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The Effect of Egg Laying Cycle on Egg Comp-onerts

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16 FAYOUMI and 13 White Plymouth pullets were available during the first year of laying. 4322 eggs from the Fayoumi pullets and 3767 eggs from the Plymouth pullets of different clutch sizes were dissected into their components. Egg weight and components weights and percentage increased during winter and spring months and decreased during hot summer months. Egg albumen and yolk weight decreased with the advancement of the position of the egg in the clutch. Albumen percentage decreased and yolk percentage increased with the advancement of the position of the egg in the clutch. The first egg in cycle of two eggs had heavier shell, thicker shell and lower shell percentage than the second egg. In cycles of three eggs or more, the first and last eggs in the clutch had heavier shells, thicker shells and higher shell percentage than in between eggs. These trends were observed during the season-of high rate of egg production. The Plymouth birds laid heavies eggs with heavier albumen and yolk than the Fayoumi eggs. Fa youmi eggs were of higher yolk and shell percentage than th Plymouth eggs.

The first egg in a cycle is usually laid in the morning and is generally heavier than the other eggs in the same cycles. The succeeding eggs in the cycle decrease gradually in size (Petrovic 1967). The decrease in weight per egg was greater in short clutches than those in long ones (Raimo 1947). However, Sigaeve (1964) observed that egg weight was not affected by the clutch size in high producers. Raimo, (1947) reported that the greater the weight of the first egg, the higher the decrease in weight between the first and last eggs in the clutch. He also found in small clutches of two and three eggs that the average weight was higher than that of eggs in longer clutches.

Irregular variation in shell weight was observed with the increase in clutch size, while its percentage decreased with the advancement in clutch position (Amer, 1959). Shell thickness in the two-egg, laying cycle is higher in the second egg than in the first one. In cycles of three or more eggs, the shells of the first and last eggs are thicker than those in between (Romanof and Romanoff, 1949).

Material and Methods

16 Fayoumi hens of 6 months of age and 13 White Plymouth Rock hens, 8 months of age were used in this experiment for 21 months. Every breed was housed in separate house with shaded yards. A trapnest was used for each four hens to record individual egg production. The birds were fed a balanced mash diet during all the experimental period containing 17.32% digestable protein. The clutch size was determined by the number of successive days which one egg was laid or a group of eggs were laid successively. All the eggs laid by the Fayoumi pullets summing up 4322 and by the Plymouth Rocks summing up 2767 eggs were dissected and the different components were freed and weighed.

Results and Discussion

Egg weight

It could be observed that the Plymouth Rock laid heavier eggs than the Fayoumi in all cycles. The yearly average of egg weight was 53.6 and 46.3 g for the Plymouth and Fayoumi respectively. The differences between the two breeds in the one, two, three and four egg laying cycles were highly significant. The heavier breed produced the heavier eggs (Table 1). In both breeds, egg weight of different position in the clutch tended to increase with the increase in clutch length to four and five egg laying cycles in the Plymouth Rock and the Fayoumi respectively. After that, egg weight decreased with the increase in clutch length with some exception in six and seven egg laying cycles. In general, the first egg had the heaviest weight in the cycle, then the weight of the following eggs decreased with the advance of the egg in the cycle.

Statistical analysis showed no significant differences between egg weight according to the position of the egg in the clutch. The only exception to that is the significant differences in the two egg laying cycles.

The largest weight of the first egg may be explained by the preceding rest period (pause) which enables the hens to deposit more nutritive materials, mainly in the albumen percentage in the first egg. In the present study it was noticed however, that the last eggs in the long cycles in both breeds were sometime heavier than the preceding ones. (Tables 3, 4, 5, 6, 7 and 8). Similar results were reported by other workers such as Raimo (1947). The previous trend can be already observed in both breeds in all cycles in the seasons of high egg poduction (Spring and Summer). While the trend was not clear in the period of low egg production, especially in long cycles. Egg weight of both breeds showed different seasonal variation trends according to the length of cycle, the lowest egg weight observed during summer and the heaviest during winter for both breeds. The differences between seasons in egg weight were highly significant in the case of three, four and five egg laying cycles (p 0.01) and not significant in other cycles. Amer (1959) and Kamar (1962) reported that egg weight attined maximum during January and February and

TABLE 1. Monthly and breed differences in egg weight and its components.

