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EFFECT OF SEX RATIO ON SOME PRODUCTIVE AND REPRODUCTIVE TRAITS IN JAPANESE QUAIL

By

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Abstract: *A total of 447 Japanese Quail chicks produced during three sex ratio were included in the present study to evaluate the effect of sex ratios among mating parents on some productive and reproductive traits. The results obtained can be summarized as follows:*

1- Body weight recorded at hatch and 2 weeks of age increased significantly from (8.21, 33.17gm), (8.01, 31.89 gm) in 1:2 and 1:3 sex ratios to 8.30 and 34.11 gm in 1:1 sex ratio. Similar trend was observed for average daily gain calculated during the growth periods from 0-2 and from 2-4 weeks of age.

2- Body weight recorded at 4 and 6 weeks of age increased significantly from (89.98, 150.01gm), (85.17, 146.91gm) in males and (103.71, 155.8 gm), (99.87, 151.02 gm) in females of 1:2 and 1:3 sex ratios to 91.91, 153.18 gm in males and 105.31, 161.38 gm in females of 1:1 sex ratio. Also, similar trend was observed for average daily gain recorded during the growth periods from 4-6 and from 0-6 weeks of age.

3 - Age at sexual maturity of females decreased significantly from 53.02, 55.13 days in 1:2 and 1:3 sex ratios to 51.91 days in 1:1 sex ratio.

4- Total egg number produced during the first 10 weeks of laying period increased significantly from 61.11, 59.81 eggs in 1:2 and 1:3 sex ratios to 61.72 eggs in 1:1 sex ratio. Similar trend was observed for total egg weight and daily egg mass produced among the first 10 weeks of laying period.

5- Fertility, hatchability and embryonic mortality percentages were significantly affected by sex ratio studied.

INTRODUCTION

Research work in poultry is often handicapped by limiting in budget, time and space. Some of these problems might be alleviated by

using Japanese quail as a pilot animal for breeding research. However, its comparability with the domestic fowl must be better understood if the full potential of the quail is to be realized.

Quail have the advantages of rapid growth rate, small size, good reproductive potential, short life cycle, low feed requirements, good meat taste, better laying ability and shorter time of hatching as compared with the different species of poultry, so it is considered as a pilot animal for poultry breeding investigations. Quail is the smallest avian species raised for meat and egg production. Panda and Singh, (1990) has also assumed worldwide importance as a laboratory animal (Baumgartner, 1990). Furthermore, quail could be considered a good and economical source for animal protein.

The optimum mating ratio in quail (males : females) was considerably lower than optimum ratios reported for other species of poultry, which ranged between (1:1) to (1:3) consider as an optimum mating ratio, while (1:1) sex ratio considered as the best ratio in quail for all productive and reproductive traits. The present study was undertaken to study the effect of different sex ratios on some productive and reproductive traits in Japanese quail.

MATERIALS AND METHODS

Data of the present study were collected on the flock of Japanese quail (Coturnix coturnix japonica) maintained at the Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt during the period from October 2002 until May 2003.

Breeding plan and management:

A total number of 288 birds (96 males and 192 females) at 6 weeks of age were taken at random from the flock under consideration as the parents of the present study. The sex ratio for mating in the present study were 1:1, 1:2 and 1:3 male: females and each bird in each group hade equal space in the laying battery. More details for management and feeding procedures of the flock were described by Abdel-Mounsef, (2005).

Measurements:

Individual body weights were recorded biweekly from hatch until 6 weeks of age to the nearest 0.1 gm. Body weights at hatch, two, four and six weeks of age were referred to as (BW_0, BW_2, BW_4 and BW_6).

Individual absolute daily body weight gain during the different growth periods studied from 0-2, 2-4, 4-6 and from 0-6 weeks of age

were obtained by the formula of (Brody, 1945) and referred to as ADG_{0-2}, ADG_{2-4}, ADG_{4-6}, ADG_{0-6}.

Age at sexual maturity (ASM) for females was recorded individually in days, total egg production (number and weight) were recorded from onset of laying till 10 weeks of production and referred to as (TEGN and TEGW). However daily egg mass (DEM) was estimated as the average egg number x the average egg weight per week/7 days.

