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MORPHOMETRIC DEVELOPMENTAL STUDIES ON THE SEMINIFEROUS TUBULES IN TESTES OF FAYOUMI AND RHODE ISLAND RED COCKERELS

(With 5 Tables and 15 Figures)

By

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دراسات مورفومترية على تطور القنيات المنوية في خصية سلالتـي
الفيومي والرودايلاند الأحمر

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أجريت دراسات قياسية على حجم وكم القنيات المنوية في سلالتي الفيومي والرودايلاندالأحمر وذلـك في خلال الفترة من عمر يوما واحدا وحتى عمر أربعة وعشرين اسبوعاً ، قورنت عدة متغييرات مورفولوجيه في كلا السلالتين اشتملت محيط وحجم القنيات المنوية والعدد الكلي للخلايا النسلية ومقدار انصاف اقطار انوية الخلايا الدعاميه. كما عين ظهور باكورة النطفه الغير تامة والتامة . وخلصت هذه الدراسة الى أن الديوك الفيومي تبكر في الوصول الى مرحلة النضوج الجنسي عنه في سلالة الرودايلاند الأحمر.

SUMMARY

Biometrical as well as quantitative histological studies were carried out on the seminiferous tubules of the testis of Fayoumi and Rhode Island Red cockerels from one day to 24 weeks of age. Various morphological parameters such as the diameter and the absolute volume density of the seminiferous tubules, the total number of germ cells, the first appearance of spermatids and sperm and the nuclear cross sectional area of the Sertoli cells were applied on the testes of both breeds and documented that Fayoumi cockerels reached sexual maturity earlier than those of the Rhode Island one.

INTRODUCTION

The development of the sex organs in the male domestic fowl is of concern to poultry breeders as well as scientific workers. Sexual maturity in broiler breeder males is of interest to the commercial breeder who would like to select males at a young age to reduce the generation interval in their breeding program. Numerous quantitative studies have been made on spermatogenic cells (CLERMONT & PEREY, 1957; RUSSELL and CLERMONT, 1977 and MAUSLE, STAEDLER and STENGER, 1982). Sertoli cells (BUSTOS-OBREGON, 1970; CAVICCHIA and DYM, 1977; NISTAL, ABAURREA & PANIAQUA, 1982). However, there are relatively few quantitative data on the pattern of testicular growth during postnatal development in domestic fowl. The present study deals with two fowl breeds chosen for low and high fecundity, one genetically capable

for relatively low egg production (Fayoumi breed) (HASSAN, EL-HAMMADY and KHATTAB, 1973) and the other (Rhode Island Red breed) for high egg production (GLEICHAUF, 1966).

MATERIAL and METHODS

The birds used in this work were obtained from the poultry breeding research Farm, Faculty of Agriculture, Assiut University. The birds were randomly chosen among the two breeds stocks; Fayoumi and Rhode Island Red, at different ages from one day post-hatching up to 24 weeks of age (Table 1). Body weight, testicular weight and testicular measurements were recorded. The testicular volume was determined using the formula: $4/3\ \pi\ d_1 \times d_2 \times d_3$ (AHMED, LENNOX and MACK, 1969), where a d_1 (length); d_2 (width); d_3 (thickness) and $4/3\ \pi$ is constant (0.5238).

After routine histological preparation, serial paraffin sections werecut at 5-7Um in thickness and stained with Haematoxylin and Eosin, PAS Haematoxylin (DRURY and WALLINGTON, 1980).

Semithin sections stained with toluidine blue were also prepared from the testes of both breeds.

The proportion (volume density) of the seminiferous tubules in the testes were determined by the aid of a square grid with 100 point mounted in the eye-piece of a light microscope (WEIBEL et al., 1966). The diameter of the seminiferous tubules represent means for 20 tubules were measured by using an ocular micrometer. The average number of the different cell types, as well as the cross-sectional area of the Sertoli cell nuclei, were determined. All these measurements were carried out from five different areas in the testis of both breeds for each age group. Data were statistically analysed by means of (NCR) computer in two ways of variance.

Table (1): Materials available in the present study

Age in weeks	Number of males	
	Fayoumi	Rhode Island Rod
One-day-old	7	4
1 week	6	4
2 weeks	5	3
4 weeks	6	3
6 weeks	4	3
8 weeks	5	3
12 weeks	5	3
16 weeks	9	3
20 weeks	7	3
24 weeks	6	3

RESULTS

The biometrial analyses between the testis of both breeds from one day to 24 weeks age (Tables 2, 3) and (Fig. 1), revealed that, there was a relatively slow testis growth to 12 weeks of age in both Fayoumi and Rhode Island Red cockerels. The weight of each testis was about 0.011 gm and 0.005 gm at one day old and reached 0.43 and 0.22 gm at 12 weeks age for Fayoumi and Rhode Island red chickens, respectively. The testis of Fayoumi chicken was suddenly increased to 6.18 gm at 16 weeks age, whereas in Rhode Island, the testis grew at a lower rate (0.6 gm).

At 16-24 weeks age, the average testis weight of Fayoumi increased approximately three fold and reached about 22.7 gm, while those of the Rhode Island chickens were approximately 8.53 gm.

