Assiut Vet. Med. J. Vol. 43 No. 85, April 2000

Dept. of Animal Prod.,
Fac. of Agriculture, Assiut University, Egypt

AGE OF PUBERTY AND SEXUAL MATURITY IN RELATION TO BODY WEIGHT, SEMEN QUALITY AND SOME BLOOD CONSTITUENTS OF DANDARAWI AND FAYOUMI CHICKENS UNDER UPPER EGYPT CONDITIONS

(With 8 Tables)

By

O.S. AFIFI and Y.A. DOWIDAR*

*Animal Prod. Dept., Fac. of Agric., Al-Azhar Univ.,Assiut, Egypt

(Received at 30/3/2000)

العمر عند البلوغ والنضج الجنسي وعلاقته بوزن الجسم وجوده السائل المنوي وبعض مكونات الدم في دجاج الدندراوي والفيومي تحت ظروف مصر العليا

أسامه سامي عفيفي ، يسري عبد المجيد دويدار

أجريت هذه الدراسة على ٥٠٠ كتكوت غير مجنس عمر يوم من سلالتي الدندراوي والفيومي (٢٥٠ من كل سلاله) وذلك لتحديد العمر ووزن الجسم وجوده السائل المنوي ووزن وأطوال بعض أجزاء الجسم والتغيرات الكيميائية لبعض مكونات الدم وبلازما السائل المنوي عند البلوغ والنضج الجنسي. وقد أوضحت النتائج أن عمر البلوغ والنضج الجنسي في إناث وذكور الدندراوي أقل معنويا من إناث وذكور الفيومي. كما وجد أن ذكور وإناث الدندراوي عند البلوغ والنضج الجنسي أخف وزنا من ذكور وإناث الفيومي. وكانت أوزان الخصيتين والمبيض وقناة البيض أثقل وزنا في الدندراوي عنه في الفيومي، بينما كان طول وارتفاع العرف وطول قناة البيض والمسافة بين العظام الدبوسية في الفيومي أكبر من الدندراوي. ولقد وجد أن الصفات الكيميائية المدروسة لسيرم الدم لم تتأثر معنويا بالسلالة قبل وعند البلوغ والنضج الجنسي باستثناء قيم البروتين الكلى والجلوبيولين فكانت أكبر معنويا في دجاج الدندراوي عن الفيومي. وقد أظهرت النتائج أن السائل المنوي لديوك الدندراوي متميزاً معنويا في صفات الجودة (انخفاض نسبه الشواذ، وارتفاع الحركة التقدمية للحيوانات المنوية) عن السائل المنوي في الفيومي، بينما يتميز الأخير معنويا بالصفات الكميه (حجم القذفة ، القوام ، التركيز) عن الدندراوي. ووجد أن الصفات الكيميائية لبلازما

السائل المنوي لم تتأثر معنويا بالسلالة أثناء البلوغ أو النضج الجنسي باستثناء البروتين وسكر الجلوكوز. مما سبق يتضح أنه تحت ظروف أسيوط فان سلالة الدندراوى رغم أنها أصغـــر وزنا عند البلوغ والنضج الجنسي إلا أنها تبدأ في إنتاج البيض والسائل المنوي مبكرا عـــن سلالة الفيومي. كما أن ديوك الدندراوي تنتج سائلا منويا أعلى في الجودة بينما الفيومي ينتج سائلا منويا يتميز بصفات الكم عن نظيره الدندراوي، كما أن دجاج الدندراوي كـــان أكـــثر تأقلماً عن الفيومي للظروف المناخية بأسيوط.

