggs. *Poult. Sci.* 41 : 1533.
- Stadleman, W. J. and Cyrus, M. (1952). Effect of temperature on loss of egg quality. *Poult. Sci.* 31 : 936.
- Strain J. H., and Johnson, A. S. (1956). Seasonal, hatch and strain effect on egg quality. *Poult. Sci.* 35 : 1174.
- Warren D. C., Conrad, R. Schumacker A.E. and Avery., T. B. (1950). Effects of fluctuating environmental temperatures on laying hens. Kansas Agric. Exp. Sta. Bull. 68.
- Wilhelm, L. A., (1940). Some factors affecting variation in egg shell quality *Poult. Sci.* 19 : 246.
- and Heiman, V. (1938). Seasonal Change in interior quality of new laid eggs. Wash. Agric. Exp. Sta. Bull. 358.
- Wilson W. G., (1948). Some effects of increasing environmental temperatures on pullets. *Poult. Sci.* 27 : 813.
- , (1949). High environmental temperatures as affecting the reaction of laying hens to iodized casein. *Poult. Sci.* 28 : 581.
- Yeates, N. T., Lee, D. H. R. and Hines, J. G. (1941). Reaction of domestic fowls to hot climates. *Proc. Roy. Soc. Queensland* 53 : 105.

(Printed in 1968)

دراسة مقارنة عن مكونات البيض في اللجهورن الأبيض والبليموث روك
الأبيض والنيوهامبشير تحت الظروف المحلية

المخلص

أجريت هذه الدراسة على عينات شهرية من بعض أنواع هذا الدجاج بغرض معرفة مكونات البيض والصفات الداخلية وقد تبين من البحث النتائج الآتية :

(١) يميل وزن البيض الى النقصان في الجو الحار كما تبين وجود علاقة ايجابية بين وزن البيض ووزن البياض - وسلبية بين وزن البيض ووزن الصفار *

(٢) تبين أن النسبة المئوية لوزن القشرة بالنسبة لوزن البيض ينقص كلما تقدم العمر بالدجاجة كما تنقص أيضا بزيادة حرارة الجو في شهور الصيف *

(٣) كان كل من معامل الصفار ووحدات جدخ نسبيا عالية القيمة في مبدأ وضع البيض ثم كانت تنقص دون نظام بعد ذلك * وكان أقل المستويات هو في شهر يناير مع زيادة معدل وضع البيض وكذلك في شهر يولية وهو أعلى شهور السنة حرارة *

(٤) تبين أن ظهور حالات البقع الدموية والقطع اللحمية في البيض تباين باختلاف أنواع الدجاج اللجهورن هي أقل هذه الأنواع تعرضا لهاتين الظاهرتين بينما كان أكثر الأنواع بالنسبة لذلك هو النيوهامبشير *

هذا وقد كان الفرق على أكبر قدر في شهور الصيف *