Egypt. J. Anim. Prod. **24**, No. 1-2, pp. 137-150 (1984)

Egg Characteristics and Monthly Differences Affecting Fertility, Hatchability and Embryonic Mortality in Pekin Ducks

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PEKIN ducks were used in studying the effect of hatching months and egg measurements on fertility, hatchability and embryonic mortality.

The experiment was carried under the usual system of mating and nutrition in Poultry Research Station, Faculty of Agriculture, Cairo University.

The study included 3748 eggs in the two years, 2151 eggs in the first year (from January to May) and 1597 eggs in the second year (from January to April).

The fertility was 83.83 %, 85.97 % and 84.74% for the first, second and average of the two years, respectively. The highest fertility were obtained in winter.

Hatchability were 20.52 %, 33.07 % and 25.94 % for the first, second and average of the two years, respectively. The best hatchability were obtained in winter, spring and winter for the three items respectively. Embryonic mortality were 79.48 %, 66.93 % and 74.06 % for the same items.

There were significant variance between months and hatchability and embryonic mortality, and between years and hatchability and embryonic mortality, but it was insignificant in respect to fertility.

Effect of egg length, egg width and egg index on fertility, hatchability and embryonic mortality were studied.

There was significant correlation between egg length and fertility, and between egg index and hatchability only. The correlation coefficient for the other traits were insignificant.

Fertility

The average fertility percentge for Pekin duck eggs incubated from February to April ranges between about 75 to 89·3 % (Kamar, 1962). Haffez (1970) found that fertility average rangs between 73·38 to 82·77% in Pekin

eggs incubated from February to May. Cooper (1955) found that the maximum fertility was in April and June, while the minimum was in July and September. It was found that higher degrees of temperature are, at least in part responsible for the summer decline in fertility (Heywong, 1944).

The fertility of medium (81-90g) and large eggs (91-100g) was greater than that of the small eggs (70-80g). (Doncev and Cvetamov, 1964) Haffez (1970) found that fertility increases with increasing egg weight.

The fertility of eggs with a high index (73-81%) was found to be about 3% greater than that of eggs with a low (61-69%) or medium index (70-72.9%)

There was no appreciable difference between the latter indices (Doncer and Cvetanov, 1964).

Hatchability

There were seasonal effects on hatchability investigated by many workers. The hatchability was found to be higher in spring and summer than during winter (Smith, 1933), while in Egypt the hatches of fall and spring show higher hatchability than those of winter and summer (El-Ayadi and El-Ibiary, 1957). The maximum hatchability occurred in July and September, and the minimum was in May and June (Haffez and Kamar, 1955).

Egg weight was not correlated to hatchability when eggs were classified into 17 weight groups, but when they were grouped into three weight groups, the medium class (87-100g) had the highest hatchablility (Hornova *et al.*, 1958). However, the highest hatchability was also recorded for eggs weighing 72·59. Haffez, 1970).

Doncev and cvetanov (1964) found that hatchability of medium eggs (81-90g.) was greater than that of small (70 - 80 g.) and large eggs (91-100g).

There was no appreciable difference in the hatchability of fertile eggs with a low, medium and high index (61-69·9%, 70-72·9% and 73-81% respectively.

The hatchability percentage of total eggs set and for fertile eggs ranges from 27·23 to 41·11% and from 33·17% to 54·62% respectively (Haffez, 1970). Moreover, she found that hatchability was not affected when eggs held till 7 days.

Embryonic mortality

Imbryonic mortality in chicken accurs at any time from fertilization till the day of hatching.

There are many genetical and environmental factors affecting the rate of embryonic mortality during and before incubation (landauer, 1948 and Romanoff, 1949).

The cause of embryonic mortality may be due to one or more of the following factors : egg quality, changes in metablic rate and environmental temperature (Henderson, 1930, Taylor *et al.*, 1933 and Barrot, 1937).

Inbreeding lead to a slight increase in embryonic mortality during the first week of incubation. This increase was higher from the 18th day till the end of incubation period (Byerly *et al.*, 1934).

Materail and Methods

The investigation was carried out at the Poultry Research Station, Faculty of Agriculture, Cairo University.

The work has been done on white Pekin duck, through two successive hatching seasons. The first season was during the period from January to May and the second was from January to April the next year.