Months and breeds	Egg wt.	Albumen		Yolk		Shell	
		wt.	%	wt.	%	wt.	%
Fayoumi							
December	47.7	27.0	56.7	15.8	33.1	4.9	10.3
January	47.3	27.4	58.0	14.6	30.7	5.3	11.3
February	48.1	27.8	57.9	14.9	31.0	5.4	11.2
Winter	47.7	27.4	57.5	15.1	31.6	5.2	10.6
March	47.7	27.3	57.3	15.3	32.1	5.0	10.6
April	45.6	26.3	57.8	14.4	31.5	4.9	10.7
May	44.2	25.4	57.5	14.4	32.6	4.4	9.9
Spring	46.8	26.3	57.5	14.7	32.1	4.8	10.4
June	54.5	26.4	58.2	14.6	32.1	4.4	9.7
July	44.6	25.3	56.8	15.0	33.5	4.3	9.7
August	46.0	26.9	58.5	14.4	31.3	4.7	10.8
Summer	45.3	26.2	57.8	14.7	32.3	4.5	10.1
September	45.7	25.7	56.2	15.2	33.2	4.8	10.6
October	46.5	26.9	58.0	14.8	31.8	4.7	10.2
November	46.9	26.1	55.7	15.8	33.6	5.0	10.6
Autumn	46.4	26.2	56.7	15.3	32.9	4.8	10.5
Plymouth							
December	57.8	35.1	60.7	14.9	30.9	4.8	8.4
January	54.2	33.4	61.7	15.3	28.3	5.4	10.0
February	54.6	33.5	61.3	15.8	28.9	5.3	9.8
Winter	55.6	34.0	61.2	16.3	29.4	5.2	9.4
March	53.2	32.5	61.0	15.6	29.3	5.1	9.6
April	53.8	32.7	60.8	16.2	30.1	4.9	9.0
May	52.9	31.9	60.3	16.3	30.8	4.7	8.9
Spring	53.3	32.4	60.7	16.0	30.1	4.9	9.2
June	49.3	30.3	61.5	14.8	30.0	4.2	8.5
July	49.3	30.1	61.1	14.9	30.3	4.3	8.6
August	51.0	31.3	61.4	15.4	30.2	4.3	8.5
Summer	49.2	30.6	61.3	15.0	30.2	4.3	8.5
September	51.2	30.7	60.1	15.9	31.1	4.5	8.8
October	56.6	34.5	60.9	16.9	29.9	5.2	9.2
November	59.9	36.8	61.4	17.8	29.8	5.3	8.8
Autumn	55.9	34.0	60.8	16.9	30.3	5.0	8.9

the minimum during July and August. The increase in egg weight during winter and spring seasons is associated with the suitable environmental conditions usually prevailing in these seasons. However, the low values of egg weight recorded during summer could be attributed to the effect of high environmental temperature on egg formation.

Albumen weight and percentage

Plymouth Rock eggs had more albumen weight and percentage than the Fayoumi eggs (Table 2, 3, 4, 5, 6, 7 and r).

TABLE 2. **Seasonal variations in egg weight and its components of one egg laying cycle.**

Items and breed	Winter	Spring	Summer	Autumn	Average
Fayoumi					
Egg wt.	45.3	45.3	45.6	46.0	45.6
Albumen wt.	25.5	26.6	23.1	26.3	26.4
%	56.4	58.8	50.5	57.2	57.8
Yolk wt.	14.8	13.6	14.1	15.0	14.4
%	32.7	30.1	30.9	32.6	31.6
Shell wt.	5.1	5.0	4.5	4.7	4.8
%	11.2	11.1	9.8	10.2	10.6
Plymouth					
Egg wt.	55.6	54.4	52.8	53.4	54.0
Albumen wt.	34.4	34.2	33.0	32.6	33.5
%	61.9	62.8	62.5	61.1	62.1
Yolk wt.	16.0	15.6	15.4	16.8	15.7
%	28.8	28.6	29.2	29.6	29.0
Shell wt.	5.2	4.8	4.3	4.9	4.8
%	9.3	8.8	8.2	9.3	8.9

F value :	Between breeds	Between seasons
Egg wt.	= 307.4½½	1.1
Albumen wt.	= 241.1**	3.7
Albumen %	= 10.4*	0.7
Yolk wt.	= 69.5**	7.9*
Yolk %	= 0.9	3.4
Shell wt.	= 0.1	17.3**
Shell %	= 6.9*	0.8

TABLE 3. Seasonal variations in egg weight and its component of two eggs laying cycle.

Items and breeds		Winter		Spring		Summer		Autumn		Average	
		Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.
Egg wt.	1	49.3	56.8	48.1	56.8	48.9	54.4	46.4	60.2	48.2	57.1
	2	47.7	55.9	45.7	54.2	43.9	51.8	45.1	57.7	45.6	54.8
Albumen wt.	1	28.5	35.5	28.2	35.5	29.9	34.4	26.3	37.3	28.3	35.7
	2	27.2	34.4	26.4	32.9	25.0	31.6	25.2	35.4	26.0	33.4
Alb. %	1	57.7	62.5	58.6	62.5	61.2	63.2	56.6	61.9	58.4	62.0
	2	56.9	61.5	57.9	60.6	57.0	60.9	55.9	61.4	56.9	61.1
Yolk wt.	1	15.4	15.7	14.6	16.1	14.4	15.2	15.3	17.6	14.9	16.2
	2	15.0	16.0	14.1	16.3	14.4	15.5	15.2	17.1	14.7	16.3
Yolk %	1	31.2	27.6	30.4	28.4	29.5	27.9	32.9	29.3	31.3	28.3
	2	31.5	28.6	30.9	30.1	32.8	29.9	33.6	29.7	32.2	29.6
Shell wt.	1	5.5	5.6	5.3	5.2	4.5	4.8	4.9	5.2	5.0	5.2
	2	5.5	5.6	5.1	5.0	4.4	4.7	4.7	5.1	4.9	5.1
Shell %	1	11.1	9.9	10.9	9.1	9.3	8.9	10.5	8.8	10.6	9.2
	2	11.6	9.9	11.2	9.2	10.1	9.1	10.5	8.9	10.9	9.3