Fertility, hatchability and embryonic mortality% were recorded and referred to as (FRP%, HAP% and EMP%). Embryonic mortality (EMP%) was recorded among early (EEM%) from 1-10 days of incubation and late (LEM%) from 11-18 days of incubation. The total embryonic mortality percentage (TEM%) was obtained by the sum of (EEM% plus LEM %). Accordingly, the residual eggs in the hatcher were broken to determine the fertile eggs and embryonic mortality.

Statistical analysis :

Statistical analysis were conducted using the General Linear Models (GLM) procedure of base SAS software (SAS Institute, 1998).

Differences between each two means were done according to Duncan's Multiple Range Test. Prior to analysis the data taken for all percentages were transformed using arc-sin transformation. After analysis, means were re-transformed to the original values.

RESULTS AND DISCUSSION

Growth traits:

Body weight and daily gain:

Results obtained in figure (1) indicate that average body weight recorded at 0 and 2 weeks of age through different sex ratios used among mating parents i.e. 1:1, 1:2 and 1:3 male : females, while, the average daily gain recorded during the periods from 0-2 and 2-4 weeks of age were obtained in figure (2).

The least–square means and their standard errors for body weight recorded at hatch, 2 weeks of age and average daily gain calculated from 0-2, 2-4 weeks of age are presented in table (1). However, BW_0 increased significantly ($P<0.05$) from 6.39 gm for chicks produced from sex ratio 1:3 to 7.18 and 7.21 gm for chicks produced form sex ratios 1:2 and 1:1, respectively. The differences between two sex ratios 1:1 and 1:2 for this growth trait were not significant. The same trend was observed for BW_2,

ADG $_{0-2}$. and ADG $_{2-4}$, during the different sex ratios studied. Similar range of estimates were reported by different investigators for BW_0 and BW_2 (Lepore and Marks, 1971; Marks, 1980; Thomas et al, 1993; Mousa, 1993 and Aboul-Hassan, 2000 & 2001a). Meanwhile (Lepore and Marks, 1971; and Aboul-Hssan, 2000) reported similar range of estimates for ADG $_{0-2}$ and ADG $_{2-4}$.

Results obtained in figure (3 & 4) indicate that average body weight recorded at 4 and 6 weeks of age through different sex ratios used among mating parents (1:1, 1:2 and 1:3) in males and females, respectively. However, results obtained in figures (5 & 6) indicate the average daily gain calculated from 4-6 and 0-6 weeks of age through different sex ratios used among mating parents in males and females, respectively.

The least-square means and their standard errors for body weight recorded at 4, 6 weeks of age and average daily gain calculated from 4-6, 0-6 weeks of age are presented in table (2). However, BW_4 increased significantly ($P<0.05$) from 81.93 gm for birds produced from sex ratio 1:3 to 84.72 and 86.31 gm for birds produced from sex ratios 1:2 and 1:1. The differences between two sex ratios 1:1 and 1:2 for this trait were not significant. Similar trend was observed for ADG $_{4-6}$ and ADG $_{0-6}$. during the different sex ratios studied (Table, 3). Similar range of estimates were reported by different authors for BW_4 and BW_6 (El-Fiky, 1991; Mousa, 1993 and Aboul-Hassan, 2000 & 2001a). Meanwhile (El-Fiky et al, 1996 and Aboul-Hassan, 2000) reported similar range of estimates for ADG $_{4-6}$ and ADG $_{0-6}$.

Reproductive and egg production traits:

Age at sexual maturity (ASM):

Results obtained in figure (7) indicate that average age at sexual maturity (ASM) and total egg number (TEGN) produced during the first 10 weeks of laying. through different sex ratios used among mating parents. The results indicate that the females produced from sex ratio 1:1 were reached to ASM early by 2.14, 6.20 days than those produced from sex ratios 1:2 and / or 1:3.

Table (4) cited the least–square means of age at sexual maturity, however, ASM decreased significantly ($P<0.01$ or $P<0.05$) from 54.31 days for females produced from sex ratio 1:3 to 52.01 and 51.21 days for females produced from sex ratios 1:2 and 1:1, respectively. In general, similar range of estimates were reported by different workers for ASM

(Garrett et al, 1972; Marks, 1979 & 1980; Kadry et al, 1986; Aboul-Hassan et al, 1999 and El-Fiky et al, 2000a).