SUMMARY

A total number of 500 one-day old unsexed native strain Fayoumi (F) and Dandarawi (D) chicks (250 each) were chosen randomly and used to study the age and body weight, semen quality, some organs weight and lenght, and some blood and semen biochemical changes at puberty and at sexual maturity as affected by different strains. The obtained results revealed that the age at puberty and at sexual maturity for native strain (D) females and males were (P≥.05) earlier than (F) females and males. At age of puberty and sexual maturity, the mean body weight for (F) males and females was (P≥.05) heavier than that of (D) males and females. At sexual maturity the testis, ovary and oviduct weight for (D) were (P≥.01) heavier than that for (F), however, comb length and highness, oviduct lenght and distance between iliac bones (cm) were bigger in (F) than in (D). The biochemical serum traits were not affected by strain before and during or after sexual maturity except T. protein and T. globulin. Dandarawi showed the highest values of total serum protein and globulin when compared with (F). At sexual maturity, the ejaculate volume, density, total abnormalities, and sperm concentration for (F) was (P≥.05) higher than that for (D), while the advanced motility was found to be (P≥.05) higher in (D) than (F). Seminal plasma traits were not affected by strain at puberty and sexual maturity except total protein and glucose. It could be summarized that, under Assiut environmental conditions, the (D), with lower body weights at puberty or at sexual maturity, started to produce egg or semen earlier than (F) with heavier body weights at the same ages. Also, the (D) males produce semen with highest quality values, while the (F) males produce semen with highest quantity values. This apparent superiorty of (D) to (F) could be due to their better acceptability for adaptation under the subtropical conditions in Assiut.

Key words: *Puberty, maturity, semen, blood constituents.*

INTRODUCTION

During the recent decades, the extensive importation of high producer exotic commercial layers has tended to reduce the amount of research on local strains undertaken in Egypt, and hence the amount of information available on native fowl stocks including Fayoumi (F) and Dandarawi (D). Although, they still contribute to a great extent in meat and egg supply (El-Hossari, 1970; Ali, 1979 and Sharaby, 1998).

At maturity, the higher body weight recorded in literature for Fayoumi and Dandarawi (males and females) was 1475g (Al-Mufti, 1978). However, Stino et al. (1981) recorded lower body weights (1321g and 1056g in the two strains, respectively). The age of sexual maturity of local strains was studied by many workers (Attia and Abd-El-Hakim, 1972; Abdel Galil, 1993 and El-Full, 1995). Under subtropical conditions, Abdel Latif and El-Hammady (1992) found that the age at sexual maturity ranged from 154 to 207.5 days for Dandarawi chickens.

Also, the relationship between age at sexual maturity and both body and egg weight was studied by many researchers (El-Gammal and El-Danasoury, 1973; Afifi, 1984). However, the age of puberty and its relationship with age at sexual maturity, semen quality, blood serum parameters have not yet adequately studied.Therefore, this experiment was conducted to determine the age and body weight, semen characteristics and some blood constituents at puberty and sexual maturity for Fayoumi and Dandarawi chickens under subtropical environmental conditions.

MATERIALS and METHODS

The present study was carried out at Poultry Research Unit, Animal Production Dept., Fac. of Agric., Al-Azhar Univ., Assiut, during the period from 1/5/1998 and continued up to 1/12/1998.

A total number of 500 one-day old unsexed Fayoumi and Dandarawi chicks (250 each) were used in this study. The chicks were randomly chosen and wing banded. Chicks of the experimental strains were housed and kept under uniform conditions of temperature, humidity, lighting and ventilation all over the experimental periods.

Chicks were free from pullorum and vaccinated against Newcastle. Diets and water were offered ad labium. The composition of diets used are shown in (Table 1).

Table 1: Composition and calculated analysis of the experimental diets (%).

Ingredients	%	
	Starter + Grower	Layer
Yellow corn	62.5	65.0
Wheat bran	9.22	6.63
Soya been meal (44%)	24.60	18.70
Limestone	.50	6.8
Bone meal	2.5	2.20
Salt	.30	.30
Premix[1]	.30	.30
Methionine	.08	.07
Calculated analysis:		
Me (Kcal/Kg feed)	2841.10	2743.95
Crude protein %	18.95	15.88
C:P ratio	149.94	172.84
Methionine %	.39	.34
Lysine %	1.0	.08
Methionine & Cystine %	.71	.61
Calcium %	1.03	3.31
Phosphorus (available) %	.44	.39

1 Each package of 6 Kg contains: 5 Million I.U Vit. A.; 1250.00 I.U Vit. D3; 2 mg Vit. K; 3 gm Vit. B2; 150 mg Choline chloride; 4 gm Calcium D- Pantothenate; 8 mg Vit. B12; Nicotine Acid 15 mg; 40 mg Magnesium; 1 mg Copper; 1mg Iodine; 100 mg Selenium; 20 mg Iron; 40 mg Manganese; 20 mg Zinc; 1 mg Cobalt.

