

Effect of Different Artificial Light Regimes on Sexual Maturity in the Fayoumi Fowl

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THIS WORK comprised 200 female Fayoumi pullets divided into 4 groups of 50 individuals. Three groups received different regimes of artificial illumination ; the fourth control group had only the natural day-light. The light regimes were from hatch to sexual maturity, from 3 months of age to sexual maturity and from hatch to three months of age the daily period of artificial illumination increased by 15 min at weekly intervals to complete the natural day-light up to 14 hr, up to the end of experiment.

The light application caused earlier sexual maturity with greater effect in the group receiving light since hatching.

The body weight, the ovary and oviduct weights and the first egg weight were all reduced due to light application. The reduction was greater in case of light application up to sexual maturity.

The total number of ovarian follicles was also reduced specially by prolonged light application. The size of the follicles did not show differential response.

Many authors have reported that the age of fowls at first egg laying is affected by the day-light length. The rate of pullets maturation is directly proportional to the rate of change in day-length during the growing stage (Morris and Fox, 1960). Restriction of daily light period to 6 hr during the growing stage retarded age at sexual maturity (Bowman *et al.*, 1966; Lowe and Heywang, 1954; Lillie and Denton, 1955). Davis *et al.* (1964) concluded that the age at sexual maturity was about the same for all pullets receiving 12 hr of darkness during the growing stage regardless of the length of light cycles. The authors staged that the dark period was the stimulating factor during the growing stage.

Gradual decrease in the quantity of light per day from 22 to 13 hr a 0 to 20 weeks of age delayed sexual maturity (McClary, 1960). On the other hand, increasing day-length during the growing stage hastened sexual maturity (Lowe and Heywang, 1964). Providing light for growing pullets in 2, 4 and 6 periods per day hastened sexual maturity over those receiving the same amount of light in one period (King, 1961). Wilson *et al.* (1962) also stated that increasing the day-light in alternating phases of 8 hr light and 3 hr darkness reduced age at sexual maturity.

This work was planned to test the reaction of the Egyptian native Fayoumi fowls to artificial lighting. Hastening sexual maturity by artificial light treatment may add further privilege to this naturally early maturing breed.

Material and Methods

This study was carried out in the Poultry research of the Faculty of Agriculture, Cairo University in Egypt.

This study comprised four groups of 50 female Fayoumi pullets. One group was exposed to supplementary artificial light up to the age of sexual maturity (Group I). The second group was subjected to light from 3 months of age to the onset of puberty (Group II). The third group received artificial light up to 3 months of age only (Group III). The fourth group was kept as untreated control group under the natural day-light (Group IV) during the spring season.

Each pen (5x5 m) of the treated groups was lighted by a 60 watt incandescent lamp with a reflector placed at 7 feet above the floor. The lighting started at sun set for a period of 15 min daily in the first week of light application for each group. The lighting period was increased by 15 min daily through the successive weeks to extend the allover daylight length to 14 hr daily which remained constant at this level till the sexual maturity was acquired.

The age at sexual maturity, first egg laying ; the body weight at this age and the first egg weight were recorded for each individual fowl within the four groups.

The first and the last ten maturing hens in each group were dissected, their ovaries and oviducts were weighed. The ovarian follicles were counted into three classes ; initiation 0.1-0.2 cm first period of growth 0.3-0.9 cm ; and second period of growth over 1 diameter.

Results and Discussion

The extension of day length by artificial gradually-increasing lighting reduced age, body weight and first egg weight at sexual maturity. Between the groups the one which received light treatment from hatch till sexual maturity (Group I) showed the youngest age at sexual maturity compared to that treated from three months of age (Group II) or that treated till three months of age (Group III) which showed approximately the same age (Table 1). Previous studies in other fowl breeds also revealed that the subjection of pullets to gradual artificial illumination produced rapid sexual maturity (Walther and Newell, 1962 and Lowe and Heywang, 1964). Statistical analysis proved highly significant difference (at 0.01) between any light treated group and the

control one. Also Group I varied significantly from both groups II and III. By this light treatment we could gain one month advance in sexual maturity and egg production.

Light treatment seems to have no effect on body weight at sexual maturity and the first egg weight unless it occurs close to the age of sexual maturity. This was the case in Group I, and Group II. On the other hand, Group III, did not differ significantly in these characters from that of the control (Table 1). The attainment of sexual maturity at early ages coincided with lighter body and first egg weights (Morris, 1962 and Kamar, 1967). In general it could be concluded that the increase in day-length either naturally or artificially caused the birds to mature sexually earlier.

TABLE. 1 Effect of artificial illumination on age, body weight and first egg weight at sexual maturity in Fayoumi fowls.

Items	Light treatment groups				“F” value between groups
	I	II	III	IV	
Age (days)					
Mean±S.E.	193.5±1.6	208.1±1.6	209.7±2.2	228.5±2.3	54.03**
Range	171-205	188-221	173-232	193-245	
Body weight (g)					
Mean± S.E.	1175.1±26.2	1152.5±22.5	1245.2±22.5	1260.3±27.7	5.76 **
Range	825-1500	875-1450	1025-1600	925-1615	
First egg Weight (g)					
Mean±S. E.	33.1±0.5	34.2.±0.6	35.7±0.5	37.0±0.6	9.59**
Range	25-38	25-43	29-42	30-45	

Significant at	0.01	
L.S.D. value at	0.05	0.01
Age (days)	5.43	7.17
Body weight (g)	65.72	91.41
First egg weight (g)	1.52	2.03

TABLE 2. Effect of different light treatments on the weights (g) of ovary and oviduct at sexual maturity (early and late) in Fayoumi fowls.