Post-hatching, the testes of both Fayoumi and Rhode Island chickens were formed of a network of seminiferous tubules with narrow lumina as well as solid cords separated by abundant intertubular tissue (Figs. 2, 3). These tubules and cords were formed of a single layer of spermatogonia and Sertoli cell (Fig. 4), resting on a well distinct PAS positive basement membrane. The spermatogonia were slightly larger than Sertoli cells, their nuclei were oval or rounded in shape and contained one or more nucleoli. The total number of the germ cells per tubule was higher in Fayoumi (14) than in Rhode Island red (9). The Sertoli cells were of tall columnar variety with less clear cell boundaries and granular cytoplasm containing faintly stained PAS positive granules. Their nuclei were oval or spindle in shape and lie perpendicular to the basement membrane with one or two deeply stained nuclei (Fig. 4). The cross sectional area of the nuclei in the Sertoli cells of Fayoumi testis (34.6 Um^2) was slightly larger than those of Rhode Island Red (33.3 Um^2). The mean number of Sertoli cells per tubule appeared to be similar in both breeds (Tables 4, 5). The seminiferous tubules and cords were surrounded by two or three layers of elongated cells with oval or elongated vesicular nuclei and faintly stained cytoplasm. Mitotic figures were demonstrated among these cells. The diameter of the seminiferous tubules was slightly larger in the testis of Fayoumi (43.9 Um) than those of the Rhode Island chickens (41.8 Um). The absolute volume density of the seminiferous tubules in the testis of Fayoumi breed was higher (2.2 mm^3) than those of the Rhode Island (1.62 mm^3) (Tables 4, 5).

At 1-4 weeks age (Fig. 5), the seminiferous tubules joined each other and forming a network. The proportion of the seminiferous tubules with narrow lumen was found to be higher than those recorded in the testes of one day old.

The mean diameter of the seminiferous tubule, the total number of germ cells and the nuclear cross sectional area of the Sertoli cell were gradually increased than those observed in the previous age. Spermatogonial cells with large sized vesicular nuclei and pale stained cytoplasm was occasionally demonstrated among the epithelium in the testis of both breeds. However, few numbers of primary Spermatocytes were demonstrated in the seminiferous tubules of Fayoumi chicken.

Table (2): Biometerical measurements of the testis of Fayoumi chickens at different age groups.

Age weeks	Body wt gm.	Testis wt. gm.		Aver. Testis wt. gm.	Testis wt. gm.	Aver. Testis Dimensions mm			Average Testis Volume mm^3
		Right	Left		Body wt. gm. %	Length	Width	Thickness	
1-day	33.7± 0.8	0.011± 0.0019	0.011± 0.0019	0.011± 0.0019	0.068± 0.0091	4.25± 0.5	1.4± 0.21	1.27± 0.14	4.3± 1.39
1-week	48.2± 0 8	0.0162± 0.0038	0.023± 0 0037	0.019± 0.0037	0.082± 0.014	6.1± 0.3	2.0± 0	2.0 ± 0	12.73± 0.63
2-weeks	77.6± 2.58	0.022± 0.0012	0.025± 0.0027	0.024± 0.002	0.061± 0.003	6.25± 0.52	2.67± 0.17	2.42± 0.3	22.1± 6.1
4-weeks	166.7± 8.8	0.077± 0.012	0.08± 0.012	0.078± 0.012	0.096± 0.019	7.8± 0.17	4.0± 0.25	3.9± 0.33	63.7± 9.6
6-weeks	440.0± 34.6	0.23± 0.02	0.24± 0.02	0.236± 0.02	0.11± 0.013	12.5± 0.76	5.0± 0.25	4.7± 0.17	154.7± 23.4
8-weeks	503.3± 29.1	0.38± 0.06	0.43± 0.033	0.41± 0.046	0.163± 0.019	13.8± 0.83	6.5± 1.0	5.8± 0.5	220.99± 23.3
12-weeks	793.3± 34.8	0.42± 0.033	0.45± 0.029	0.43± 0.03	0.09± 0.016	13.9± 0.33	6.1± 0.58	5.8± 0.33	262.1± 44.8
16-weeks	940.0± 40.0	5.3± 0.51	7.1± 1.5	6.18± 1.01	1.3± 0.17	38.8± 3.8	21.3± 3.18	16.3± 1.36	7576.6± 2479.7
20-weeks	1043.3± 34.8	10.3± 0.12	12.3± 0.76	11.3± 0.4	2.2± 0.17	40.8± 0.88	25.2± 0.44	21.0± 0	11278.6± 91.2
24-weeks	1406.7± 146.2	20.7± 2.67	24 6± 4.36	22.7± 3.44	3.23± 0.34	58.0± 5.9	28.7± 1.1	25.5± 1.0	22307.4 ± 2944.7

± S.E.

Table (3): Biometrical measurements f the testis of Rhode Island Red Chickens at different age groups.

Age weeks	Body wt. gm.	Testis wt.gm.		Aver. Testis wt.gm.	Testis wt.gm. Body wt.gm.%	Aver. testis dimensions mm			Aver. testis volume mm^3
		Right	Left			Length	Width	Thickness	
1-day	44.5± 2.2	0.005± 0.0015	0.005± 0.0015	0.005± 0.0015	0.022± 0.004	4.0± 0.6	1.25± 0.14	1.0± 0	2.7± 0.68
1-week	48.3± 1.2	0.007± 0.0005	0.0077± 0.0003	0.0073± 0.0004	0.03± 0.0018	5.5± 0.3	1.83± 0.22	1.4± 0.3	8.11± 3.1
2-weeks	76.3± 3.6	0.019± 0.004	0.019± 0.004	0.018± 0.004	0.05± 0.01	5.7± 0.3	2.17± 0.08	2.0± 0	12.8± 0.69
4-weeks	12.0± 10.0	0.024± 0.0095	0.028± 0.0088	0.026± 0.0096	0.046± 0.018	6.0± 0.58	2.2± 0.17	2.0± 0	13.77± 2.35
6-weeks	260± 15.3	0.047± 0.0088	0.047± 0.0088	0.047± 0.0088	0.037± 0.0088	8.3± 0.3	2.7± 0.17	2.2± 0.17	25.7± 4.79
8-weeks	411.7± 36.9	0.088 0.009	0.093± 0 006	0.091± 0.0079	0.044± 0 0029	9.8± 0.17	3.0± 0	3.0± 0	46.29± 0.79
12-weeks	876.7± 197	0.22± 0.017	0.23± 0.066	0.22± 0.015	0.054± 0.0077	12.1± 0.8	5.0± 0.66	4.42± 0.3	147.3± 27.6
16-weeks	1033.3± 145.3	0.6± 0.32	0.6± 0.32	0.6± 0.32	0.13± 0.085	12.3± 1.7	5.8± 1.8	4.6± 1.3	234.8± 161.8
20-weeks	1300± 115.5	1.27± 0.067	1.27± 0.067	1.27± 0.067	0.197± 0.011	14.7± 1.33	6.67± 1.76	5.25± 1.16	312.2± 149.2
24-weeks	1991.7± 79.5	8.2± 2.17	8.9± 2.18	8.53± 2.18	0.87± 0.21	39.0± 1.74	20.5± 2.0	18.5± 2.3	8034 5± 2129.7