Total egg number and weight (TEGN & TEGW):

Results obtained in figure (7) indicate that the actual number of eggs laid per female during the first 10 weeks of laying through different sex ratios used among mating parents (1:1, 1:2 and 1:3).

Table (4) cited the least–square means of total egg number and weight laid per female during the first 10 weeks of laying, however TEGN & TEGW increased significantly ($P<0.01$ or $P<0.05$) from 54.68 eggs, 451.86 gm for females produced from sex ratio 1:3 to 59.23 eggs, 463.13 gm and 61.11 eggs, 472.78 gm for females produced from sex ratios 1:2 and 1:1, respectively. The present results were agreement with the estimates reported by different authors for TEGN & TEGW (Strong et al, 1978; Havenstein et al, 1988; El-Fiky, 1994; El-Fiky et al, 2000a; Aboul-Hassan et al, 1999 and Aboul-Hassan 2000 & 2001a).

Daily egg mass (DEM):

Table (4) cited the least–square means of daily egg mass produced during the first 10 weeks of laying, however DEM increased significantly ($P<0.01$ or $P<0.05$) from 7.81 gm/day for females produced from sex ratio 1:3 to 8.43 and 8.66 gm/day for females produced from sex ratios 1:2 and 1:1 , respectively. The females produced from sex ratio 1:1 produced DEM more than those produced from 1:2 and or / 1:3 sex ratios by 4.53, 10.85 gm/day. Sabri et al, 1993; Aboul-Hassan et al, 1999 and Aboul-Hassan, (2001a & b) reported similar range of estimates for DEM.

Fertility and hatchability percentages (FRP & HAP%):

Results obtained in figure (8) indicate that the actual means of fertility and hatchability percentages through different sex ratios used among mating parents (1:1, 1:2 and 1:3).

Table (4) cited the least–square means of fertility and hatchability percentages, however, FRP% increased significantly ($P<0.01$ or P0.05) from 74.38% for females produced from 1:3 sex ratio to 79.18, 81.33% for females produced from sex ratios 1:2 and 1:1 . Also, HAP% increased significantly ($P<0.01$ or P 0.05) from 59.01 for females produced from 1:3 sex ratio to 63.81 and 65.96% for females produced from sex ratios 1:2 and 1:1. Narahari et al (1988) reported significant ($P<0.05$) effect for sex ratio on fertility percentage and non -significant effect for this non–genetic factor on hatchability percentage. A reverse trend was observed by Mandour and Sharaf (1993), they reported significantly ($P<0.05$) for this

non-genetic factor on hatchability percentages, while fertility percentages did not affected significantly by this non-genetic factor.

Embryonic mortality percentage (EMP%):

Results obtained in figure (8) indicate that the actual means of embryonic mortality percentage through different sex ratios used among mating parents (1:1, 1:2 and 1:3).

Table (4) cited the least–square means of mortality percentages, However, EEM% decreased significantly (P<0.01 or P0.05) from 5.00 % for the eggs produced from females of 1:3 sex ratio to 4.58 and 4.46% for the eggs produced from females of 1:2 and 1:1sex ratios . Also, LEM and TEM % decreased significantly (P<0.01 or P<0.05) from 17.86, 22.86% for the eggs produced from females of 1:3 sex ratio to 17.01, 21.59% and 16.22, 20.68% for the eggs produced from females of 1:2 and 1:1 , sex ratios, respectively.

Table (1): least–square means ±S.E for average body weight recorded at 0, 2 weeks of age and average daily gain calculated from 0-2 and 2-4 weeks of age through different sex ratios.

Trait	Sex ratio					
	No.	1 : 1	No.	1 : 2	No.	1 : 3
BW_0	75	7.21±0.18 ^{a}	148	7.18±0.21 ^{a}	225	6.39±0.19 ^{b}
BW_2	70	30.1±0.24 ^{a}	138	29.2±0.31 ^{a}	212	27.4±0.26 ^{b}
ADG_{0-2}	75	2.32±0.20 ^{a}	148	2.18±0.25 ^{a}	225	2.03± 0.21 ^{b}
AG_{2-4}	70	5.38±0.26 ^{a}	138	5.23±0.33 ^{a}	212	5.01±0.28 ^{b}

a, b**:** Means in the same row with different superscripts are significantly (P< 0.01) differ.

