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# Plasma LH in Chicks Subjected to Different Photoperiodic Treatments

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Four groups of one week old chicks were used to study the effect of photoperiodic treatments on plasma LH values and age of sexual maturity. Groups 1 and 2 were subjected to constant 14 L: 10D and 6 L : 18 D respectively from one week of age and thereafter. Groups 3 and4 experienced photoperiodic change of 6↑14 and14↓6. respectively in two equal steps at 5 and 7 weeks of age. Plasma LH values were slightly higher and the day of first age was slightly earlier under 14L : 10D than under 6L : 18D regimes. In contrast to 14↓6, 6↑14 treatments produced higher LH values and earlier sexual maturity. Light manipulations affect endogenous reproductive processes. No correlation existed between plasma LH values of the growing chicks and their subsequent rate of lay.

It is assumed that light stimulation is translated into measurable levels of gonadotrophins (*i.e.* LH) which increases during initiation of the gonadal growth. Plasma LH increases during the first week of age in both sexes. Thereafter levels of the hormone stabilized in males but fell over 1 or 2 weeks in females. Plasma LH levels during the period from 9 weeks until the onset of puberty are variable. Though the average concentrations remained relatively low from 9 weeks till 16 weeks of age. The hormone level increases before the onset of puberty and fell as the first egg was laid (Sharp 1973, 1974 and 1975 and Bonney, 1976). All the studies cited above were carried out on domestic fowls kept under constant 14 hr light and 10 hr dark (14L : 10 D). There are no reported studies on levels of circulating gonadotrophines in chickens under different combinations of light and dark. As radiommunassay for avian gonadotrophin (*i.e.* LH) is now available, thus it is of interest to investigate the effect of change in light regimes during the growing period on plasma LH and age of sexual maturity. Also one wonders whether there is any relationship between plasma LH values during growing period and the subsequant rate of lay.

## Material and Methods

One day-old white Leghorn chicks were used. The chicks were housed in light proof rearing separate rooms. The birds were transferred to light proof laying house at 18 weeks of age. The chicks were caged individually

in separate rooms. Commercial diet and water were offered ad-libtum. Birds were allocated randomly into equal groups (each of 24 chicks) and received the following photoperiodic treatments :

(1) 14 hr of light/10 hr of dark (141:10D) cycles were used throughout the experiment.

(2) 6 hr of light/ 18 hr of dark (6L : 18D) cycles were used throughout the experiment.

(3) 14L: 10D cycles were used till 5 weeks of age when the lighted period was decreased in two steps each of 4 hr at 5 and 7 weeks of age to become 6L : 18D cycles (14 6).

(4) 6L:18D cycles were used to 5 weeks of age and then the lighted period was increased in two steps each of 4 hr at 5 and 7 weeks of age to become 14:10D cycles (6 14).

Blood samples (one ml) were withdrawn from the wing veins into heparinizedl syringes every 15 days starting at one week of age till shortly before the sexuae maturity hetherto sampling continued every week till the oviposition of the first egg. Blood was collected twice (one ml + one m) from each bird at ond week of age only and once (one ml) thereafter. Blood collection was carrie out always within one hour beginning at the fifth hour after the onset of light which coincides with I100 hr of the solar day. Blood samples were centrifuged within 10 min at 2.700 r.p.m. for 15 min and then the plasma was separated and stored at -20° till assay. Plasma LH was estimated by radiommunoassay method according to Follett, Scanes and Cunningham (1972) with modification adopted by Abdelrazik (1977). Eggs oviposition were recorded automatically to the nearest minutes.