At 10 weeks of age, the males and females were transferred to individual cages. Birds of the two strains were raised under similar conditions to minimize environmental differences. Age and body weight at puberty and at sexual maturity for Fayoumi and Dandarawi were individually recorded. Histologically, the age of puberty for strain is defined as the number of days from the date of hatching to the time which can be observe ruptured ovarian follicle for females or observed

sperm in seminiferous tubules for males. Sexual maturity for females was estimated individually when 50% of females started to lay the first egg (El-Gammal and El-Danasoury, 1973) and for males when the semen characteristics became constant (El-Sharabasy, 1974). Males were trained by abdominal massage technique for semen collection. Semen was collected individually twice/week at 9 a.m. Semen evaluations were carried out immediately according to Melrose and Laing (1970). Volume of semen was measured with a graduated pipette. The testis (left and right) weight, ovary weight, oviduct weight (gm) and length (cm) and the comb length and height (cm) were measured. Therefore, sixty birds representing Fayoumi and Dandarawi (30 birds from each strain, 10 birds each period, and 5 birds from each sex) were randomly taken, before puberty, at puberty and at sexual maturity, and slaughtered by severing the jugular veins. Immediately, the oviducts, ovaries and testis were collected and small pieces from each part were fixed in Bouin's fluid. After proper fixation, the materials were dehydrated and embedded in paraffin wax. Step serial sections were cut at about 5-7um. Also, blood samples were collected from males and females in sterile centrifuge tubes and left at room temperature to clot. The samples were centrifuged for 10 minutes at 3000 r.p.m and the serum was then kept frozen at -20°C until analyzed. Seminal plasma was also analyzed. Using commercial kits purchased from Sdavo (Italy) and Biocon (Germany), blood serum and seminal plasma samples were analyzed for total protein, albumin, total globulin and glucose. However, total cholesterol, urea nitrogen, GOT and GPT were analyzed in blood serum.

Data were statistically analyzed by analysis of variance using GLM procedure of SAS (1985). Differences between means were determined using Duncan's multiple range test as described by Duncan (1955).

RESULTS and DISCUSSION

1-Age and body weight at puberty and sexual maturity:

The age and body weight at puberty and sexual maturity for the two local strains are presented in (Table 2, 3 and 4). The age at puberty for Dandarawi (D) females was earlier ($P \geq .05$) than Fayuomi (F) females by about 14 days (113 *vs.* 127 days). Also, the (D) females had relatively earlier age at sexual maturity as compared with (F) females (175 *vs.* 182 days). The average age at sexual maturity cited in the literature for (D)

and (F) females was 179.8 and 179.9 days of age, respectively (Amer, 1991; Abdel-Latif and El-Hammady, 1992; Abdel Galil, 1993). However, Attia and Abdel-Hakim, (1972) found that the age at sexual maturity for (F) was 129 days. Afifi (1984) reported that (F) and (D) began to lay at age of 142.40 and 173.71days, respectively. Nawar and Abdou (1999) reported that the age at which (F) started to lay was 155 days. Earlier age at sexual maturity (154 days) for (D) was reported by Eitan and Soller (1993). Later age at sexual maturity (207.5days) for (D) was reported by Abdel-Latif and El-Hammady, (1992).

At age of puberty, the (D) males started to produce semen at 104 days of age, while (F) males started at 113 days of age. The (D) males was sexually matured earlier than (F) males by 7 days (134 *vs.* 141 days).

At age of puberty, the means body weight for (F) males (996.7gm) and females (975.5gm) were (P≥.05) heavier than that of (D) males (903.3gm) and females (876.7gm).

The means body weight at sexual maturity for (F) males (1620 gm) and females (1360 gm) were (P≥.01) higher than that for (D) males (1460gm) and females (1316gm). Similar results were reported by Sharara (1974); Dorgham, (1980); Amer, (1991); Abdel-Latif and El-Hammady (1992) and Dowidar et al., (1999). However, Nawar and Abdou (1999) reported that (F) sexually matured at 1057.4±6.16gm body weight. Hassan et al. (1973) found that the mean body weight of (F) at sexual maturity was significantly lower than the (D) (1232 vs. 1320 grams). Afifi, (1984) revealed that the mean body weight for (F) and (D) at sexual maturity was 1131.49 vs. 1140.05gm, respectively.

