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The Effect of Artificial Light Treatment on Growth of Gonads and Endocrines of Fayoumi Chicks

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A TOTAL number of 708 day- old Fayoumi chicks were used to test the effect of extra light treatment of their rate of growth and endocrine glands development. The chicks were divided into two equal groups. One group was kept under natural day - light conditions. The other group received extra artificial light to extend the day-light gradually to 14 hr with steps of 15 min increment weekly.

The light treatment accelerated the growth rate equally in males and females. The body weight at 12 weeks was 350 and 319 g in the control group for the males and females while the treated group reached 435 and 387 g respectively, or more than 20% increase .

Researches on the effect of light on growth in chicks have dealt mainly with broiler strains and the results are some what conflicting. According to the work done by Mueller *et al.* (1951) on advantage in growth was achieved by using artificial light. However, Beane *et al.* (1962) and Siegel *et al.* (1963) proved beneficial growth effects when practising artificial light.

Some investigators recommended the application of almost continuous light (Moore, 1957 and Shultz *et al.*, 1959). Meanwhile, Cherry and Barwick (1962) recommended an alternating pattern consisting of a long light period and short (2 hr) dark period. Moreover, Kamar (1963) concluded that splitting of the long nights by 2 hr artificial lighting improved growth rate and increased body weight among Fayoumi chicks until 26 weeks of age. Improvement in growth rate was quite pronounced when light treatment was applied after the season of the shorter days. Besides, the females were more responsive artificial lighting than the males.

Recent studies conducted by Weaver and Siegel (1968) confirm the opinion that continuous light from hatch till 56 days of age resulted in body weight incre ments over than the control or when applying a period of darkness.

The aim of this work was to find out the effect of artificial lighting on the rate of growth of the naturally slow growing chicks of the Egyptian native breed "Fayoumi".

Material and Methods

The work was executed in the Poultry Research Station of the Faculty of Agriculture, Cairo University, Egypt.

A total number of 708 day-old chicks hatched on 7, April 1968 were available. They were divided into two groups. On group was kept under natural conditions as control while the other received artificial lighting. The control group comprised 108 and 147 females, the treated goup contained 248 males and 205 females. The birds were individually weight to the nearest 5 g at two weeks intervals starting from day-old hatched chicks till 12 weeks of age. At 12 weeks of age, 10 females from each group were slaughtered and the thyroids, adrenals, pituitaries, thymus, ovaries and oviducts were dissected out and weighed to the nearest mg. The tests of 10 individuals of each group was also weighed at this age.

The pens of the treated groups were artificially illuminated by 160 watt incandescent bulbs with a reflector located in the centre of the ceiling approximately 7 feet above the floor level. Automatic devices were used to switch the light on, at the fixed time according to the design of the experiment. The lighting regimes used in the experiment was gradually increase in the daily light-length by artificial illumination, at sun-set, on the basis of 15 min weekly increments to attain 14 hr of both natural and artificial light daily, the day-light length in Cairo during April is 12, 54 hr, then this level remained constant to the end of the experiment.

Result and Discussion

Body weight

Exposing chicks to gradual increase in day-length resulted in body weight increment over that of the control. The growth rate of both males and females increased by extending day-length (Table 1). On the average, the percentage increase in treated males and females over the control was 17% and 21% at 4 weeks of age to 24% and 21% at 12weeks of age, with a peak of 31% and 32% respectively at 8 weeks of age. Analysis of variance, "F" value, proved the significant effect of light treatment after four weeks, also the sexes varied significantly in their reaction to lighting (Table 1).

Endocrine glands

Adrenal, thyroid and thymus glands weighed higher in the treated group than the control, whereas, the pituitary gland was smaller in the treated than in the control group. The percentage increases in adrenal, thyroid and thymus weight due to light treatment were 30%, 151% and 178% respectively (Table 2).

TABLE 1. Effect of light treatment on body weight in male and female Fayoumi chicks at successive weeks of age.

Age in weeks	Body weight (g) Illuminated		control		% increase due to light treatment		"F" value	
	Male	Female	Male	Female	Male	Female	Treatment	Sex
Hatch	29.7+ 20-39ϕ	29.6 22-38	27.3 20-34	26.9 21-34	9	10		
2	51.3 35-75	50.3 30-65	53.2 30-80	49.7 35-70	4	1		
4	105.4 55-160	97.9 50-155	89.4 45-115	80.9 45-130	17	21	55.03**	22.26**
6	183.3 75-275	164.7 90-255	153.8 70-240	136.9 65-250	19	20		
8	274.8 115-385	248.5 110-340	210.0 110-310	188.2 80-330	31	32	268.14**	68.93**
10	343.7 145-560	311.2 150-485	272.6 125-440	245.1 115-410	26	27		
12	434.8 155-360	386.8 165-580	350.2 135-580	318.6 130-540	24	21	127.26**	54.18**

+ = Mean value
ϕ = Range
** = Significant effect at 0.01

TABLE 2. Effect of light treatment on the absolute (mg) and relative (mg / 100 g) weights of the different endocrine glands in twelve weeks old Fayoumi chicks.