Eggs were collected and Kept for a period not less than 24 hr, and not more than 7-10 days. Before incubation they were given a serial number and measured for the two axis to detect the egg index ($\frac{\text{width}}{\text{length}} \times 100$). The eggs were candeled to exclude the unsuitable ones for incubation (invisbile crack, malposition of the air space and poresity of the egg shell.

Throughout the incubation period, candling was performed twice : at the 8th and the 22nd day of incubation. Dead and unhatched embryos were examined to determine their age.

Fertility was estimated as the percentage of fertile eggs to total egg set. Hatchability was estimated as the percentage of the healthy duckling hatched on the 28th. day of incubation to the total fertile eggs.

Embryonic mortality was estimated as a percentage of embryos died in age less than 8 days (first week W_1) and embryos died in age 8-21 days (second- and third week W_{2+3}) and that died in age 22 - 28 days of incubation (fou rth week W_4.).

Analysis of variance was carried out, according to Snedecor (1956) for testing the difference in fertility, hatchability, and embryonic mortality between years and months. This was done after the percentage were transferred to their corresponding angles, the angle being equal to arosin percentage.

Results and Discussion

Fertility

In the present study the highest fertility percentage was obtained in May and February in the first year, and only in February in the second year (Table 1). Kamar (1962) and Haffez (1970) obtained the maximum fertility in March. The minimum fertility was in April wihch agrees well with that obtained by Kamar (1962) and Haffez (1970).

TABLE 1. Percentage of fertility in Pekin duck eggs

	Years				Total	
	1971		1972			
	No. egg set	% fertility	No. egg set	% fertility	No. egg set	% fertility
January	86	80.23	142	84.51	228	82.89
February	662	85.20	626	88.82	1288	86.96
Winter	748	84.63	768	88.02	1516	86.35
March	935	84.60	686	84.26	1621	84.45
April	349	78.22	143	83.22	492	79.67
May	119	89.08	—	—	119	89.08
Spring	1403	83.39	829	84.08	2232	83.65
Total	2151	83.82	1597	85.97	3748	84.74

The overall fertility during the period of study was 84·74 ± 7.03%. This result is slightly higher than those obtained by kamar (1962) and Haffez (1970).

The analysis of variance (Table 2) showed that the differences in fertility between years and between months were insignificant.

The effect of egg size and index on fertility.

a.— Effect of egg length

The eggs were classified according to their length into five classes (5·0-5·5, 5·6 - 6, 6·1-6·5, 6·6-7·0 and more than 7·1 c.m). It was found that

fertility increases with the increase of the egg length. A positive significant correlation (r = 0.82) between the two traits was found (Table 3 and Fig 1 a).

TABLE 2. Analysis of variance of fertility in ducks.

Source of variation	d.f.	S.S.	M.ss	F
Between years . . .	1	32.9004	32.9004	1.55
Between months . .	4	121.2353	30.3088	1.44
Error	19	402.0273	21.1593	
Total	24	556.1630		

TABLE 3. Effect of egg length on fertility and hatchability.

Egg length	5.0—5.5 C	5.6—6.0 C	6.1—6.5 C	6.6—7.0 C	More than 7.0 C
% Fertility	79.37	82.89	55.52	85.92	100 %
% Hatchability	24.00	24.77	27.22	21.31	33.33%

b.— Effect of egg width

The eggs were classified into five classes according to their width (3.9-4.1, 4.2-4.3, 4.4-4.5, 4.6 - 4.7 and 4.8-5.0 c.m.). The fertility percentages were 73.76, 78.02, 86.29, 87.61 and 83.54%, for the five classes, respectively. It can be seen that fertility increases with the increase of the egg w dth until the fourth class (4.6-4.7 cm), then it decreases again in the fifth class (Table 4 and Fig. 1 b).

A positive insignificant correlation was found between the egg width and fertility (r=0.25).