## Results

*Plasma LH*

Figure 1 shows the mean values of plasma LH concentrations of domestic pullets kept under different photoperiodic treatments during the period from 1 week of age to the oviposition of the first egg. The mean values of plasma LH were high during the first week of age and decreased slightly thereafter till shortly before sexual maturation. Plasma LH values were higher for pullets maintained under constant 14L.10D than for pullets maintained under constant 6L : 18D. The concentration of plasma LH in pullets subjected to photoperiodic cut off decreased and become lower than in pullets maintained under the constant photoperiodic treatments. The levels of plasma LH increased when the pullets were subjected to photoperiodic increase. Generally, plasma LH values, under all the photoperiodic treatments, LH values, under all the photoperiodic treatments, increased during a period of 2 to 4 weeks and then decreased immediately before the oviposition of the first egg.

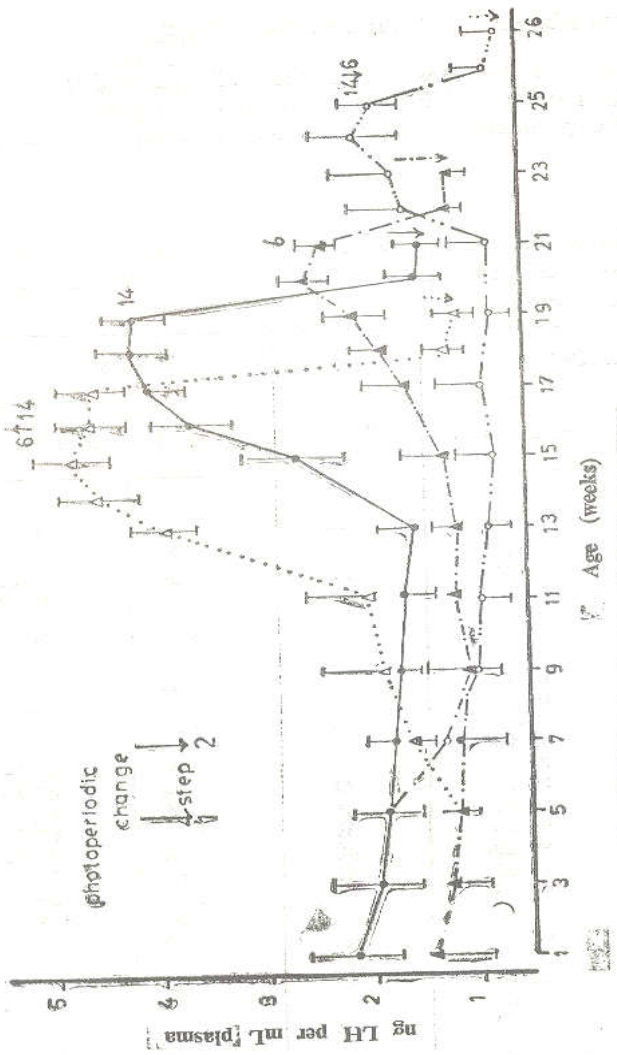


Fig. 1. Plasma luteinizing hormone concentrations in pullets maintained under different photoperiodic treatments from 1 to 26 weeks of age.

14 = a constant photoperiod of 14L:10D.
6 = a constant photoperiod of 6L:18D.
6↑14 = a change in photoperiod from 6L:18 D to 14L:10 D.
14↓6 = " " 14L:10 D to 6l : 8 D.
Vertical lines indicate ± S.e.m. Vertical arows indicate first oviposition.

*Age of laying the first egg*

Figure 1 shows the mean age of laying the first egg of pullets kept under different photoperiodic treatments. The age of laying the first egg was the earliest when pullets were kept under photoperiodic increase treatments and was the latest when pullets were kept under photoperiodic decrease treatments. The pullets which received constant 14L:10D treatments laid their first egg about 15 days earlier than the pullets which received constant 61 : 18D treatments.

*The relationship between plasma LH levels and rate of lay*

Table 1 shows plasma LH values at one week of age and the subsequent rate of lay of each individual bird maintained under constant photoperiod throughout the experiment. It is clear that individual variation is very remarkable.