2-Organs weight:

Table 3 and 4, showed that, at sexual maturity, the testis weight, ovary and oviduct weight for (D) were (P≥.01) higher than that for (F) except in comb (length and highness), oviduct lenght and distance between iliac bones. This may be due to breed differences (Sturkie and Opel, 1976; Sturkie, 1986). On the other hand, at the age of puberty or before that, the same traits were not significantly affected by strain.

3-Biochemical serum traits:

Results presented in Table 5, exhibited that the biochemical traits which studied in this experiment were not affected by strain before and during or after sexual maturity except total protein and total globulin. The significant increase of plasma total protein and globulin concentrations in the present study may be attributed to the increase in

T4 hormone (May, 1980). Furthermore, thyroid hormones accelerate cellular reactions in most organs and tissues of the body, including the liver in which total protein and globulin are formed (Pearson et al., 1981). Dandarawi showed the highest values of total serum protein and globulin when compared with (F). Agag (1983) stated that protein fractions are known to be influenced by genetic and non genetic factors. Ress and Nordskog (1981) found that the variations in total serum proteins between breeds may be due to the globulin fraction. El-Hammady et al. (1995) found that the physiological potentiality of (D) may by more pronounced than (F). Similar results were found by Dowider et al., (1999).

4- Semen Characteristics:

Table 6, shows that at puberty, the ejaculate volume for (F) (.19±0.04ml) was (P≥.05) bigger than that for (D) (.18 ±0.04ml). At sexual maturity, the ejaculate volume for (F) (0.56±0.04ml) was (P≥.05) higher than that for (D) (0.45 ±0.04ml). Lake and Stewart (1978) reported that egg-layer and broiler produced .15 to .20 and .35ml semen, respectively. However, the ejaculate volume in local chicken strains ranged from 0.26 to 1.13ml (El-Sharkawy, 1981; Kamar, 1984 and El-Hammady et al., 1995). Similar results was obtained by El-Sharkawy (1981) and Kamar et al., (1987). On the other hand, the ejaculate volume obtained in the present experiment was lower than those reported by El-Ashwal (1993) and this may be due to environmental conditions and some physiological differences. Kamer and Badreldin (1958) indicated that cocks with heavier body weights were found to produce higher volumes of semen.

The semen density was found to be (P≥.05) higher in (F) than (D). The trend in semen density was associated with a very similar trend in semen concentration (Table 5). El-Sharabasy et al. (1990) found highly significant correlation (r=.92) between semen density and sperm concentration. The advanced motility was (P≥.05) better in (D) semen than that in (F) semen. Similar results were reported by Dowider (1999) how found that the advanced motility was significantly (P≥.05) higher in (D) semen than that in (F) semen. However, El-Ashwal (1993) reported that the spermatozoa motility in the semen of (F) cocks exceeded that of (D) by about 4.7%. Regulation of functions of non mammalian spermatozoa, such as the initiation of motility, is associated with changes in the internal pH of the spermatozoa (Zeng et al., (1996). A rise in

internal semen pH initiates motility of spermatozoa (Gatti et al., 1993). Bogdonoff and Shaffner (1954) stated that the differences in sperm motility may be attributed to semen pH value. Saito et al. (1996) revealed that alkalinization of the extracellular fluid alone can induce the reinitiation of motility of spermatozoa. The total abnormalities values were significantly (P≥.05) higher in (F) cocks than in (D) cocks. There was a negative relation between motility and the percentage of abnormalities, the more abnormalities were found the less was the motility of the sperm (Kamar and Badreldin, 1959). The low percentage of deformed spermatozoa in (D) semen may be due to sexual activity which allow the sperm to be retained for sufficient time to mature. Similar results were found by Kamar et al., (1984); Attia and Badawy (1996) and Dowidar (1999). Fayoumi males produced high percentages of total abnormalities as compared to other breeds (Kamar, 1958).

Sperm concentration was (P≥.05) higher in (F) than that in (D) (Table, 5). Similar results were obtained by Dowidar (1999). However, El-Ashwal (1993) found that the spermatozoa concentration mean of (D) males was higher than that of the (F). The increase in sperm concentration in the present study coincided with higher sperm volume. Highly significant differences between breeds and strains in sperm concentration were found (Sturike, 1986). Lake and Stewart (1978) found that the sperm concentration for egg-layer and broiler fowls was 5.0 and 5.7×10^9 sperm/ml, respectively, equivalent to 1.0 and 2.0×10^9 sperms per collection. De Reviers (1988) reported 4 to 6×10^9 sperm per ejaculation, which was the performance of males under optimum environmental conditions.