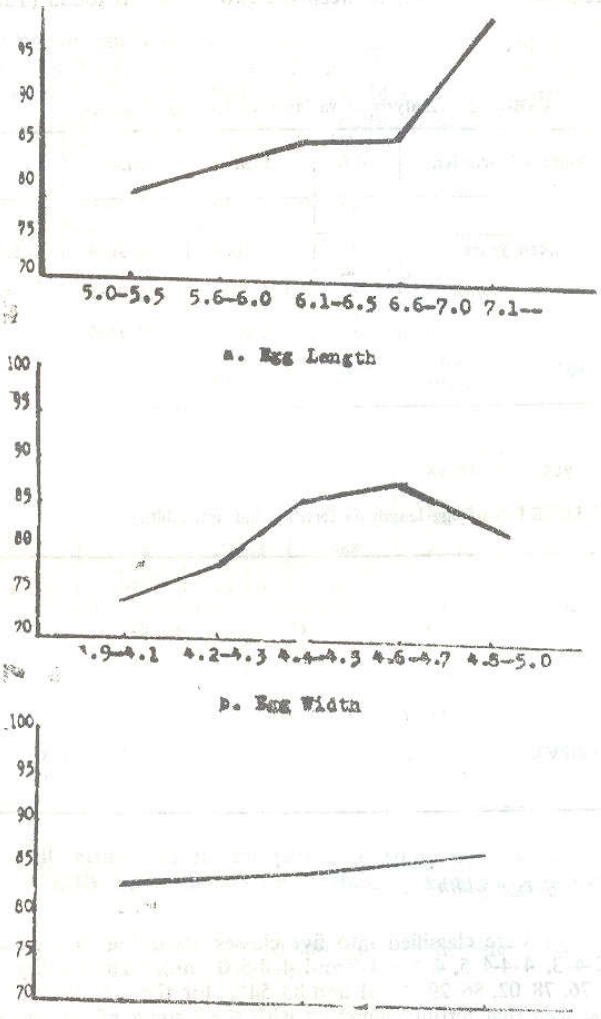

Fig. 1 Relationship between Egg measurements and Fertility.

TABLE 4. Effect of egg width on fertility and hatchability.

Egg width	3.9—4.1 C	4.2—4.3 C	4.4—4.5 C	4.6—4.7 C	4.8—5.0 C
% Fertility	73.76	78.02	86.29	87.61	83.54%
% Hatchability . .	16.35	26.80	24.54	28.94	24.24%

c.— Effect of egg index (width/length ×100).

The eggs were classified into three classes according to egg index, low (less than 70%), medium (70-74·9%) and (more than 75%). The fertility values were (82·23%, 84·42 and 26·68%) in three classes respectively. This is in full agreement with that found by Doncev and cventanov (1964) who reported that the fertility of the eggs with high index (73-81%) was about 3% higher than that of the eggs with low (61-69·9%) or medium (70-72·9%) index (Fig. 1c). The correlation coefficient (r) was found to be 0·17, which is insignificant.

TABLE 5. Effect of egg index on fertility and hatchability.

Egg index	Less than 70%	40—74.9 %	more than 75%
% Fertility.	82.83	84.42	86.69
% Hatchability . .	24.68	25.76	27.48

Hatchability

From these data shown in Table 6, it can be concluded that the maximum hatchability in the first year was obtained in January and February, while in the second year it was achieved in March and February. Considering average of the two years, the highest hatchability was in February and March too.The lowest hatchability was in April and May in the first year,and in April in the second year, and in April and May considering the average of the two years. These results agreed with those obtained by Haffez (1970) who found that the maximum hatchability was in March and the minimum in May and June.

TABLE 6. Percentage of hatchability in two years and their average.

	Years						Total		
	1971			1972					
	No.fertile eggs	No. egg hatched	Hatch %	No.fertile eggs	No.eggs hatched	Hatch %	No.fertile eggs	No.egg hatched	Hatch %
January	69	21	30.43	120	27	22.50	189	48	25.40
February	564	172	30.50	556	173	31.11	1120	345	30.80
Winter	633	193	30.49	676	200	29.59	1309	393	30.02
March	791	147	18.58	578	232	40.14	1369	379	27.68
April	273	24	8.79	119	22	18.49	392	46	11.73
May	106	6	5.66	—	—	—	106	6	5.66
Spring	1170	177	15.13	697	254	36.44	1867	431	23.09
Total	1803	370	20.52	1373	454	33.07	3176	824	25.94

The overall hatchability was 25.94. This result is much lower than that obtained by Kamar (1962) and Haffez (1970) who found 57.5% and 42.02% respectively. This difference may be due to genetical differences among populations used. Moreover, nutritional and environmental comidtions in the different experiments may also play a role in these differences.