Glands	Weight of glands: Illuminated		Control		% variation due to light treatment
	Absolute	Relative	Absolute	Relative	
Adrenal . .	60.5+ 47-90 ϕ	11.8 8.1-15.8	46.4 30-65	15-2 8.8-22.5	30
Thyroid . .	37.6 25-85	7.4 4.0-17.5	15.0 5-25	4.7 2.5-7.7	151
Thymus	3045.0 1000-4100	568.8 235.3-689.7	1094.4 650-1500	363.5 178.1-500	178
Pituitary	7.0 5-12	1.4 0.8-2.2	8.77 3-14	2.9 1-5.5	-20

+ Mean value ϕ Range

It is interesting to notice that those glands related directly with growth, thymus and thyroid, were highly enlarged by light treatment. Kleinpeter and Miner (1947) indicated birds showed thyroid stimulated activity by added light. D'Angelo (1963) and Critchlow (1963) concluded that ill umination may influence thyroid activity, but the precise pathway, receptors and their mechanisms through which the light acts to stimulate thyroid activity are not known. Also, the exact function of the thymus gland is still obscure (Hohn, 1961).

Ovary, oviduct and testes

Although absolute ovary and oviduct weights of the treated group were larger than the control, the relative weights (mg ovary and oviduct weight to 100 g body weight) were nearly the same for both groups. This means that the increase in their growth is not a special effect depending on light treatment or on related endocrines, but it may be due to the effect on general growth of body tissues. On the other hand, testes weight showed negative response to light treatment, they were smaller in weight in the treated group than in the control (Table 3). This reduction in the rate of growth in tests may be a secondary effect to the reduction in the pituitary rate of growth or to great increase in cortical hormones and thyroid hormones. According to Kumeran and Turner (1949), and Marshall (1961), both adrenal and thyroid hormones reduce the secretion of gonadotrophins in birds. Marshall (1961) added that thyroid hormone is required for normal growth, but excessive thyroid hormone resulted in gonadal and gonadotrophines depression particularly in chickens. However, this age, is 12 weeks, were relatively young to test the effect of light on testes, or ovary growth as testes always mature sexually at not less than four months (Kamar, 1960). Also, ovaries may not initiate any sexual activity before four months (Hafez and Kamar, 1955). In general, it can be stated that until three months of no sexual activity was initiated either in males or females, as far as testes and ovary growth was concerned.

TABLE 3. **Effect of light treatment, on the sbsolute (mg) and relative (mg/100 g) weights of the ovary, oviduct and testes in Fayoumi chicks at twelve weeks of age**

Organs	Weight of organs				%Variation due to light treatment
	Alluminated		Control		
	Absolute	Relative	Absolute	Relative	
Ovary . . .	241.5+ 155-290ϕ	46.6 33-60.5	144.0 75-232	45.6 36.2-56.9	68
Oviduct . .	121.0 85-165	23.2 13.1-31.8	75.7 37-125	24.0 17.5-34.7	60
Testes . . .	445.5 200.1300	72.4 33.3-194	1265.0 250-5300	284.9 38.1-1420.9	-65

\+ Mean value ϕ Range

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تأثير الاضاءة الصناعية على النمو والغدد التناسلية والصماء فى الدجاج

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استخدمت ٧٠٨ كتكوت فيومى عمر يوم لاختبار تأثير المعامله بضوء اضافى على سرعة النمو وتطور الغدد الصماء • قسمت الكتاكيت الى قسمين متساويين وضعت احدى المجموعتين تحت الظروف الطبيعية لضوء النهار ، وعرضت المجموعة الأخرى لضوء صناعى لاطالة ضوء النهار تدريجيا ليصل الى ١٤ ساعة بزيادة ١٥ دقيقة أسبوعيا •

زادت سرعة النمو بمعاملة الضوء بالتساوى لكلا من الاناث والذكور وكان الوزن الحى عند العمر ١٢ أسبوعا ٣٥٠ ، ٣١٩ جم فى مجموعة المقارنة لكلا من الذكور والاناث • بينما المجموعة التى عوملت وصل وزنها الى ٣٨٧ر٤٣٥ جم أى أكثر من ٢٠٪ زيادة •

وبالنسبة للغدد الدرقية والتيموسية وفوق الكلية ظهرت زيادة واضحة فى الوزن نتيجة لمعاملة الضوء بينما أظهرت الغدة النخامية انخفاضا فى الوزن •

زاد وزن المبيض وقناة المبيض لمعاملة الضوء مع زيادة وزن الجسم ، ولذلك فان الزيادة النسبية لوزن الجسم لم تتأثر •