F value :	Between breeds	Between seasons	Between eggs in clutch
egg wt.	11.1**	1.1	7.3*
alb. wat.	227.5**	0.2	18.7**
alb. %	1.3	0.2	1.3
Yolk wt.	37.8**	6.9**	0.1
Yolk %	1.8*	0.7	1.8
Shell wt.	0.8	3.6	0.3
Shell %	81.8**	12.8**	2.9

The yearly average for albumen weight and percentage was 32.7, 26.6., g (61.0% 57.4%) for the plymouth asd Fayoumi respectively. Highly significant differences were observed between breeds in albumen weight in cycles of one, two, three, four and five eggs and albumen percentage of cycles of three, four, five and six eggs. While differences in albumen percentage were significant in the cycles of one egg only. Findings reported by Hafez *et al.*, (1955) showed that the Egyptian breeds laid eggs with relatively less albumen than the foreign breeds. This may be due to the fact that the larger the egg, the heavier the albumen weight. In the Fayoumi both albumen weight and percentage of different positions of eggs in the clutch increased with the increase in clutch length with a slight deviation in the six and seven egg laying cycles. Meanwhile, in the Plymouth Rock eggs, both absolute and relative albumen weight tended to increase with the increase in clutch length until the four egg laying cycles, then decreased in the five and six egg cycles, and increased in the seven egg cycles.

TABLE 4. Seasonal variations in egg weight and its components of 3 eggs laying cycle.

Items		Winter		Spring		Summer		Autumn		Average	
		Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.
Egg wt.	1	48.3	53.6	48.5	59.4	45.1	54.7	463	56.9	47.1	57.4
	2	47.8	57.6	47.1	56.7	44.6	53.1	44.8	54.5	46.2	55.4
	3	47.4	57.6	46.8	42.3	51.2	45.6	55.2	45.4	45.4	54.7
Alb. wt.	1	27.7	31.3	28.0	36.8	25.9	33.7	26.6	36.1	27.0	35.6
	2	27.6	35.6	27.0	34.6	25.8	32.9	25.5	32.8	26.6	3 3.8
	3	26.7	35.1	26.6	33.8	24.1	31.1	26.4	33.2	25.9	33.1
Alb. %	1	57.3	58.4	57.7	61.7	57.5	61.6	57.5	63.3	55.7	61.2
	2	57.6	61.8	57.4	61.0	57.7	61.9	56.9	60.3	57.7	61.2
	3	56.4	60.9	57.5	60.6	56.9	60.7	57.8	60.2	57.3	60.6
Yolk wt.	1	15.2	16.6	15.4	17.3	14.9	16.3	15.1	15.8	15.2	16.6
	2	15.3	16.4	15.2	17.1	15.0	16.4	14.8	16.8	15.1	16.8
	3	15.1	16.6	14.8	16.8	14.2	15.6	14.7	17.0	14.7	16.5
Yolk %	1	31.5	30.9	31.7	29.1	33.0	29.8	32.6	27.7	32.2	29.4
	2	32.0	28.4	32.4	30.1	33.7	30.9	33.1	30.9	32.8	830.1
	3	31.8	28.9	31.9	30.1	33.5	30.5	32.1	30.8	32.3	30.1
Shell wt.	1	5.4	5.8	5.1	5.5	4.3	4.7	4.6	5.1	4.9	5.2
	2	5.0	5.6	4.8	5.0	3.9	3.9	4.5	4.8	4.5	4.8
	3	5.6	5.9	4.9	5.2	4.0	4.5	4.6	4.9	4.8	5.1
Shell %	1	11.2	10.7	10.6	9.2	9.5	8.6	9.9	8.9	10.3	9.3
	2	10.4	9.7	10.2	8.9	8.7	7.3	9.9	8.8	9.8	8.7
	2	10.4	9.7	10.2	8.9	8.7	7.3	9.9	8.8	9.8	8.7
	3	11.9	10.2	10.7	9.3	9.5	8.9	10.1	8.9	10.5	9.3

F value :	Between breeds	Between seasons	Between eggs in clutch
egg wt	295.4**	10.3**	2.4
alb. wt	214.1**	3.6*	1.6
%	91.1**	0.6	0.6
Yolk wt.	99.3**	2.8	0.6
%	57.6**	2.9	1.2
Shell wt.	34.8**	89.9**	15.4**
%	66.6**	36.3**	11.5**

TABLE 5. Seasonal variations in egg weight and its components of 4 eggs laying cycle.