The analysis of variance showed that the differences between months were significant (Table 7a, b).

The relation between egg measurements and hatchability

a. *The effect of egg length*

As shown in Table 3 and Fig 2, the hatchability increases with the increase of egg length. However, this increase is not systematic .The correlation between these 2 traits was found to be insignificant (r=0.53).

TABLE 7. **Analysis of variance of hatchability in ducks.**
a) Hatchability from the total eggs set

	d.f.	S.S.	M.ss	F
Between years	1	399.9053	399.9053	18.84**
Between months	4	789.7876	197.4469	8.32**
Error	19	451.1540	23.7449	
Total	24	1640.8469		

b) Hatchability from the fertile eggs.

	d.f.	S.S.	M.ss.	F
Between years	1	471.3520	471.3520	15.55**
Between months	4	886.9934	221.7484	7.31**
Error	19	576.1102	30.3214	
Total	24	1934.4556		

b. *Effect of egg width*

In the classes of egg measuring as shown in Table 4, it is seen that the highest hatchability percentage was in the class measuring (4·6 - 4·7 cm). and the lowest was in the class measuring (3·9 - 4·1 cm). This result is in accordance with that found between egg width and fertility (Fig. 2b.)

The correlation coefficient was insignificant (r=0·59).

c. *Effect of egg index*

As shown in Table 5 and Fig. 2 it can be concluded that hatchability increases with the increase of egg index. It can be concluded that the egg index is a quick critirion for fertility and hatchability.

This result does not agree with that found by Doncev and Cvetanov (1964). They found in ducks that there was on appreciable difference in hatchability or fertile eggs grouped into three index classes.

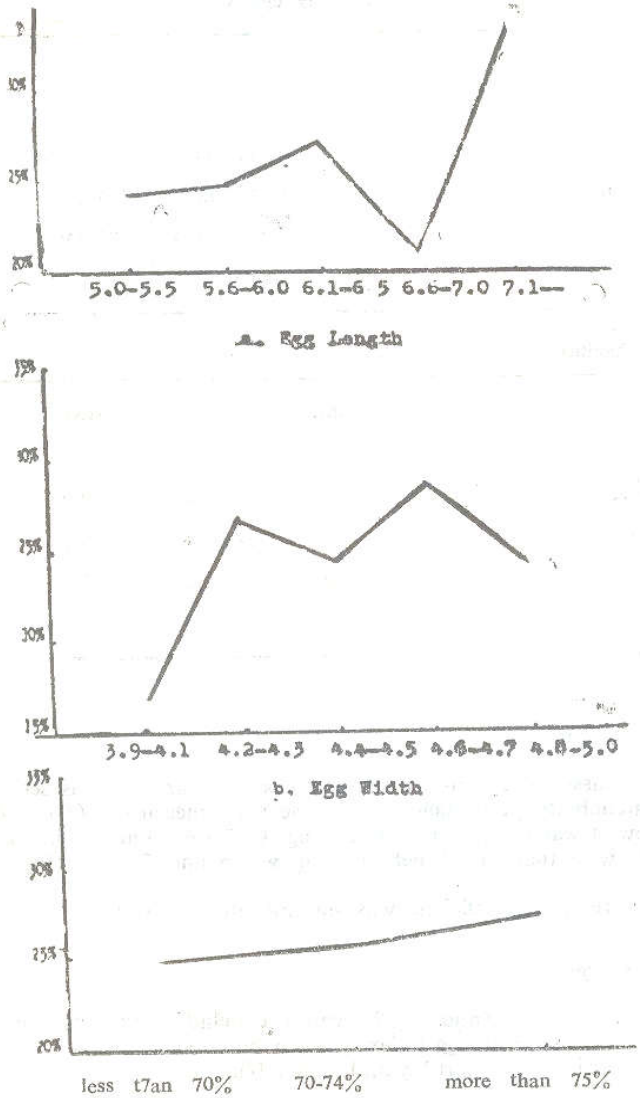

Fig. 2. Relationship between egg measurements and hatchability.

The correlation between egg index and hatchality was found to be significant (r=0·78).

Embryonic mortality

Embryonic mortality was estimated for each year separately. A combined estimate was also determined for both years jointly (Table 8).

TABLE 8. Embryonic mortality percentage during incubation period.