Table 6 shows that the highest values of semen quality (e.g. motility) were found in (D) males, while the high vales of semen quantity (ejaculate volume; density and concentration) were observed in (F) cocks.

5-Biochemical seminal plasma traits:

Results presented in Table 7, exhibited that the biochemical traits of seminal plasma which studied in this experiment were not affected by strain during or after sexual maturity except total protein and glucose. These differences may be due to the genetic make-up of each strain. Similar results were observed by El-Sharabasy et al. (1990) and Dowider (1999).

Table 4: Means and standard errors (X±S.E) for body weight, testis weight (%) and comb as affected by different cock strains.

Strain[1]	Stage[2]	B.W (gm)	Testis (%)			Comb	
			R	L	Total	Length (cm)	Highness (cm)
F	1	569.0±20.4^{e}	0.17±.00^{d}	0.18±.1^{d}	0.35±.17^{d}	6.0±.3^{b}	3.03±.4^{b}
	2	996.7±20.4^{c}	0.92±.07^{c}	1.09±0.04^{c}	2.01±0.11^{c}	9.12±.5^{a}	4.76±.4^{a}
	3	1620.0±20.4^{a}	1.04±.19^{b}	1.11±0.32^{b}	2.15±0.05^{b}	9.96±1.0^{a}	6.00±.3^{a}
D	1	515.7±20.4^{e}	0.13±.00^{d}	0.16±.00^{d}	0.29±.03^{d}	5.10±.2^{b}	2.77±.4^{b}
	2	903.3±20.4^{d}	0.82±0.17^{c}	0.99±.15^{c}	1.85±0.3^{c}	6.63±.7^{b}	3.87±.4^{b}
	3	1460.0±20.4^{b}	1.21±0.39^{a}	1.32±0.42^{a}	2.53±.7^{a}	8.70±.5^{a}	5.40±.3^{a}

Means in the same column with different superscript are significantly different (P≥.05).

[1]D= Dandarawi, F= Fayoumi.

[2] 1- females , 2- males.

Table 5: Some biochemical serum parameters as affected by different strains.

Strain[1]	Stage[2]	T. protein (g/dl)	Albumin (g/dl)	T. globulin (g/dl)	Glucose (mg/dl)	T. cholesterol (mg/dl)	Urea nitrogen (mg/dl)	GPT (U/L)	GOT (U/L)
F	1	5.45±.8^{c}	2.55±.4^{a}	6.13±.5^{b}	91.8±14.9^{a}	128.4±13.5^{b}	14.0±1.2^{a}	60.6±3.0^{a}	20.2±1.0^{a}
	2	5.97±.7^{c}	2.27±.3^{a}	4.53±.4^{d}	139.4±14.9^{a}	106.3±13.2^{a}	20.2±1.1^{a}	57.6±3.0^{a}	19.2±1.0^{a}
	3	5.97±.7^{c}	3.51±.5^{a}	2.45±.1^{e}	137.6±14.3^{a}	114.4±12.3^{a}	19.2±1.2^{a}	68.6±3.0^{a}	22.9±1.0^{a}
D	1	10.14±.5^{a}	2.98±.3a	7.14±.3^{a}	105.8±14.9^{a}	96.4±12.3^{a}	11.3±1.3^{a}	56.4±3.0^{a}	18.8±1.0^{a}
	2	7.69±.4^{b}	1.98±.2^{a}	5.71±.4^{c}	123.2±14.9^{a}	165.3±11.3^{a}	22.1±2.0^{a}	54.2±3.0^{a}	18.1±1.0^{a}
	3	8.95±.3^{b}	3.55±.4^{a}	5.40±.3^{c}	129.8±14.9^{a}	114.8±12.5^{a}	21.6±2.1^{a}	48.8±3.0^{a}	16.3±1.0^{a}

Means in the same column with different superscript are significantly different (P≥.05).

[1]D= Dandarawi, F= Fayoumi.