Light treatment groups	Ovary g		Oviduct g	
	Early	Late	Early	Late
I	26.9 23.1-34.8	12.8 0.2-25.0	29.9 14.9-34.3	13.0 0.6-32.3
II	21.5 14.0-27.0	15.6 5.9-29.5	25.1 8.7-33.3	12.6 1.6-39.0
III	27.4 19.3-34.5	19.0 0.6-31.9	34.4 25.2-45.4	14.0 0.9-28.2
IV	28.4 19.4-42.4	19.3 0.5-41.4	32.3 22.4-44.7	17.4 1.0-39.0

TABLE 3. Effect of different light treatments on the average total number of ovarian follicles and the grown follicles (1-3 cm in diameter) in the early and late sexually matured Fayoumi fowls.

Light treatment groups	Total number of ovarian follicles per fowl		Number of grown follicles over 1 cm/ per fowl	
	Early	Late	Early	Late
I	86	127	4	2
II	176	99	4	2
III	218	81	4	3
IV	168	118	4	3

TABLE 4. Percentage of different size maturation and ovarian follicles due to the effect of different light treatments in the early and late sexually matured Fayoumi fowls

Light treatment Groups	% of follicles per fowl					
	Initiation 0.1-0.2 cm		First period of growth 0.3-0.9mc		Second period of growth over 1 cm.	
	Early	Late	Early	Late	Early	Late
I	73	82	22	16	5	2
II	80	68	18	30	2	2
III	80	66	18	31	2	3
IV	73	73	25	25	3	2

This effect was reflected also on the reproductive system, the ovary and oviduct. The two groups receiving light till sexual maturity (I and II) showed the least weight of ovary and oviduct (Table 2). The control had the highest weight. This picture was exactly the same in late early ten maturing ones. It is interesting notice from Table that the early maturing hens had ovaries double in weight and oviducts of 50% more weight to that of the late maturing hens.

The present work shows clearly the antagonism between the somatic maturity and the sexual maturity especially in the period of age just prior to puberty. The light stimulating the production of gonadotrophins of the pituitary (Romanoff and Romanoff, 1949; Donovan and Harris, 1960; Yeates, 1954; Amoroso and Marchall, 1960; Van Tienhoven, 1961 and Critchlow, 1963), hastens the sexual maturity at earlier age and lighter weight of both the whole body and reproductive organs. On the other hand, these hormones may check the effect of hormones engaged in somatic maturity specially the growth hormone. It is clear from Tables and that some individual in each treated group showed great persistancy in growth in the expence of retarding sexual maturity

Further work was excuted to find out the effect of light treatment on the follicle number and size in the ovaries (Table 3 and 4). Groups I and II illuminated to sexual maturity, showed the least number of follicles in the early maturing hens. This seems to be a time factor not direct effect of light since Group I, the earliest maturing group (171 days), showed a very low value. less than half of any other group (Fig. 1). This could be ascertained by the highest value of follicle number in the late maturing individuals (205 days) in the same group (Croup 1). It ought to be noted that this group is the one exposed to prolonged light treatment. Bonadonna (1958), and Critchlow (1963), stated that prolonged light treatment results in the reduction of follicles number. The size of the follicles did not show clear cut nifference (Table 4). The largest follicle-over 1cm diameter had the same number in all groups, 4 follicles in early maturing individuals and 2 follicles in the late maturing ones.

Does this effect of light inhancing sexual maturity - a favourable economic character - will be of a subsequent unfavourable effect on the egg production capacity since it reduces body weight, weight, of ovary and oviduct, number of follicles and first egg weight ? This question has to be answered by following up the production for one or two years.

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تأثير نظم الاضاءة الصناعية على النضج الجنسي في الدجاج الفيومي

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شملت الدراسة مائتان من الدجاج الفيومي البدرى وقد قسمت الى ٤ مجاميع كل منها خمسون دجاجة وكان منها ٣ مجاميع معاملة بالاضاءة ومجموعة مقارنة . وكانت الاضاءة الصناعية من الفقس الى عمر النضج الجنسي ومن عمر ٣ شهور الى عمر النضج الجنسي ومن الفقس الى عمر ٣ شهور . وقد رفعت الاضاءة الصناعية بمعدل ١٥ دقيقة اسبوعيا لتكملة الاضاءة الطبيعية في ذلك الوقت الى ١٤ ساعة يوميا .

ووجد ان الاضاءة الصناعية قد ساعدت على التبيكر بالنضج الجنسي وكانت أبكر الدجاجات في النضج الجنسي هي التي اضى لها صناعيا من الفقس حتى النضج الجنسي . ولكن كان التبيكر في النضج الجنسي مصحوبا بنقص في وزن الجسم ووزن البيضة عند النضج الجنسي وكذلك نقص وزن قطر هذه البويضات بالاضاءة الصناعية .

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