Table (2): Least-square means ±S.E for average body weight recorded at 4 and 6 weeks of through different sex ratios.

Independent Variable	No.	BW_4	No.	BW_6
Sex ratio				
1 : 1	70	86.31±0.33 a	60	144.11±0.40 a
1 : 2	142	84.72±0.40 a	131	141.33±0.49 a
1 : 3	210	81.93±0.36 b	199	139.11±0.44 b
Sex:				
Male	210	80.18±0.38 a	192	132.18±0.41 a
Female	212	87.31±0.30 b	198	146.37±0.33 b

a, b**:** Means in the same column under the same effect with different superscripts are significantly (P<0.01) differ.

Table (3): Least-square means ±S.E for average daily gain recorded at 4-6 and 0-6 weeks of age through different sex ratios.

Independent Variable	No.	ADG_{4-6}	No.	ADG_{0-6}
Sex ratio				
1 : 1	70	1.33±0.26 a	60	3.23±0.30 a
1 : 2	142	1.40±0.22 a	131	3.01±0.36 a
1 : 3	210	1.23±0.24 b	199	2.89±0.33 b
Sex:				
Male	210	1.21±0.28 a	192	2.86±0.36 a
Female	212	1.36±0.21 b	198	3.21±0.21 b

a, b**:** Means in the same column under the same effect with different superscripts are significantly (P<0.01) differ.

Table (4): Least–Square means±S.E for reproductive and egg production traits studied .

Trait	Sex ratio		
	1 : 1	**1 : 2**	**1 : 3**
ASM (day)	51.21±1.81 ^{a}	52.01±1.62 ^{a}	54.31±1.46 ^{b}
TEGN (egg)	61.11±1.52 ^{a}	59.23±1.66 ^{a}	54.68±1.82 ^{b}
TEGW (gm)	472.78±7.11 ^{a}	463.13±8.31 ^{a}	451.86±8.92 ^{b}
DEM (g./d.)	8.66±2.46 ^{a}	8.43±2.98 ^{a}	7.81±3.31 ^{b}
FRP%	81.33 ^{a}	79.18 ^{a}	74.38 ^{b}
HAP %	65.96 ^{a}	63.81 ^{a}	59.01 ^{b}
EEM %	4.46 ^{a}	4.58 ^{a}	5.00 ^{b}
LEM %	16.22 ^{a}	17.01 ^{a}	17.86 ^{b}
TEM %	20.68 ^{a}	21.59 ^{a}	22.86 ^{b}

a, b**:** Means in the same row with different super–scripts are significantly (P<0.01) differ .

Figure 1. The effect of sex ratio on body weight recorded at hatch and 2 weeks of age.

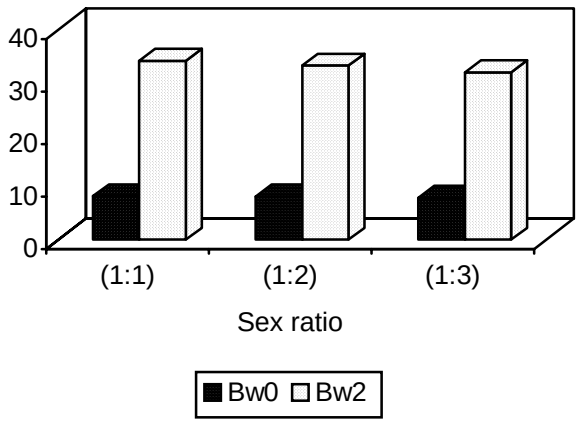


Figure 2. The effect of sex ratio on average daily gain recorded during 0-2 and 2-4 weeks of age.

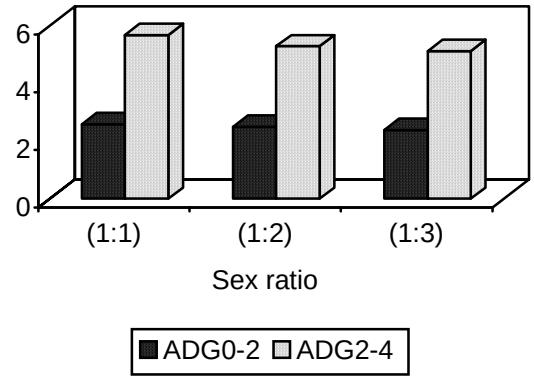


Figure 3. The effect of sex ratio on body weight recorded at 4 and 6 weeks of age in males.