Items		Winter		Spring		Summer		Autumn		Average	
		Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	ply.	Fay.	Ply.
Egg wt.	1	47.8	60.3	47.6	57.3	47.6	61.5	47.9	50.0	47.7	58.2
	2	46.4	58.5	47.2	55.5	45.6	56.1	48.1	49.0	46.9	45.6
	3	46.8	58.2	46.3	54.0	44.4	54.4	48.1	46.5	46.3	54.3
	4	46.6	58.7	45.7	54.6	44.2	56.9	46.0	51.5	45.6	55.8
Alb. wt.	1	27.3	37.9	27.5	34.6	27.9	40.1	27	428.8	27.6	36.0
	2	26.3	36.6	27.1	33.6	26.5	35.7	27.8	27.4	27.0	34.0
	3	27.1	36.2	26.5	32.5	25.3	34.5	27.4	28·2	26.4	33.4
	4	26.7	36.7	25.9	32.9	25.2	36.1	26.1	39.9	76.0	34.3
Alb. %	1	57.2	62.9	57.9	60.4	58.7	65.2	57.7	57.6	57.8	61.5
	2	56.7	62.6	57.4	60.7	58.1	63.6	57.7	55.9	7.75	60·7
	3	57.8	62.2	57.2	60.1	57.1	63.3	57.1	60.6	55.6	61.6
	4	57.4	62.6	56.8	60.3	57.0	63.4	56.8	68.1	57.0	61.1
Yolk wt.	1	14.9	16.4	14.9	17.9	15.1	16.3	15.5	16.7	15.1	16.7
	2	14.8	16.3	15.3	17.2	14.8	16.0	15.1	17.1	15.0	16.7
	3	14.5	16.5	15.0	16.8	14.8	15.5	15.6	14.0	15.1	16.1
	4	14.5	16.4	14.8	17.0	14.5	16.1	14.9	17.2	14.7	16.6
Yolk %	1	31.3	27.2	31.5	29.8	31.6	26.6	32.3	33.3	31.7	29.2
	2	32.0	27.9	32.4	30.9	32.3	28.5	31.5	34.9	32.1	30.6
	3	31.0	28.4	32.4	31.1	33.3	28.4	32.5	30.0	32.3	29.5
	4	41.1	27.9	32.4	31.1	32.8	28.4	32.5	33.0	32.3	30.1
Shell wt.	1	5.5	6.0	5.1	5.6	4.6	5.1	5.1	5.6	5.0	5.5
	2	5.3	5.6	4.8	4.7	4.4	4.5	5.2	4.5	4.9	4.9
	3	5.2	5.4	4.8	4.8	4.3	4.5	4.5	4.3	4.8	4.8
	4	5.4	5.6	4.9	4.7	4.5	4.7	4.9	4.5	4.9	4.9
Shell %	1	11.5	9.9	10.7	9.8	9.6	8.2	10.6	9.1	10.6	9.3
	2	11.3	9.6	10.2	8.5	9.6	8.0	10.8	9.1	10.5	9.8
	3	11.2	9.4	10.4	8.8	9.6	8.3	10.4	9.3	10.4	9.0
	4	11.5	9.5	10.8	8.6	10.2	8.2	10.7	8.6	10.8	8.7

F value :	Between breeds	Between seasons	Between eggs in clutch
Egg wt.	89.3**	4.3*	2.2
Alb. wt	80.9**	5.0**	0.8
%	57.7**	7.3**	0.3
Yolk wt.	49.3**	1.7	1.3
%	12.8**	4.4*	0.4
Shell wt.	30.5**	19.7**	3.6*
%	282.1**	45.1**	1.6

TABLE 6. Seasonal variations in egg weight and its components of 5 eggs laying cycle.