TABLE 1. The relationship between base levels of plasma luteinizing hormone (LH) during the growing period and rate of lay of pullets maintained under two photoperiodic treatments.

| Pullet No. | 14L:10D | | Pullet No. | 6L:18D | |
|---|---|---|---|---|---|
| | ngLH/ml | Rated of Lay | | ngLH/ml | Rated of Lay |
| 1 | 3.89 | 98.29 | 25 | 1.70 | 75 |
| 2 | 2.37 | 64.29 | 26 | 1.27 | 89.29 |
| 3 | 3.85 | 89.29 | 27 | 1.30 | 82.14 |
| 4 | 2.08 | 96.43 | 28 | 0.57 | 75 |
| 5 | 0.73 | 85.71 | 29 | — | — |
| 6 | 0.44 | 60.71 | 30 | 0.37 | 67.86 |
| 7 | 2.08 | 85.71 | 31 | 0.63 | 78.57 |
| 8 | 0.64 | 85.71 | 32 | 0.44 | 67.86 |
| 9 | 3.81 | 100 | 33 | 1 | 78.57 |
| 10 | 3.40 | 92.86 | 34 | 0.54 | — |
| 11 | 2.27 | 75.00 | 35 | 0.53 | 75. |
| 12 | 2.17 | 82.14 | 36 | 1.20 | 82.14 |
| 13 | 3.25 | 89.29 | 37 | 1.44 | 67.86 |
| 14 | 1.51 | 96.43 | 38 | 1.50 | 82.14 |
| 15 | 2.98 | 92.86 | 39 | 1.47 | 05.71 |
| 16 | 2.63 | 89.29 | 40 | 2.66 | 78.57 |
| 17 | 4.13 | 85.71 | 41 | 1.67 | 78.57 |
| 18 | 3.51 | 92.85 | 42 | 1.97 | 82.14 |
| 19 | 2.49 | 92.85 | 43 | 1.99 | 78.57 |
| 20 | 1.89 | 82.14 | 44 | 1.65 | 78.57 |
| 21 | 3.25 | 60.71 | 45 | 1.95 | 89.29 |
| 22 | 3.70 | 82.14 | 46 | 1.45 | 82.14 |
| 23 | 3.44 | 92.85 | 47 | 3.52 | 85.71 |
| 24 | 2.15 | 89.29 | 48 | 1.92 | 67.86 |

Correlation coefficient ($r_1$) = 0.17 $r_2$ = 0.18

## Discussion

*The effect of photoperiodic treatments on plasma LH*

Plasma LH values in chicken received 14L: 10D coincide with values obtained by Bonney (1976). The long photoperiod stimulates slightly more LH

releases into the circulation than the short photoperiod. Similar trend is very much remarkable in canaries (Serinus canarius) (Nicholls, 1974), white crowned sparrows (Zonotrickia Leucophrys gambelii) (Follett, Farner and Mattocks (Jr) (1975) and quail (Coturnix conturnix Japonica) (Gledhill and Follett, 1976 and Follett, 1976).

Domestic pullet's sexual activity was delayed but reproductive activity was not totaly susppressed under short photoperiod as occurs in these wild birds. In contrast to short days long days illuminate the photoinducable phase of these photic dependent wild birds (Follett, 1973) and then more the reproductive processes become active. In domestic pullets, since small differences in plasma LH values were noticed between the effect of constant 14L:10D and 6L:18D treatments then the effects of photoperiodic change is appreciated.

The increments of pullets plasma LH values during three weeks before the oviposition of the first egg agree with results reported earlier by Bonney, Cunningham and Furr (1974), Sharp (1975) and Bonney (1976). This prepubertal peak accompanies the rapid phase of follicular growth (Gilbert, 1971) and may be essential for sexual maturation. The fall of plasma LH immediately before the oviposition of the first egg may be due to the feed back effect of gonadal steroids of the rapidly growing follicles (Furr, 1969, 1973 and Shahabi, Norton and Nalbandov, 1975). The most earliest prepubertal LH peak was achieved by 6↑14 photoperiodic treatment which means that the pronounced effect may be due to photic change treatments. The increasement of plasma LH values under 6↑14 over those under constant 14L:10D treatments and the decrement of plasma LH under 14↓6 below those under constant 61:18D treatments indicated that the greatest responses depend on the photic change.