Table (4): Quantitative analysis of the seminferous tubules in the testis of Fayoumi chickens at different age groups.

Age in weeks	Seminiferous tubule				Number of Germ cells/tubule			Total No. /tubule	Sertoli cell	
	Diameter Um	No./ field	Vol.density%	Absol.Vol. mm^3	Spermato-gonia	Spermato-cytes	Sperma-tids		No./tubule	Nuclear cross sec. area Um^2
1-day	43.9± 1.4	—	50.9± 0.55	2.2± 1.7	14± 0.88	—	—	14± 0.68	4± 0.33	34.6± 4.8
1	47.6± 1.4	31± 1.3	53.3± 1.9	6.8± 0.52	17± 1.7	—	—	17± 1.7	5 ± 0.33	49.2± 3.78
2	51.5± 1.79	26± 1.8	58.4± 1.85	13.0± 3.9	17± 1.53	—	—	17± 1.53	4± 0.33	52.9± 6.2
4	63.6± 1.4	22± 1.2	67.6± 1.7	42.2± 6.2	25± 2.73	3± 0.67	—	28± 2.6	5± 1.53	62.9± 8.3
6	63.8± 1.3	21± 0.33	71.67± 2.4	111.7± 19.7	28± 1.5	4± 0.58	—	32± 1.33	4± 0.88	63.5± 14.6
8	64.3± 2.9	18± 0.67	74.8± 0.39	171.3± 18.1	30± 1.5	3± 0.88	—	33± 2.3	5± 0.67	76.5± 16.9
12	64 8± 0.99	17± 1.2	79.7± 1.14	208.5± 34.2	32± 2.4	19± 4.3	—	51± 2.3	4± 0.58	105.7± 16.5
16	184.7± 9.3	6± 0.58	94.1± 0.49	7134.6± 2338.0	72± 8.8	95± 11.9	207± 43.9	374± 64.1	4± 1.15	125.7± 14.5
20	201.5± 13.2	5± 0.67	94.9± 0.94	10699.5± 132.3	81± 12.2	133± 7.2	269± 97.2	483± 108.3	6± 1.2	126.2± 3.2
24	250.2± 17.1	4± 0.33	95.2± 0.49	21260.8± 2882.4	78± 3.3	118± 6.1	302± 52	498± 50.8	5± 0.58	127.8± 2.1

± = S.E.

Table (5): Quantitative analysis of the seminiferous tubules in the testis of Rhode Island chickens at different age grups.

Age in weeks	Seminiferous tubule				Number of Germ cells/ tubule			Total No. /tubule	Sertoli cell	
	Diameter Um	No./field	Vol.density%	Absol.vol. mm^3	Spermato-gonia	Spermato-cytes	Sperma-tids		No/Tubule	Nuclear cross sec. area Um^2
1-day	41.8± 0.33	—	61+ 2.14	1.62+ 0.36	9± 0.58	—	—	9+ 0.58	4+ 0.88	33.3+ 5.95
1	44.9± 0.2	43+ 0.67	64.9± 1.16	5.2± 2.02	14± 1.3	—	—	14± 1.3	4+ 0.88	37.7+ 3.6
2	49.3± 3.43	40+ 1.16	65.8± 1.04	8.56+ 0.47	18± 1.0	—	—	18± 1.0	4+ 0.33	47.1± 1.8
4	51.6± 4.1	26+ 1.7	66.1± 1.97	9.04+ 1.4	24± 3.3	—	—	24+ 3.3	5± 0.33	42.9± 2.8
6	54.5± 1.04	24± 1.5	67.7± 3.5	17.1+ 2.2	25± 0.58	—	—	25+ 0.58	3± 0.33	46.1± 1.1
8	61.3+ 2.5	23+ 0.88	74.1± 0.4	33.6+ 0.8	25± 0.58	—	—	25+ 0.58	4± 0.58	53.4+ 7.1
12	70.1± 1.9	19± 1.5	84.7+ 0.29	124.7± 23.9	25+ 2.4	10± 3.1	—	35± 4.7	4+ 0	76.5+ 14.5
16	71.4± 1.79	19+ 2.7	85.2+ 0.58	200.5 ± 137.9	32+ 5.04	13+ 4.6	—	45+ 7.6	5± 0.88	114.2+ 22.7
20	105.8± 8.7	8 + 1.2	89+ 1.9	273.8+ 124 1	48+ 3.5	44+ 2.96	15± 4.3	107 + 6.96	4± 0.3	116.3+ 4.8
24	252.6± 15.9	3± 0.33	92.3± 1.1	7459.9+ 2066.5	10^5 ± 12.5	181+ 31.02	346± 7.2	632 ± 50.5	6± 0.88	123.6+ 5.5