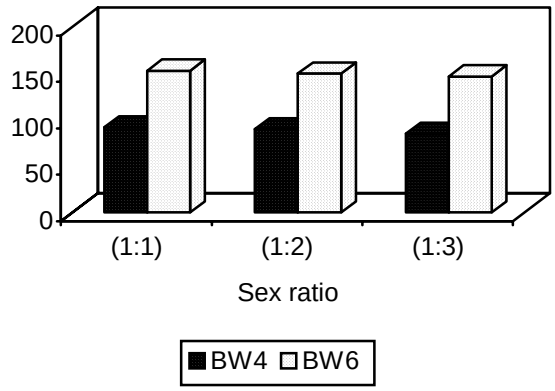


Figure 4. The effect of sex ratio on body weight recorded at 4 and 6 weeks of age in females

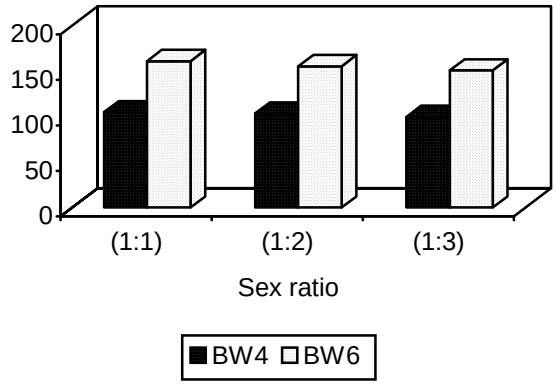


Figure 5. The effect of sex ratio on daily gain recorded during 4-6 and 0-6 weeks of age in males

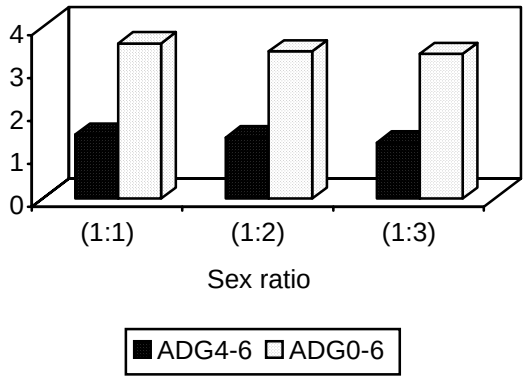


Figure 6. The effect of sex ratio on daily gain recorded during 4-6 and 0-6 weeks of age in females.

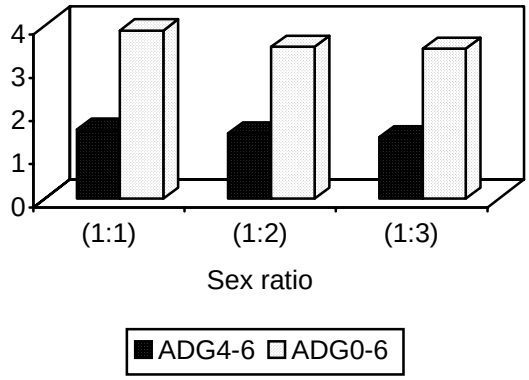


Figure 7. The effect of sex ratio on ASM and TEGN in the first 10 weeks of laying.

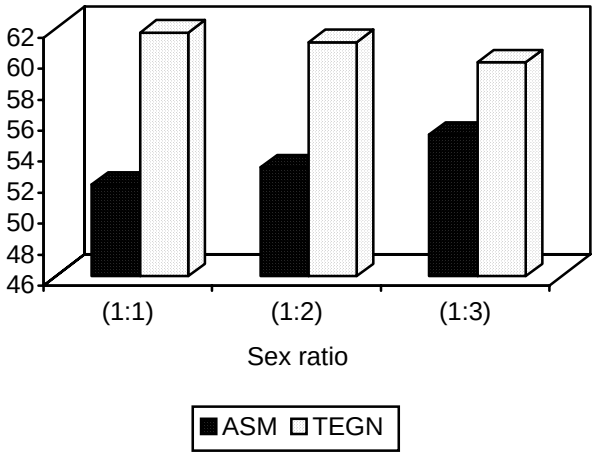
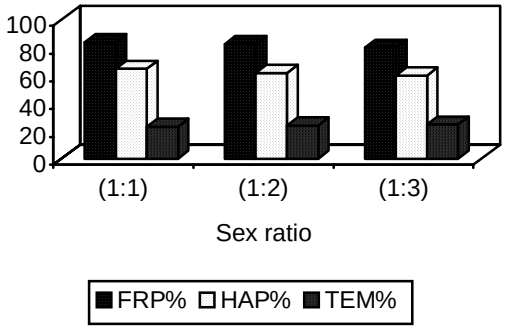