[2] 1- females , 2- males.

Table 6: Means and standard errors (X±S.E) for semen characteristics as affected by different strains.

Strain[1]	Stage[2]	Age wk	Ej. Volume (ml)	Density (1-4)	Ad. motility (%)	Abnormalities (%)	Concentration ($X10^9$/ml)	Concentration ($X10^9$/ej)
D	1	15	.18±.04^d	1.25±.1^d	65.0±1.9^e	18.00±1.0^b	1.58±.2^c	0.28±.2^c
		16	.30±.04^c	1.30±.1^d	70.00±1.9^b	16.00±1.0^b	2.42±.2^b	0.73±.2^b
		17	.33±04^c	2.10±.1^b	77.20±1.9^b	14.90±1.0^b	2.58±.2^b	0.85±.2^b
		18	.39±.04^c	2.20±.1^b	81.00±1.9^a	12.60±1.0^c	2.80±.2^b	1.09±.2^b
		19	.45±.04^b	2.50±.1^b	84.10±1.9^a	11.00±1.0^c	3.19±.2^a	1.44±.2^a
	2	20	.44±.04^b	2.65±.1^b	85.00±1.9^a	10.20±1.0^c	3.58±.2^a	1.55±.2^a
		21	.45±.04^b	2.71±.1^b	84.20±1.9^a	10.30±1.0^c	3.53±.2^a	1.58±.2^a
F	1	15	----	----	----	----	----	----
		16	.19±.04^d	1.20±.1^d	57.00±1.9^d	22.7±1.0^a	1.64±.2^c	0.31±.2^c
		17	.27±.04^c	1.20±.1^d	66.00±1.9^c	21.11±1.0^a	1.74±.2^c	0.47±.2^c
		18	.30±.04^c	1.70±.1^c	69.80±1.9^c	17.40±1.0^b	2.40±.2^b	0.72±.2^b
		19	.39±.04^b	2.30±.1^b	73.00±1.9^b	15.20±1.0^b	3.11±.2^a	1.21±.2^a
	2	20	.56±.04^a	3.01±.1^a	78.40±1.9^b	14.60±1.0^b	4.11±.2^a	2.30±.2^a
		21	.56±.03^a	3.09±.1^a	79.00±1.9^b	14.40±1.0^b	4.31±.2^a	2.41±.2^a

Means in the same column with different superscript are significantly different (P≥.05).

[1]D= Dandarawi, F= Fayoumi.

[2] 1- females , 2- males.

Table 7: Some biochemical seminal plasma parameters as affected by different strains.

Strain[1]	Stage[2]	T. protein (g/dl)	Albumin (g/dl)	T. globulin (g/dl)	Glucose (mg/dl)	T.cholesterol (mg/dl)	Urea nitrogen (mg/dl)
F	1	2.90±.02^a	.58±.01^a	2.32±.05^a	55.71±2.5^a	67.57±13.5^a	9.18±1.2^a
	2	1.59±.02^d	.70±.03^a	.89±.01^a	25.96±1.5^c	51.35±13.2^a	8.76±1.1^a
D	1	2.03±.02^b	.62±.03^a	1.42±.03^a	35.45±2.1^b	89.64±12.3^a	13.80±1.3^a
	2	1.76±.02^c	.73±.02^a	1.02±.04^a	20.40±1.3^d	74.32±11.3^a	9.71±2.0^a

Means in the same column with different superscript are significantly different (P≥.05).

[1]D= Dandarawi, F= Fayoumi.

[2] 1- females , 2- males.

Table 8: Maximum and minimum values of ambient temperatures (C°) and relative humidity (%) during the experiment period under subtropical conditions.

Month	Ambient temperatures (C°)		Relative humidity (%)	
	Max.	Min.	Max.	Min.
May	37.81	19.40	53.54	17.84
June	37.32	20.64	57.90	22.00
July	39.79	22.35	60.10	20.26
August	39.12	23.03	68.94	30.55
September	37.54	20.98	68.77	27.20
October	34.65	17.44	69.74	26.68
November	28.31	12.57	78.53	37.50
December	22.99	7.65	85.52	41.94

REFERENCES

Abdel-Galil, M.A. (1993): Evaluating the performance of some local breeds of chickens under certain plains of nutrition. Ph.D. Thesis, Fac. of Agric., Menia Univ., Egypt.