*The effects of photoperiodic treatments on sexual maturity*

The earlier age of oviposition of the first egg under 14L:10D than under 6L:18D was noticed also by King ( 1961 ) Siegel, Ceane and Howes ( 1961 ) and Morris (1967). Morris (1966) stated that the relation between constant photoperiod and sexual maturity is curve linear with slightly earlier maturity occurring in flocks reared under 14 than 6 hr photoperiod which coincide with the present results. The long constant photoperiod slightly activate the reproductive processes leading to the onset of oviposition. Comparing differences in age at first egg acheived by photoperiodic change with differences produces by constant photoperiod indicate that the greatest response is due to photoperiodic change rather than the prevailing absolute dylength. These results agree with those reported by Morris and Fox (1958 and 1960), Morris, Fox and Jennings (1964) and Morris (1966 and (1967).

It may be concluded that the endogenous release of LH from the enterior pituitary of the growing chicks responds to exogenous photoperiodic change and that is associated with the subsequent differences in age of laying the first egg.

An interesting point is to find a method by which one can preducate the quality of the chicks as early as possible for sake of economy. The unexistence correlation between plasma LH values at early age of the chicks and their subsequent rate of lay may be attributed to tremendous variations between the individual pullets. Since LH is the hormone which induces ovulations then the most likely is that good correlation exists between rate of lay and follicle stimulating hormone (FSH). These points call for developing more reliable and confidence assay for chicken FSH.

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## هرمون التبويض LH في بلازما دم كتاكيت عرضت لمعاملات ضوئية مختلفة

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لمعرفة تأثير الاضاءة على هرمون وعمر النضج الجنسى استعملت اربعة مجاميع من الكتاكيت عمر أسبوع لأربعة معاملات ضوئية مختلفة كالآتى :

مجموعة ١ : وضعت تحت ١٤ ساعة اضاءة + ١٠ ساعات اظلام .

مجموعة ٢ : وضعت تحت ٦ ساعة اضاءة + ١٨ ساعة اظلام .

مجموعة ٣ : وضعت تحت ١٤ ساعة اضاءة + ١٠ ساعات اظلام ـ حتى عمر ٥ أسابيع ، حينما خفضت فترة الاضاءة بمقدار ٤ ساعات وعند عمر ٧ أسابيع خفضت الاضاءة بنفس المقدار لتصبح دائما ٦ ساعات اضاءة + ١٨ ساعة اظلام .

مجموعة ٤ : وضعت تحت ٦ ساعات اضاءة + ١٨ ساعة اظلام حتى عمر ٥ أسابيع حينما زيدت فترة الاضاءة بمقدار ٤ ساعات وعند عمر ٧ أسابيع زيدت الاضاءة بنفس المقدار لتصبح دائما ١٤ ساعة اضاءة + ١٠ ساعات اظلام .

كان مستوى هرمون التبويض فى بلازما الكتاكيت التى تعرضت لـ ١٤ ساعة اضاءة + ١٠ ساعات اظلام أعلى قليلا من مستواه فى بلازما الكتاكيت التى تعرضت لـ ٦ ساعات اضاءة + ١٨ ساعة اظلام ، وجد أن أعلى مستوى لهرمون التبويض وأبكر ميعاد للنضج الجنسى كان فى الكتاكيت التى تعرضت لزيادة الاضاءة بعكس الكتاكيت التى تعرضت لنقص فترة الاضاءة .

لم يوجد أى ارتباط بين مستوى هرمون التبويض أثناء فترة النمو وخلال وضع البيض .