Figure 8. The effect of sex ratio on the percent of fertility, hatchability and embryonic mortality.



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الملخص العربي

تأثير النسبة الجنسية على بعض الصفات الإنتاجية والتناسلية فى السمان الياباني

فهمى عبدالعزيز الفقى– محمد منير شعبان مبروك– محمد أبوالحسن أحمد– ناصر عبد لمنصف

قسم الإنتاج الحيوانى – كلية الزراعة – جامعة الأزهر - القاهرة

أجريت هذه الدراسة على ٤٤٧ طائر أنتجت خلال ثلاثة من النسب الجنسية للتزاوج وتهدف الدراسة الحالية إلى تحديد تأثير النسب الجنسية المختلفة على بعض الصفات الإنتاجية والتناسلية في السمان الياباني .

وقد أوضحت الدراسة النتائج الآتية :

١- ازداد وزن الجسم عند عمر الفقس و٢ أسبوع من ٨,٢١ و ٣٣,١٧جم و من ٨,٠١و٣١,٨٩جم في الطيور الناتجة من تزاوج النسب الجنسية ١ : ٢ و ١ : ٣ إلى ٨,٣٠ و ٣٤,١١ جم في الطيور الناتجة من تزاوج النسب الجنسية ١:١. ولوحظ نفس الإتجاه بالنسبة لمعدل النمو اليومى المحسوب خلال الفترات من صفر- ٢ ومن ٢-٤ أسبوع من العمر.

٢- ازداد وزن الجسم عند عمر ٤ و٦ أسبوع من (٨٩,٩٨ و١٥٠,٠١ جم) ومن (٨٥,١٧ و ١٤٦,٩١ جم) في ذكور الطيور الناتجة من تزاوج النسب الجنسية ١:٢ و١:٣ إلى (٩١,٩١و١٥٣,١٨جم) في ذكور الطيور الناتجة من تزاوج النسبة الجنسية ١:١ ومن (١٠٣,٧١ و ١٥٥,٨١) ومن (٩٩,٨٧ و ١٥١,٠٢ جم) في إناث الطيور الناتجة من تزاوج النسب الجنسية ١:٢و ١:٣ إلى (١٠٥,٣١ و ١٦١,٣٨) في إناث الطيور الناتجة من تزاوج النسبة الجنسية ١:١ . وأيضا لوحظ نفس الإتجاه بالنسبة لمعدل النمو اليومى المحسوب خلال الفترات من ٤-٦ ومن صفر-٦ أسبوع من العمر.

٣- الإناث الناتجة من تزاوج النسبة الجنسية ١:١ نضجت جنسيا مبكرا (٥١,٢١ يوم) بالمقارنة بالإناث الناتجة من تزاوج النسب الجنسية١:٢ و ١:٣ حيث نضجت جنسيا عند (٥٤,٣١ و ٥٢,٠١ يوم) على التوالى.

٤- ازداد العدد الكلى للبيض المنتج خلال العشرة أسابيع الأولى من الإنتاج من (٦١,١١ و ٥٩,٨١) بيضة في الإناث الناتجة من تزاوج النسب الجنسية ١: ٢ و١:٣ إلى ٦١,٧٢ بيضة في الإناث الناتجة من تزاوج النسبة الجنسية ١:١. ولوحظ نفس الإتجاه بالنسبة للوزن الكلى للبيض المنتج خلال العشرة أسابيع الأولى من الإنتاج وكذلك كتلة البيض اليومية المنتجة خلال نفس المدة من الإنتاج.

٥- أثرت النسبة الجنسية تأثير معنوى على كل من نسبة الخصوبة والفقس والأجنة الميتة فى البيض المنتج خلال العشرة أسابيع الأولى من الإنتاج.