Abdel-Latif, M.A. and El-Hammady, H. (1992): Heritabilites of some egg production and egg quality traits in Dandarawi chickens. Egypt. Poultry Sci., Vol. 12:751-764.

Afifi, U.S. (1984): Comparative studies on some productive traits of different genotypes of chickens. M.Sc., Thesis Fac. of Agric., Assiut University, Assiut, Egypt.

Ali, M.A. (1979): Comparative study of Dandarawi, Rhode Island Red, SCWL and Dokki-4 breeds of chicken and their crosses. M. Sc. Thesis, Fac. of Agric.,Alex. Univ., Egypt.

Al Mufti, A.M. (1978): Improving broiler weight in the White Baladi chicken. M. Sc., Thesis, Fac. of Agric., Cairo University, Egypt.

Agag, I.A. (1983): Some cause of unthriftiness in Egyptian lambs and their compact. Ph. D. Thesis Fac. Vet. Med., Zagazig Univ., Egypt.

Amer, M.F. (1991): Strains of chickens developed in Egypt during the 1970s. Anim. Breeding Abstracts, 59:7170.

Attia, Y.A. and Badawy, N. (1996): Effect of dietary energy levels on reproductive performance, semen quality and offspring growth of two local chicken breed males. Egypt Poult. Sci., Vol. 16 (I) 69-86.

Attia, F.M. and El-Hakim, N.F. (1972): Restricted feeding of broiler type replacement stock. Egypt. J. Anim. Prod., 12:39-49.

Bogdonoff, P.D. and Shaffiner, C.S. (1954): The effect of pH on in vitro survival, metabolic activity and fertilizing capacity of chicken semen. Poultry Sci., 33: 665-669.

Darwish, A.A., Khalifa M.A. and Radwan, A.M. (1993): Semen characteristics in Fayoumi, White Leghorn cocks and their crosses. Egypt Soc. Anim. Repord. Fert. 5th Annual Congress, Cairo, Egypt, 200-210.

De Reveir, M. (1988): Apparel genital male et production des spermatozoides, in: Sauveur, B. (Ed) Reproduction des volailles et production d'oeufs. (Paris, INRN).

Dorghan, S.A. (1980): Genetic differences between two strains in Fayoumi chicken with special reference to heterosis. M. Sc. Thesis Fac. of Agric. Ain Shams Univ., Egypt.

Dowidar, Y.A. (1994): Comparative studies on biochemical changes in avian semen as affected by storage at different temperatures. Ph. D. Thesis, Fac. of Agric, Al-Azhar University, Cairo, Egypt.

Dowidar, Y.A. (1999): Studies on semen characteristics, fertility and hatchability of some local chicken strains. Al-Azhar, J., Vol. 29: 39-53.

Dowidar, Y.A., Nofal, R.Y., Afifi, Y.K. (1999): Carcass and some serum biochemical traits of males of three local Egyptian chickens strains. Egypt. Poult. Sci. Vol. 19(II), 395-406.

Duncan, D.B., (1955): Multiple range and multiple F tests. Biometrics. II, 1-42.

Eitan, Y. and Soller, M. (1993): Two-way selection for threshold body weight at first egg in broiler strain females. 3- reproductive performance under various levels of feed restriction. Poultry Sci., 72:1813-1822.

El-Ashwal, K.M.A. (1993): A study on the reproduction performance of chicken under subtropical conditions. M.S. Thesis, Fac. of Agric, Assiut University, Assiut, Egypt.

El-Full, E.A. (1995): Different multivariate approaches for egg production in poultry breeding experiments. Ph. D. Thesis, Fac of Agric., Fayoum, Cairo University, Egypt.

El-Gammal, A.M. and El-Danasoury, M.S. (1973): Studies on sexual maturity of some breeds and strains reared in upper Egypt. Assiut J. of Agric. Sci., Vol. 4 - No. 2, pp. 147-159.

El-Hammady, H.Y.; Abd-El-latif M.A. and Ali, K.M. (1995): Effect of Naked neck (Na) gene, dietary protein level and their interaction on body weight and semen characteristics of chicken males. Egypt. Poult. Sci., Vol. 15:87-109.