Items		Winter		Spring		Summer		Autumn		Average	
		Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.
Egg wt.	1	48.9	54.8	46.7	53.6	47.9	47.8	—	49.0	47.7	51.1
	2	48.1	55.5	56.4	53.7	43.8	46.5	—	50.0	45.9	51.0
	3	46.9	51.1	46.1	51.9	47.7	45.5	—	49.0	46.9	48.9
	4	47.0	52.1	46.1	51.9	46.3	46.3	—	47.0	46.0	48.2
	5	47.5	51.8	46.1	52.6	45.4	46.0	—	49.0	46.1	49.5
Alb. wt.	1	28.5	34.1	26.4	28.1	28.7	28.7	—	28.2	27.6	30.8
	2	27.9	34.1	26.5	32.5	25.6	28.2	—	32.2	26.5	31.1
	3	27.2	30.0	26.4	32.2	27.0	26.9	—	30.3	26.8	29.2
	4	27.2	31.4	25.7	31.3	26.4	25.9	—	26.6	26.3	28.7
	5	27.3	31.4	25.9	31.4	25.6	28.1	—	28.9	26.1	29.9
Alb. %	1	58.3	63.1	56.6	60.4	58.7	60.0	—	57.5	57.9	60.0
	2	58.0	61.4	57.1	60.5	58.5	60.7	—	62.4	57.9	61.2
	3	58.1	58.7	57.3	60.0	56.7	59.2	—	61.8	57.4	59.9
	4	58.0	60.3	56.7	60.4	56.9	59.4	—	56.6	57.2	59.2
	5	57.4	60.7	56.2	59.7	61.0	61.0	—	59.0	56.7	60.1
Yolk wt.	1	14.9	15.3	15.3	16.0	15.2	14.7	—	16.2	15.2	15.4
	2	14.9	15.9	15.1	16.2	14.0	14.4	—	14.8	14.7	15.3
	3	14.5	16.1	15.0	15.9	15.8	14.7	—	14.6	15.2	15.3
	4	14.6	15.9	14.9	15.7	14.0	14.0	—	16.2	15.0	15.2
	5	14.6	15.3	15.2	16.0	14.8	13.9	—	15.9	14.9	15.0
Yolk %	1	30.4	28.0	32.9	29.8	31.8	30.9	—	33.0	31.7	30.4
	2	30.9	28.6	32.6	30.2	32.0	30.9	—	29.6	31.8	32.3
	3	30.9	31.6	32.6	30.6	33.1	32.3	—	29.8	32.2	31.4
	4	31.2	30.6	32.8	30.3	33.4	32.1	—	34.5	32.5	31.9
	5	30.6	29.6	32.9	30.5	32.6	30.1	—	32.5	32.0	30.9
Shell wt.	1	5.6	5.4	4.9	5.2	4.6	4.3	—	4.6	4.9	4.9
	2	5.4	5.5	4.8	5.0	4.2	3.9	—	4.0	4.7	4.6
	3	5.2	4.9	4.7	4.9	4.9	3.9	—	4.1	4.9	4.4
	4	5.1	4.8	4.7	4.8	4.5	3.7	—	4.2	4.7	4.3
	5	5.7	5.0	5.0	5.2	4.9	4.1	—	4.2	5.1	4.6
Shell %	1	11.3	9.9	10.6	9.8	9.5	9.1	—	9.4	10.5	9.5
	2	11.1	9.9	10.4	9.4	9.5	8.4	—	7.9	10.3	8.9
	3	11.0	9.8	10.2	9.4	10.2	8.6	—	8.4	10.5	9.0
	4	10.9	9.1	10.4	9.3	9.7	8.5	—	8.9	10.3	8.9
	5	11.9	9.6	10.9	9.8	10.0	8.8	—	8.6	11.2	9.2

F value :		Between breeds	Between seasons	Between eggs in clutch
Egg	wt.	2.6	1.2	0.1
Alb.	wt.	51.9**	10.7**	1.6
	%	127.0**	2.9	2.6
Yolk	wt.	3.8	7.8**	0.5
	%	41.8**	15.4**	3.6*
Shell	wt.	4.6*	32.2**	2.1
	%	110.9**	29.2**	3.2*

TABLE 7. Seasonal variations in egg weight and its components of 6 egg laying cycle.