± = SE

At 6-8 weeks of age, most of seminiferous tubules demonstrated a well developed lumina. The diameter of the seminiferous tubules was slightly increased reaching about 64. 3 Um in the testis of Fayoumi and 61.3 Um in Rhode Island breed (Fig. 13). The number of the seminiferous tubules per field was reduced in the testes of both breeds. The seminiferous tubule of the testis of Rhode Island chicken were lined by a single layer of cells; spermatogonia and Sertoli cells. Primary spermatocytes were increased in number in the seminiferous tubules of Fayoumi testis than those recorded at 4 week (Fig. 6).

With the advance in age, lumination of the testicular cords were completed at 12 weeks in Fayoumi cockerels, and at 16 weeks in Rhode Island red.

At 12 weeks of age, spermatogenesis in Fayoumi chicken was quite active, resulting in multilayered seminiferous epithelium (Fig. 6). Spermatogonia, primary and secondary spermatocytes as well as Sertoli cells were demonstrated among these epithelium. The mean nuclear cross-sectional area of Sertoli cells indicative of their metabolic activity was greatly increased than that observed in the previous ages. They were about 105.8 Um^2 in Fayoumi while those of Rhode Island were 76.5 Um^2. The peritubular cells were reduced to a single layer of flattened cells. The absolute volume density of the seminiferous tubules of Fayoumi breed was greatly increased than that observed in the previous age. They were about 208.5 mm^3 of the total testicular volume (Table 4). The germinal epithelium of the seminiferous tubules of the Rhode Island breed was formed of a single layer of spermatogonia and Sertoli cells. Primary spermatocytes were occasionally demonstrated in some tubules (Fig. 8). The lumina of some tubules was bounded by ragged fringes of cytoplasm. The total number of germ cells was higher in Fayoumi (51) than Rhode Island breed (35).

At 16 weeks of age the diameter of the seminiferous tubules in the testis of Fayoumi cockerels was markedly increased and reached 184.7 microns. The total number of germ cells per tubule was increased in the testis of Fayoumi cockerels at 16 weeks of age (374) (Table 4 and Fig. 14) and the seminiferous tubules were lined by multilayered germinal epithelium. It was characterized by the first appearance of spermatids and immature sperms (Fig. 9). The Sertoli nulcear cross-setional area was about 125.7 Um^3. In Rhode Island, however, the diameter of the seminiferous tubules was greatly smaller (71.4 Um) than those observed in Fayoumi cockerels (Fig. 13). The seminiferous epithelium was formed mainly of spermatogonia and Sertoli cells (Fig. 10). Leptotene, zygotene and pachytene stages of the prophase primary spermatocytes were less frequently demonstrated. The total number of germ cells per tubule (45, cells) was much less than those recorded for Fayoumi breed. The number of Sertoli cells appeared to be similar in both breeds (Tables 4, 5), however, their mean nuclear cross sectional area indicative of their metabolic activity was lower in the Rhode Island than in Fayoumi cockerels (Tables 4,5 and Fig. 15). Mature sperms were demonstrated in the lumina of the seminiferous tubules as well as in the epididymis of the Fayoumi cockerels at 20 weeks of age (Fig. 11) and 24 weeks age in the Rhode Island breed (Fig. 12).

LEGEND

Fig. (1): Testicular growth of Fayoumi and Rhode Island Red chickens at different age.

Fig. (2): One day old tesis of Fayoumi chicken showing: Seminfierous cord (A) (Semithin section Toluidine blue stain, X 1000).

Fig. (3): One day testis of Fayoumi chicken demonstrating abundant intertubular connective tissue (arrow). (PAS-haematoxylin stain X 1000).

Fig. (4): Seminiferous tubule of one day old testis of Rhode Island chicken demonstrating spermatogonia (R) and Sertoli cells (S). (PAS-haematoxylin stain X 1000).

Fig. (5): One week old testis of Fayoumi chicken demonstrating the seminiferous tubules joined with each other and form a network. Notice abundant intertubular tissue (A), narrow lumin of the seminiferous tubules. (PAS-haematoxylin stain, X 160).

Fig. (6): Eight weeks old testis ofFayoumi chicken showing the appearance of primary spermatocyte in the seminiferous epithelium. (Haematoxylin and eosin stain, X 250).

Fig. (7): Twelve weeks old testis of Fayoumi cockerels demonstrating multilayered seminiferous epithelium. (PAS-haematoxylin stain, X 400).

Fig. (8): Twelve-weeks old testis of Rhode Island chicken demonstrating seminiferous tubules with narrow lumens. Notice: **a-** Spermatogonium (M), **b-** Primary spermatocytes (S), **c-** Sertoli cell nucleus (N), **d-** Peritubular cells (P). (Haemotoxylin and eosin stain, X 400).

Fig. (9): Seminiferous epith of sixteen weeks old testis of Fayoumi cockerels showing a complete spermatogenic activity up to the stage of immature sperms. (Semithin section, toluidine blue stain, X 1000).

Fig.(10): Sixteen weeks old testis of Rhode Island cockerels showing a single layer of seminiferous epithelium. (PAS, haematoxylin stain, X 400).