El-Hossari, M.A. (1970): Sign of heterosis within a population of Fayoumi chicken U.A.R. j. Anim. Prod. 10:21-25.

El-Sharabasy, A.A.M. (1974): Some studies on rabbit semen. M.Sc. Thesis, Fac. of Agric., Al-Azhar University, Cairo.

El-Sharabasy, A.A.M., Abdel-Hakim, N.F.; Shoukry, H.M.S. and Dowidar, Y.A. (1990): Effect of some extenders and storage temperatures on turkey semen characteristics. Al-Azhar J. Agric. Res. Vol. 12:45-60.

El-Sharkawy, S.I. (1981): Effect of some environmental factors on physical and chemical characteristics of poultry semen. Ph. D. Thesis, Fac. of Agric. Al-Azhar University, Cairo, Egypt.

Gatti, J.L., Chevrier, C.; Paquignon, M. and Dacheux, J.L. (1993): External ionic conditions, internal pH and motility of ram and boar spermatozoa. J. Reprod. fertil. 98:439-449.

Hassan, G.M. (1973): Effect of cross breeding on sexual maturity and egg number of the Fayoumi chicken. Assiut J. of Agric. Sci., 4:149-159.

Kamar, G.A.R., and Badreldin, A.L. (1959): Seasonal variations in semen characteristics of adult Fayoumi cocks. Poult. Sci., vol. xxxviii, No. 2 March, 1959.

Kamar, G.A.R., Khalifa,M.K.; Riad, S.A. and Sarhan, A.A. (1984): Studies on semen characteristics fertility and hatchability of Fayoumi, Plymouth Rock and Rhode Island Red cocks. Egypt. J. Anim. Prod., 24:41-50.

Lake, P.E. and Stewart, J.M. (1978): Artificial insemination in poultry, in: Ministry of Agriculture, Fisheries and Food Bulletin 213. (London, HMSO).

May, J.D. (1980): Effect of dietary thyroid hormone on growth and feed efficiency of broilers. Poultry Sci., 59, 888.

Melrose, D.R. and Laing, J.A. (1970): fertility and infertility in the domestic animals. 2nd edition, baillere Tindall and Cassell, London.

Nawar, M.E. and Abdou, F.H. (1999): Analysis of heterqtic gene action and material effects in crossbred Fayoumi chickens. Egypt Poult. Sci., Vol. 19(III) Sept. 1999 (671-689).

Pearson, A.W.; Greenwood,N.M.; Butler E.J. and Fenwick, G.R. (1981): The inhibition of trimethylamine oxidation in the domestic fowl (Gallus domesticus) by antithyroid compounds. Comp. Biochem. Physiol. C:Comp. Pharmacol., 69, 307.

Ress, M. and Nordskog, A. (1981): Genetic control of serum immunoglobulin G. levels in the chicken. Immunogenetic 8:425-451.

SAS (1985): SAS User's Guide: Statistics, Version 5 ed., Cary, NC. SAS Institute Inc., U.S.A.

Sharaby, E.S.O.H. (1998): Comparative study of morphology and productivity for Baladi, Behairi, and Fayoumi strains. M. Sc., Thesis, Fac. of Agric., Fayoum, Cairo University, Egypt.

Sharara, H.H. (1974): Studies on some productive characters in different strains of chickens under Upper Egypt condition. M. Sc. Fac. of Agric., Assiut University, Assiut, Egypt.

Stino, F.K.R.; Sabri, H.M.; Kamar, G.A.R. and El-Hossaori, M.A. (1981): Effect of crossing on different meat characteristics of Fayoumi chicks. Live body weight and related characteristics. Egypt. J. Anim. Prod. 21:25-36.

Sturkie, P. D. (1986): Avian Physiology, 4th edition, Academic press, London.

Sturkie, P.D. and Opel, H. (1986): Reproduction in the male, fertilization, and early embryonic development. In "Avian Physiology" (3d ed) (P. D.Sturkie, Ed.). N.Y.:Springer-Verlag, Chapter 17.

Zeng, Y., Oberdorf, J.A.; Florman, H.M. (1996): pH regulation in mouse sperm: identification of Na^+-, Cl^--, HCO^-_3 dependent and arylaminobenzoate-dependent regulatory mechanisms and characterization of their roles in sperm capacitation. Dev. Biol., 173: 510-520.