Items		Winter		Spring		Summer		Autumn		Average	
		Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.
Egg wt.	1	49.8	50.0	47.5	50.3	51.0	48.0	45.5	—	48.3	49.3
	2	50.3	51.0	47.1	47.5	46.1	45.8	44.0	—	47.4	47.5
	3	49.7	48.0	45.3	47.4	44.5	44.5	45.0	—	46.4	46.4
	4	47.6	49.5	43.8	46.9	45.5	43.0	44.0	—	45.2	45.9
	5	49.7	50.0	45.4	46.5	43.0	42.3	44.0	—	46.1	45.5
	6	49.6	49.0	45.3	47.3	46.5	43.0	45.0	—	46.7	45.5
Alb. wt.	1	29.0	31.2	28.1	31.1	32.3	19.1	25.3	—	28.4	30.3
	2	29.8	31.7	26.9	28.2	27.8	26.9	23.8	—	27.4	28.4
	3	29.1	29.0	25.6	28.6	25.9	25.8	25.1	—	26.7	27.7
	4	27.2	30.6	24.7	28.u	25.9	25.8	24.7	—	25.6	28.0
	5	29.4	30.6	26.3	28.3	28.0	25.0	24.5	—	26.7	27.1
	6	28.9	20.4	25.9	27.9	24.3	24.6	24.6	—	26.8	27.3
Alb. %	1	58.2	62.3	59.1	61.8	63.3	60.5	55.5	—	59.0	61.5
	2	59.2	62.1	57.0	59.4	60.5	58.9	54.2	—	57.7	60.1
	3	58.5	60.5	56.5	60.5	58.2	58.0	55.7	—	57.2	57.7
	4	57.1	61.8	56.3	61.3	56.8	59.9	56.2	—	56.6	61.0
	5	59.3	61.1	57.9	60.3	58.2	58.1	53.9	—	57.3	59.8
	6	58.3	62.1	57.0	61.3	60.1	57.8	54.6	—	56.0	60.4
Yolk wt.	1	15.4	13.5	14.6	14.1	13.8	14.7	15.7	—	14.9	14.2
	2	15.3	14.3	15.5	14.6	13.2	14.9	15.9	—	15.2	14.7
	3	15.4	14.2	15.3	14.2	13.4	14.6	15.5	—	14.9	14.3
	4	14.9	14.0	14.8	14.0	14.8	14.0	14.9	—	14.8	14.0
	5	14.9	14.5	14.7	13.9	13.0	14.2	14.8	—	14.5	14.2
	6	15.0	13.8	14.9	13.9	13.2	13.7	14.9	—	14.5	14.2
Yolk %	1	30.9	27.0	30.7	28.1	27.1	30.7	34.5	—	30.8	28.6
	2	30.5	28.1	32.9	30.8	28.7	32.7	36.0	—	32.0	30.5
	3	30.9	29.6	33.7	29.9	30.1	34.5	34.5	—	32.3	30.8
	4	31.3	28.2	33.7	30.0	32.7	32.6	33.9	—	32.9	30.3
	5	30.0	29.1	32.4	29.9	30.3	33.7	33.6	—	31.6	30.9
	6	30.3	28.0	32.8	29.3	28.4	32.y	33.1	—	31.5	33.5
Shell wt.	1	5.4	5.3	4.9	5.1	4.9	4.2	4.6	—	5.0	4.8
	2	5.2	5.0	4.7	4.7	4.9	3.8	4.3	—	4.8	4.4
	3	5.3	4.8	4.4	4.6	5.2	4.1	4.4	—	4.8	4.4
	4	5.5	4.9	4.4	4.1	4.9	3.2	3.4	—	4.8	3.9
	5	5.3	4.9	4.4	4.6	5.0	3.5	5.5	—	4.9	4.2
	6	5.7	4.8	4.6	4.5	5.3	4.0	5.5	—	5.2	4.4

TABLE 7 (*Cont.*)

Items			Winter		Spring		Summer		Autumn		Average	
			Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.	Fay.	Ply.
Shell	%	1	10.9	10.6	10.2	10.2	19.7	8.8	10.0	—	10.2	9.9
		2	10.3	9.9	10.0	9.8	10.7	8.4	9.8	—	10.2	9.1
		3	10.6	9.9	19.8	9.8	11.7	9.2	9.8	—	10.5	9.3
		4	11.6	9.9	10.0	8.8	10.7	7.5	9.9	—	10.5	8.7
		5	10.6	9.8	9.8	9.8	11.5	8.3	12.5	—	11.1	9.3
		6	11.5	9.7	10.2	9.4	11.5	9.6	12.3	—	11.4	2.2

F value		Between breeds	Between seasons	Between eggs in clutch
Eggs	wt.	0.3	25.9**	0.5
Alb.	wt.	3.8	12.1**	3.3*
	%	16.1**	1.6	15.8**
Yolk	wt.	3.3	3.7*	0.7
	%	1.9	3.4*	1.4
Shell	wt.	20.9	3.4*	1.5
		26.5	3.4	0.5

The albumen weight and percentage decreased with the advancement of the position of the egg in the clutch. The differences in albumen weight according to the position of the egg in clutch were highly significant in the two egg laying cycles and significant in the six egg laying cycles (p 0.05). While differences in albumen percentage between eggs in clutch were highly significant in the cycles of six eggs.

The large amount of the albumen in the first egg in a clutch is due to the accumulation if the albuman for a longer time during the pause than the following eggs. This results in the larg weight of the first egg of the cycle after the pause.

Also, Romanoff and Romanoff (1949) and Amer (1959) reported that albumen weight and percentage decreased with the progress of the egg in the clutch. On the other hand, Gea *et al.*, 1964) found that the albumen percentage did not change with the variation in egg size. The decrease in both albumen weight and percentage with the advancement of egg position in a clutch was more noticeable during the seasons of high egg production than the seasons of low egg production and more specially in short cycles than in long ones. It is also clear from that albumen weight and percentage tended to increase during winter and spring seasons and to decrease during summer and autumn seasons in most cycles. This is attributed to the effect of environmental temperature as reported by Gea *et al.*, (1964). The differences between seasons in albumen weight were highly significant in cycles of four, five and six eggs and significant in cycles of three eggs. While differences in albumen percentage between seasons were significant in cycles of four eggs (p. 0.05).