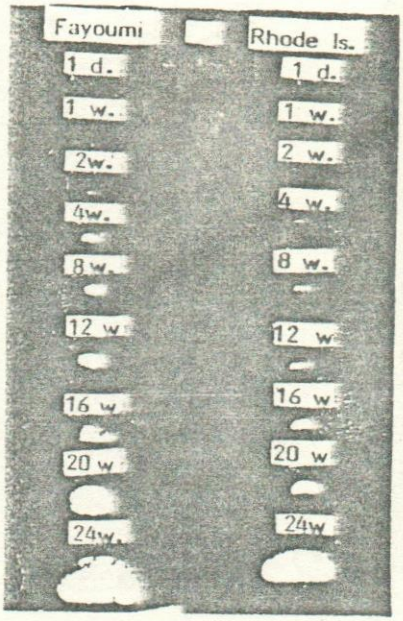
Fig.(11): Seminiferous epithelium of twenty weeks old testis of Fayoumi cockerels showing immature sperms attached to the Sertoli cells. (PAS-haematoxylin stain, X 1000).

Fig.(12): Seminiferous epithelium of twenty four weeks age of Rhode Island cockerels showing spermatogenic activity up to the stage of immature sperms. (Haematoxylin and eosin stain, X 1000).

Fig.(13): Relation between age and diameter ofthe seminiferous tubules in both Fayoumi and Rhode Islant chickens.

Fig.(14): Relation between the total number of germ cells and age in both Fayoumi and Rhode Island chicken.

Fig.(15): Nuclear cross sectional area of Sertoli cells in the testis of Fayoumi and Rhode Island chicken at different age groups.



Is.= Island

d.= day

w.= week

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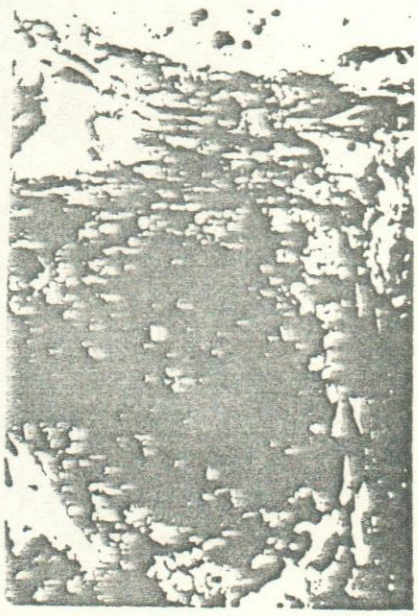

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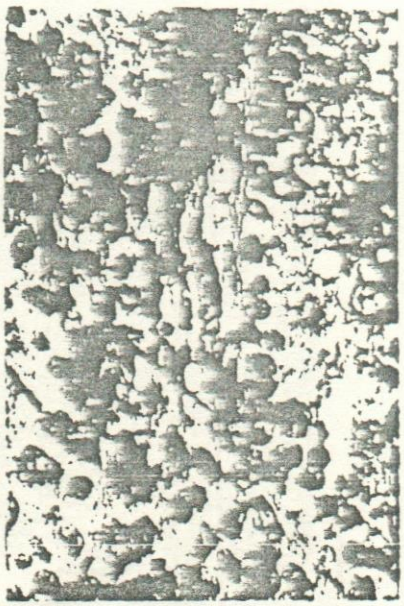

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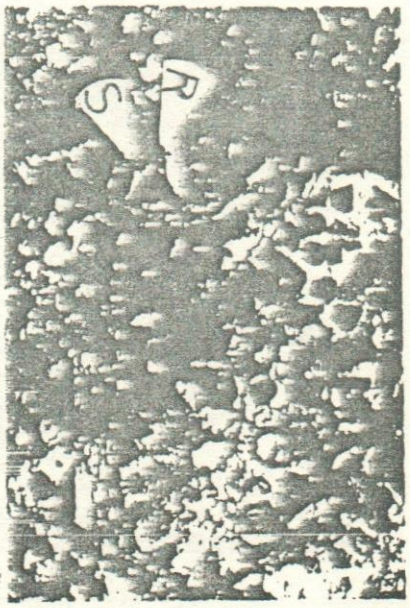

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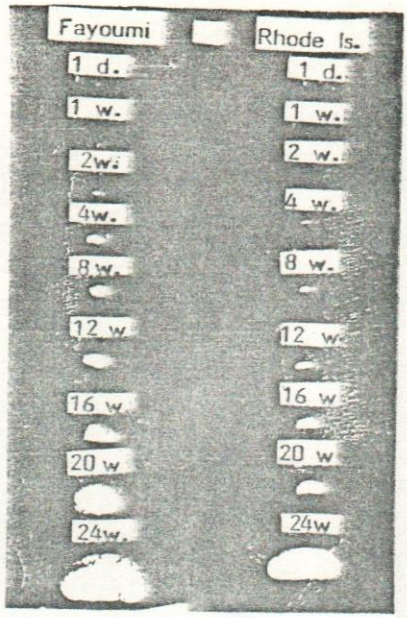
d.= day

w.= week



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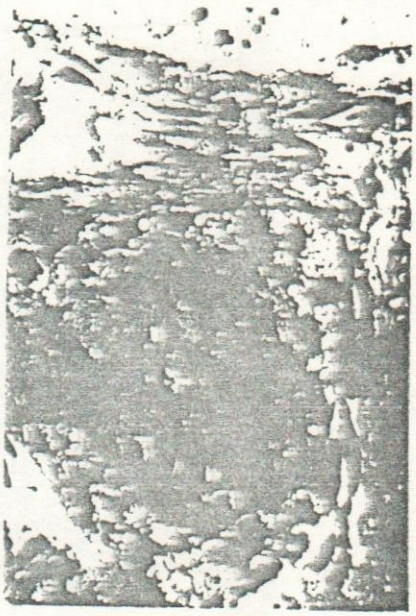