Years	% embryonic mortality	24.hr	1-8 days	9—21 days	22—28 days	Total
1971	Of fertile eggs	12.59	26.40	11.98	28.51	79.48
	Of total embr. mortal.	15.84	33.22	15.07	35.87	100%
1972	Of fertile eggs	7.28	26.15	9.10	24.40	66.93
	Of total embr. mortal.	10.88	39.07	13.60	36.45	100%
Average	Of fertile eggs	10.30	26.29	10.74	26.73	74.06
	Of total embr. mortal.	13.91	35.50	14.50	36.09	100%

In the fertile egg group the embryonic mortality was generally high (79.48, 66·93, and 74·06% for the first , second and the average of the two years respectively).

In the first 24 hr of incubation, the embryonic mortality was 12·59, 7·28 and 10.30% for the first, second and the average of the two years, respectively. These values represent about 15·84, 10.88 and 13·91% of the total dead embryos for the same periods. The dead embryos of this groups were characterised by the blood rings and blood spots and they were very tiny to be examined for any abnormalities. The appearance of their underloped blood islands-as blood rings or blood spots may be due to one or more factors such as the effect of storage period on the Zygotes, variability of the ova or the sperms, chemical structure of the egg contents, or it may be due to lethal factors (Kaufman, 1948, and Ragab and Helmy (1959).

The embryonic mortality in the rest period of incubation had two peaks as shown from the mortality curve (Fig. 3). The first one accurred during the first week (W_1), where 26·40%, 26·15% and 26·29% of the fertile eggs died, which represent about one third of the embryonic mortality. The second peak accurred during the fourth weeks (W_4) where 28·51, 24·40, and 26·73% of the fertile eggs died, which were equal to 35·87, 36· ·45, and 36·09% of the total embryonic mortality during the incubation peroid.

Analysis of variance shows that differences between years and between months were significant (Table 10).

TABLE 10. Analysis of variance of dead embryos during the two year experiments.

	d.f.	S.S.	M.ss	F
Between years	1	440.7037	440.7037	13.55**
Between months	4	884.3778	221.0945	6.80**
Error	19	617.7648	32.4139	
Total	24	1942.8463		

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تأثير مواصفات البيضة والاختلافات الشهرية على الخصوبة والفقس وموت الجنين فى البط البكينى

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استخدم البط البكينى فى دراسة تأثير كل من مقاييس البيضة وشهور التفريخ على الخصوبة والفقس وموت الأجنة ٠

وقد أجريت هذه التجربة مع استخدام النظام المعتاد فى التزاوج والتغذية فى محطة بحوث الدواجن بكلية الزراعة جامعة القاهرة ٠

وقد شملت التجربة ٣٧٤٨ بيضة فى سنتى التجربة ، منها ٢١٥١ بيضة فى السنة الأولى (من يناير حتى مايو) ، ١٥٩٧ فى السنة الثانية (من يناير حتى أبريل) ٠

وقد كانت نسبة الخصوبة فى البيض هى ٥٢ر٢٠٪ ، ٠٧ر٣٣٪ ، ٦٤ر٢٥٪ لكل من السنة الأولى والثانية ومعدل السنتين على التوالى ٠

وقد تحققت أعلى نسبة فقس فى كل من فصول الشتاء والربيع والشتاء فى كل من السنة الأولى والثانية ومعدلهما على التوالى ٠ وكانت نسبة موت الأجنة وهى ٤٨ر٧٩٪ ، ٩٣ر٦٦٪ ، ٠٦ر٧٤٪ بالنسبة للأوقات المذكورة ٠

وقد كان التغير ملموسا بين الشهور فى كل من الفقس وموت الأجنة وكذلك بين السنين فى كل منهما ولم يكن التغير ملموسا بالنسبة للاخصاب ٠

وقد درس تأثير كل من طول البيضة وعرضها ودليلها ($\frac{\text{العرض}}{\text{الطول}} \times ١٠٠$) على كل من نسبة الخصوبة والفقس وموت الأجنة ٠

وقد ظهر ارتباط معنوى موجب بين طول البيضة ونسبة الخصوبة وكذلك ما بين دليل البيضة ونسبة الفقس فقط ، وقد كان معامل الارتباط للصفات الأخرى غير معنوى ٠