TABLE 8. Seasonal variation in egg weight and its components of 7 eggs laying cycle.

Items		Winter		Spring		Average	
		Fay.	Ply.	Fay.	Ply.	Fay.	Ply.
Egg wt.	1.	50.0	53.3	45.1	—	47.5	63.3
	2.	48.0	53.5	45.4	—	46.7	53.5
	3.	46.5	53.8	44.4	—	45.2	53.8
	4.	45.4	52.0	45.1	—	45.1	52.0
	5.	46.3	53.0	44.4	—	45.2	53.0
	6.	45.3	42.0	43.5	—	44.4	52.0
	7.	45.5	52.3	43.0	—	44.1	52.3
Alb. wt.	1.	29.7	32.6	26.3	—	28.0	32.6
	2.	28.2	32.8	26.7	—	27.5	32.8
	3.	26.9	33.5	25.5	—	26.2	33.5
	4.	25.6	31.2	26.1	—	25.8	31.2
	5.	26.6	32.8	25.7	—	26.1	32.8
	6.	26.2	31.9	25.1	—	25.6	31.9
	7.	26.8	31.8	24.8	—	25.8	31.8
Alb. %	1.	59.5	61.3	58.3	—	58.9	61.3
	2.	58.6	61.1	58.9	—	58.8	61.1
	3.	57.8	62.3	57.5	—	57.7	62.3
	4.	57.1	59.9	58.0	—	57.6	59.9
	5.	57.3	61.9	57.9	—	57.6	61.9
	6.	57.9	61.4	57.7	—	57.8	61.4
	7.	58.9	60.8	57.9	—	58.4	60.4
Yolk wt.	1.	14.5	16.6	14.4	—	14.3	16.6
	2.	14.6	15.2	14.1	—	14.3	15.2
	3.	14.6	15.1	14.3	—	14.4	15.1
	4.	14.7	15.6	14.5	—	14.6	15.6
	5.	14.3	14.8	14.3	—	14.2	14.8
	6.	13.9	14.7	14.0	—	14.0	14.8
	7.	13.8	15.0	13.6	—	13.8	15.0
Yolk %	1.	29.0	28.3	31.3	—	30.2	28.3
	2.	30.5	28.6	31.1	—	30.8	28.6
	3.	31.4	28.2	32.2	—	31.8	28.2
	4.	31.7	30.1	32.1	—	31.9	30.1
	5.	30.9	28.0	33.3	—	32.1	28.0
	6.	30.8	28.3	32.1	—	31.5	28.3
	7.	30.4	28.7	31.3	—	30.9	28.7
Shell wt.	1.	5.8	5.5	4.7	—	5.1	5.5
	2.	5.2	5.6	4.5	—	4.8	5.6
	3.	5.0	5.2	4.6	—	4.8	5.2
	4.	5.2	5.2	3.5	—	4.7	5.2
	5.	5.4	5.4	4.4	—	4.8	5.4
	6.	5.1	5.3	4.4	—	4.7	5.3
	7.	4.9	5.4	4.6	—	4.7	5.4
Shell %	1.	11.5	10.4	10.4	—	11.0	10.4
	2.	10.9	10.4	9.9	—	10.4	10.4
	3.	10.8	9.6	10.4	—	10.6	9.6
	4.	11.2	10.0	9.9	—	10.6	10.0
	5.	11.6	10.2	9.8	—	10.7	10.2
	6.	11.3	10.3	10.2	—	10.8	10.3
	7.	10.6	10.4	10.7	—	10.7	10.4

Yolk weight and percentage

The white Plymouth Rock eggs had heavier yolk than the Fayumi eggs. The yearly average of yolk weight was 16.07 g and 14.92g in the Plymouth Rock and the Fayoumi respectively. However. the Fayoumi eggs had higher yolk percentage than the Plymouth Rock. Such yearly averages were 32.32 and 29.96% in the Fayoumi and the Plymouth Rock respectively (Table 1). The differences between breeds in yolk weight weré highly significant in clutches of two and three eggs and only significant in cycles of one and six eggs (p 0.05). While differences between breeds in yolk percentage were significant in the cycles of four and sir eggs highly significant in cycles of five eggs (p. 0.01). An it is well known, the large chicken eggs generally contained greater absolute amount of yolk and less percentage than small ones. Amer (1959) and Kamar (1962) reported similar conclusions.