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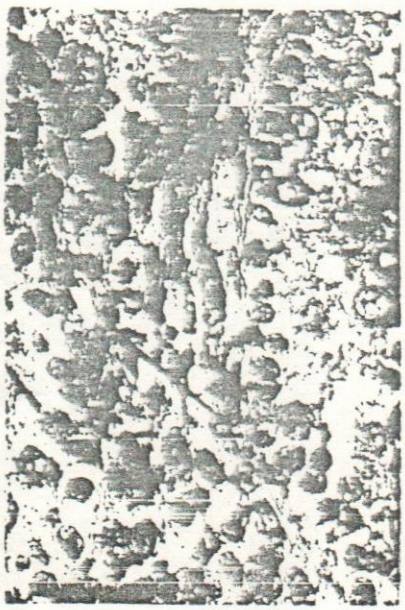

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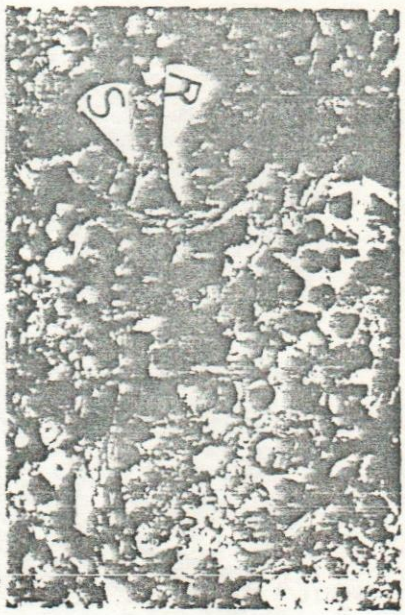

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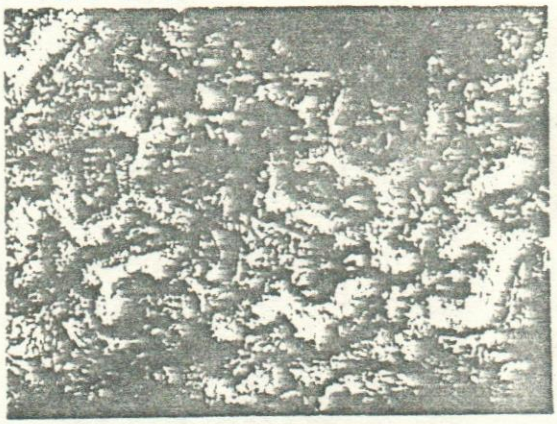
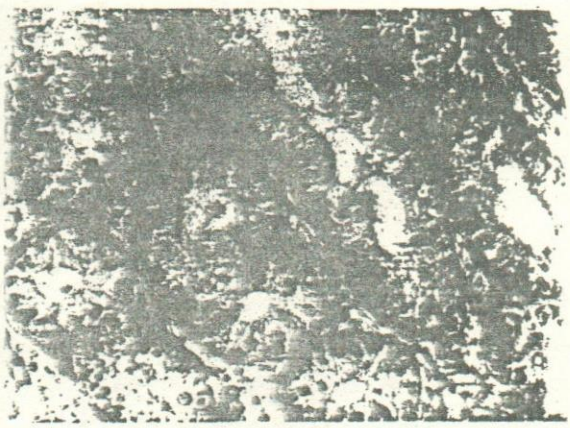
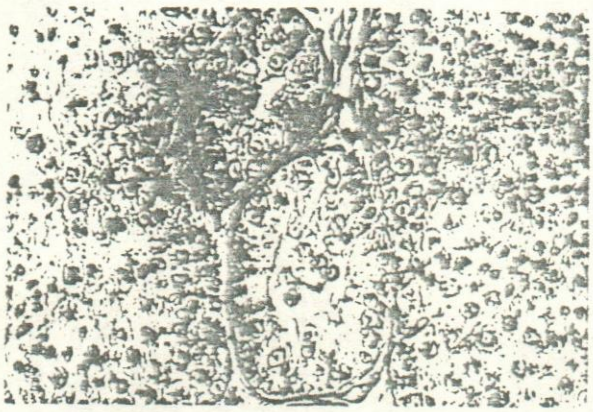
Fig(5)





Fig(6)



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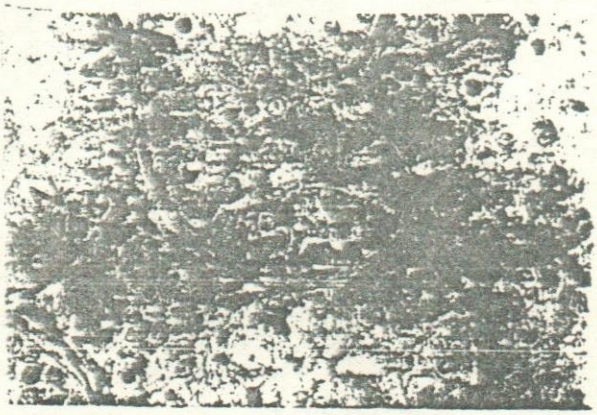
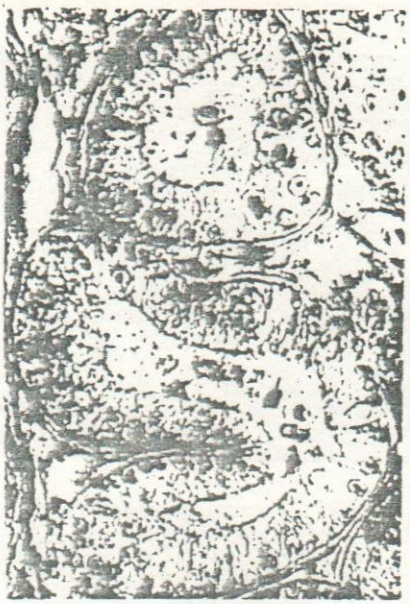
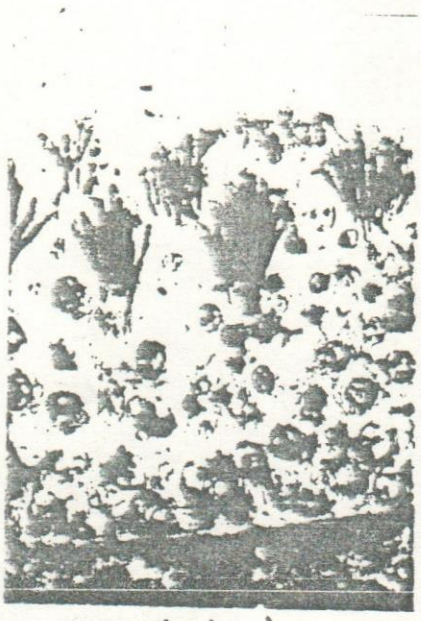