Irrespective of some slight variations, yolk weight for both breeds increased with the increase in clutch size until 4 and 5 eggs lying cycles. Afterwards, the increase in the length of clutch size decreased yolk weight. In general, yolk weight decreased with the advance of egg position in the clutch. Meanwhile, the yolk percentage increased with the progress of the egg in clutch with a slight decrease in the last egg, especially in the long cycles. The large size of yolk of the first egg in a clutch is due to the long pause. Yolk percentage increase with the progress of the egg in clutch due to the decrease in albumen and egg weight and the stability of yolk size. The previous trends were clear during the periods of high rate of egg production especially in medium cycles.

The heaviest yolks in most cycles of both breeds were observed during winter and spring with slight exceptions. Whilest the lightest yolks were observed during summer. The lighest yolk percentages were observed during summer and autmn seasons, and the lowers were during winter and spring. These differences were almost significant. The increase in yolk percentage during summer and autumn seasons may be due to the decrease in albumen weight during the same seasons.

Shell weight and percentage

The Fayoumi eggs had shells with an average weight of 4.82 g while the Plymouth eggs had shells with an average of 4.84 g The yearly average shell percentage was 10.41 and 9.02% in the Fayoumi and the Plymouth respectively (Table 1). The differences between the two breeds in shell weight were higly significant in the cycles of three and six eggs and significant in the five egg laying cycles. Meanwhile, the differences between breeds in shell percentage were lighly significant in all cycles studied exception the one egg laying cycles where the differences were only significant.

The relatively higher shell percentage of the Fayoumi eggs may be attributted to that Fayoumi is more adapted under Egyptian condition than the Plymouth and also to the small egg size of the Fayoumi.

In Plymouth, shell weight of the first egg in the clutch tended to increase with the increase in clutch length. Meanwhile, shell weight of other eggs in the clutch tended to decrease with the increase in clutch length. Fayoumi eggs showed no regular trend. Shell % tended to decrease in the Fayoumi and inrcease in the Plymouth with the increase in cluth length.

The general trend indicated that in two egg laying cycles, the first egg had heaviest shell weight. In the three or more egg laying cycles, the first and last eggs had heavier shells than the intervening eggs laying cycles the first egg had lower shell percentage than the second egg. In longer egg laying cycles the first and last eggs had higher shell percentage than the in between eggs. Significant and highly significant differences in shell weight and percentages in almost most of the cycles. The increase in shell weight and perecentage of the last egg in clutch may be due to the long time spent in the uterus as always these eggs are laid at the later part of the day. On the other hand the pause cause the increase in shell weight and percentage of the first egg in clutch. As birds become more efficient during the period of the higher rate of egg production, the previous trends were found to be clear during the seasons of high egg production than those of low production specially in long cycles. The highest shell weight and percentage occurred during winter and the lowest were during the summr season. The differences between seasons in shell weight and precentage were signiffcant and highly significant with slight exceptions. The increase in air temperature during suummer from 70 to 90°F reduces blood calcium by 25 to 30% Conrad, 1939), resulting in decreased shell weight and percentage. Kamar (1962) found that shell weight and percentage were decreased during summer and increased during winter. Shell percentage in the Plymouth was affected by the hot weather in summer than the Fayoumi breed. This may be due to the adaptation of the Fayoumi breed to the local climatic conditions in Upper Egypt. Amer (1959) mentioned that the Fayoumi breed may be characterized by uterine tissues containing more quantities of the enzyme carbonic anhydrase that is involved in the classification of the shell. Thus, we would expect that the plymouth which is less tolerant would suffer the greatest decrease in the calcium and phosphorus level.

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تأثير دورة وضع البيض على مكونات البيضة

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درست مكونات البيضة وعلاقتها بدورات وضع البيض فى ١٦ دجاجة فيومى وثلاثة عشر دجاجة بيليموث أبيض وفحصت ٤٣٢٢ بيضة فيومى و ٢٧٦٧ بيضة بليموث نتجت خلال ٢١ شهر من عمر النضج الجنسى .وكانوزن البيض ومكوناته ونسبتها مرتفعة فى الشتاءوالربيع وانخفضت فى الصيف الحار .

وبتقدم وضع البيضة فى سلسلة وضع البيض انخفضت أوزانها . وانخفضت نسبة البياض وزادت نسبة الصفار وبتقديم وضع البيض فى السلسلة . وتزن قشرة البيضة الاولى فى السلسلة الثانية وزن أعلى نسبة أقل عن البيضة الثانية . أما فى الدورات الثلاثة والاكثر عددا تكون أول بيضة وآخر بيضة ذات قشر أثقل وبنسبة أعلى عن البيض الذى فى وسط السلسلة . وقد لوحظت معظم هذه الاتجاهات فى الاوقات التى يرفع فيها انتاج البيض . وبيض البليموث أثقل وزنا وصفارا عن الفيومى . ونسبة الصفار فى الفيومى أعلى منها فى الفيومى وكذلك فى نسبة القشر بينما كان الدجاج البليموث ذى بياض وصفار أثقل من الفيومى .