Fig(8)

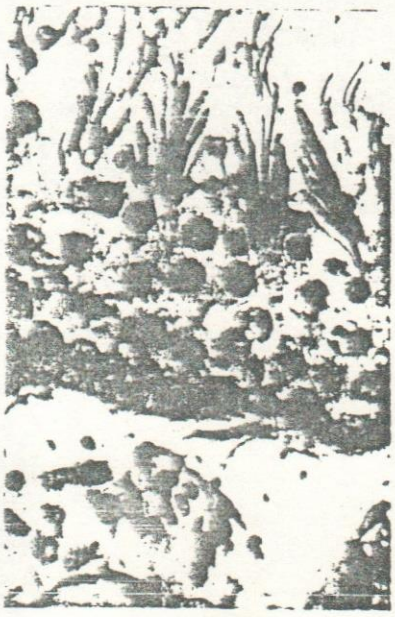
Fig(9)



Fig(10)



Fig(11)



Fig(12)

Relation between age & diameter of S.T.

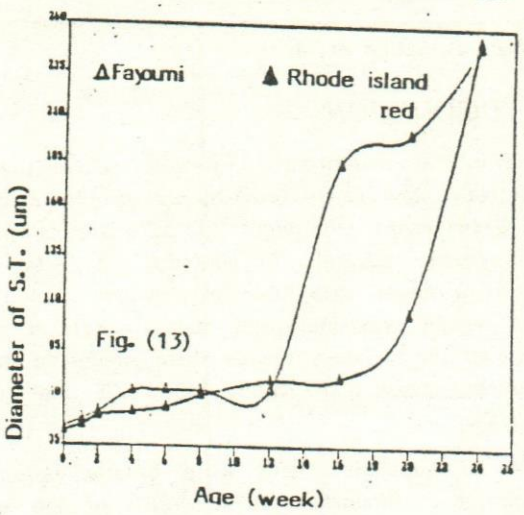


Fig. (13)

Relation between total No of germ cells and age

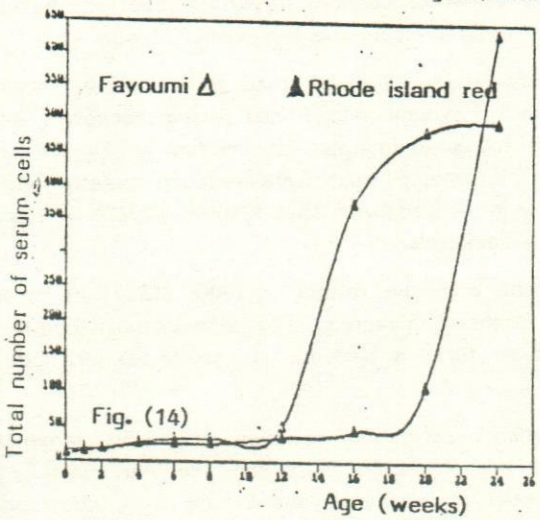


Fig. (14)

Nuclear cross sectional area of Sertoli cells

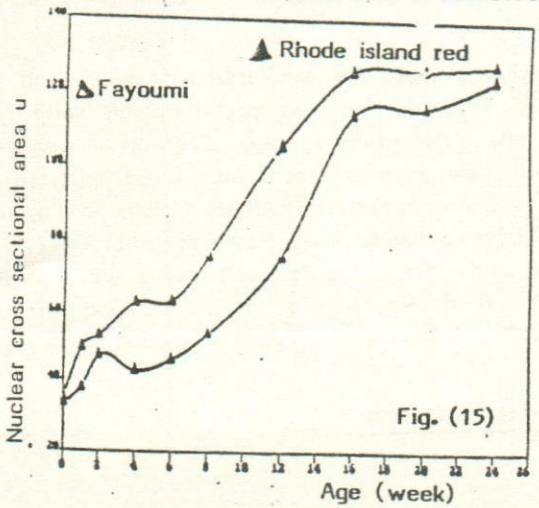


Fig. (15)

DISCUSSION

Considering the data obtained in the present study, it was evident that in both breeds there was a period of relatively slow testis growth; up to 12 weeks of age. However, the following 4 weeks (12-16 weeks old) were characterized by pronounced changes in the testis weight of Fayoumi cockerels. In contrast the testis of Rhode Island cockerels continue to grow at a lower rate than in Fayoumi cockerels. From 16-24 weeks age, the mean testis weight was increased approximately three-fold in Fayoumi and only by one fold in Rhode Island. These results were similar to the growth curve of white leghorn and Hampshire cockerels (PARKER; MCKENZIE and KEMPSTER, 1942) and Dokki-4 fowl (SALLAM, 1979).

The dimensions of the testes of Fayoumi breeds were greatly increased from the 16th week of age. In comparison their dimensions at 16 weeks of age were approximately similar to those of the Rhode Island cockerels at 24 weeks of age. However, MURAVAN (1969) in white Leghorn cockerels reported that the dimensions of the testes were increased intensively from the 9th weeks of age.

The present study revealed that the diameter of the seminiferous tubules in the testes of both Fayoumi and Rhode Island cockerels increased from 44 micron at one day of age to approximately 250 micron at 24 weeks age. Thus the number of the tubules per microscopic field were reduced greatly with the advancement of age. These results are in accord with that KAMAR (1960) in Fayoumi cockerels and SALLAM (1979) in Dokki-4 cockerels.

In agreement with the results of LAKE (1957) in Brown cockerels and MURAVAN (1969) in white leghorn cockerels. The seminiferous tubules branched and anastomosed with each other to form a network in the testes of both Fayoumi and Rhode Island Red.

The present investigation revealed that the seminiferous tubules of one day testis in both breeds appeared as a solid cellular mass or small tubules with narrow lumina. At 12 weeks of weeks of age lumina were observed in all the examined testis in Fayoumi chickens, while in Rhode Island chickens at 16 weeks of age. In ageneral these results are similar consider to those obtained by KAMAR (1960) and SALLAM (1979).

The present finding revealed that the seminiferous tubules and cords in the testis of both breeds from one day to 8 weeks post-hatching were formed mainly of spermatogonia and Sertoli cells arranged in a single layer on a well developed PAS positive membrane. These results are in accordance with those reported by WILLIAMS (1958) in single combe white Leghorn cockerels; KAMAR (1960) in Fayoumi cockerels; COOKSEY and ROTHWELL (1973) in domestic fowl. However, SALLAM (1979) mentioned that in Dokki-4 chickens the seminiferous tubules and cords were identical to that reported in mammals, being formed of two types of cells, small undifferentiated supporting cells and large gonocytes. The latter author added that the gonocytes disappeared

completely from the seminiferous cords at 8-12 weeks and the small cells were differentiated into spermatogonia and Sertoli cells.

The mitotic activity which observed among the spermatogonial cells in both breeds, was more pronounced from 1-2 weeks of age. These results are in agreement with MATHER and WILSEN (1964) in Japanese quail during the first 15-22 days of age. However, KAMAR (1960) and SALLAM (1979) in Fayoumi and Dokki-4 cockerels respectively were not able to demonstrate mitotic activity among the spermatogonial cells during the first month of posthatching development.

Similar to what was observed in Dokki-4 chickens by SALLAM (1979), the seminiferous tubules and cords in the testis of both breeds were surrounded by two or three layers of elongated peritubular cells. In adult fowl, ROTHWELL and TINGARI (1974) by using electron microscope, they described two types of peritubular; an inner fibroblast-like cells and an outer myoid cells.

The present study indicated that the Fayoumi chickens reached sexual maturity at earlier ages than Rhode Island chickens. At 16 weeks age the seminiferous tubules in the testis of Fayoumi breed were lined by well developed multilayered germinal epithelium with the first appearance of spermatids and immature sperms. However, at the same age, the seminiferous tubules in the testis of Rhode Island were formed only of spermatogonia and Sertoli cells.

Sexual maturity varied according to the breed, locality, management and nutrition. HOGUE and SCHNETZLER (1937) studied the fertility in Barred Plymouth Rock cockerels. Their studies based upon histological examination of the testes and individual mating. They reported that males reached sexual maturity as early as 16 weeks of age. However in pen mating a satisfactory level of fertility was not observed until 26 weeks of age.

In agreement with NISTAL ABAURREA and PANIAQUA (1982) the number of Sertoli cells per tubule in the testis of both breeds was not altered with the advance of age. However, their mean nuclear cross-sectional area indicative of their metabolic activities (GAYTAN and AGUILAR, 1987) was gradually increased from one day old to reach its maximal value at 24 weeks age.

JONES and LAMOREUX (1942), studied the sexual maturity in the testes of two strains of white leghorn, one of high and the other of low egg production. They reported that at 8-24 weeks of age, there were more spermatozoa in the seminiferous tubules of the testis in males of high fecundity strain. SALLAM (1979) reported that the Dokki-4 breed reached the age of sexual maturity at 20-24 weeks of age.

At 20 weeks age the seminiferous epithelium of the testis of Fayoumi cockerels showed active spermatogenesis. Mature sperms were demonstrated in the lumen. KAMAR (1960) reported similar results in the testis of 20 weeks old Fayoumi cockerels. In contrast to the testis of Fayoumi cockerels, the seminiferous tubules in the testis of the Rhode Island cockerels showed an active spermatogenesis at 24 weeks old cockerels.

The tubular spermatogenesis of the avian testis is quite similar to that in mammals (CLERMONT, 1958), thus endocrine control of spermatogenesis in birds may also be similar. The exogenous avian FSH when injected into hypophysectomized quail or young chickens (BROWN et al., 1975) induce Sertoli cell hypertrophy and germ cell development. ISHII (1977) has characterized the FSH-receptors in the avian testis but whether they are confined only to the Sertoli cells has not yet been established.

In conclusion, the Fayoumi cockerels reached sexual maturity earlier than the Rhode Island one. In addition, the higher proportion of germ cells may indicate the relatively higher degree of fertility in Fayoumi than Rhode Island Red cockerels.

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