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The Effect of Clomid (Clomiphene Citrate) on Chickens

I. Laying Performance

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ABSTRACT

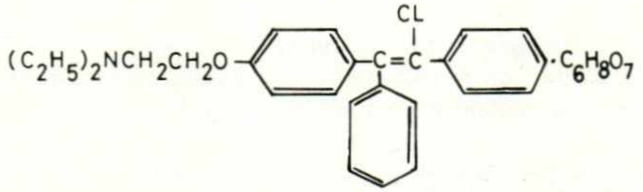
Thirty-two Single Comb White Leghorn-type pullets, 24 weeks of age, were housed in individual cages and raised under standard feeding and management practices. After being in production for one month, the pullets were divided into two groups. Each pullet in the first group was force-fed 2 mg clomid (as a source of clomiphene citrate produced by Merrell Toraude Co., Paris), suspended in 1 ml sterile saline, daily. Each pullet in the second group, acting as a control, was force-fed 1 ml sterile saline daily.

Force feeding of clomid significantly increased egg production and feed intake of the pullets. However, egg weight, shell thickness, efficiency of egg production (expressed as the amount of feed required to produce a dozen eggs), and body weight gain did not differ between the treated and control pullets.

As for other physiological effects, clomid significantly increased the average weight of each of the ovary, oviduct, adrenal and thyroid.

INTRODUCTION

Clomid (clomiphene citrate) is a substance chemically related to stilboestrol and triparanol. Its structural formula as given by Meyers *et al.* (5) is as follows:



Clomiphene induces ovulation in women provided the hypothalamo pituitary system is anatomically intact (Delange and Doorenbos, 2). The physiological aspects of the drug has been reported to possess no-progestational, androgenic or anti-androgenic activities in both human and laboratory animals (Scommegna and Lash, 1969; Holthamp *et al.*, 1966 as reported by McGinnis and Wallace, 4). In chickens clomiphene citrate possesses both anti-androgenic and anti-oestrogenic activities (McGinnis and Wallace, 4). Since, in the laying hen, both ovulation and oviposition are influenced by pituitary gonadotrophins, the possibility exists that clomid may influence the laying performance.

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In view of the foregoing information, the experiment reported herein was designed and conducted.

MATERIALS AND METHODS

Thirty-two (32) Single Comb White Leghorn-type pullets, 24 weeks of age, were housed in individual cages, one bird per cage. The laying cages were 23 cm × 46 cm × 40 cm with slanting wire floors. The cages were in a ventilated room allowing 14 hours of light per day.

The birds were fed a standard laying diet containing 16.5% crude protein. Feed and water were available to pullets *ad libitum*.

After being in production for one month, the birds were divided into two groups of 16 birds each. Each bird in the first group was force-fed 2 mg daily of clomid* suspended in 1 ml sterile saline; each bird in the second group, acting as control, was force-fed daily 1 ml of sterile saline.

Egg production for each group was recorded daily. The eggs were then individually weighed using electrical balance. The shell thickness was determined on the basis of the average of three micrometer readings taken at three different locations on the egg shell. Body weights and feed consumption were recorded at the begining of the experiment and weekly thereafter until the end of the experiment which lasted for 21 days. The rectal temperatures of 8 birds, chosen at random from each group, were taken twice weekly using a medical thermometer. At the termination of the experiment the experimental groups were slaughtered and thymi, thyroids, adrenals, ovaries and oviducts were removed and weighed. The incidence of egg irregularities such as shell-less and double-yolk eggs was recorded.

The data obtained were analysed by Student's T. test as described by Snedecor and Cochran (9).

RESULTS AND DISCUSSION

Egg production

The total number of eggs produced during the 21 days of the experiment, the percentage of egg production (hen/day), the average egg weight and the average shell thickness for each of the clomid treated and the control-groups are shown in Table 1.

Table 1 The effect of clomid on egg production, egg weight and shell thickness of White Leghorn pullets.

Treatments	Egg production[1]		Egg weight[1]	Shell thickness[1,2]
	Total No.	Hen/day		
	Eggs	%	gm	μm
Clomid	265	79[a]	58[a]	650[a]
Control	225	67[b]	57[a]	600[a]

[1] Means with different superscripts are significantly different at $P<0.01$.
[2] The two shell membranes are included.

*Clomid is a source of Clomiphene Citrate obtainable in 50 mg tablets, produced by Merrell Toraude Co., Paris.

This table shows that egg production has significantly increased ($P<0.01$) in the clomid treated group over that of the control. Although average egg weight and shell thickness tended to increase in the clomid treated group, it was, nonetheless, non-significant.

The increase in egg production could be due to the effect of the drug on the hormonal system. Generally, clomid may have a direct effect on the hypothalamus stimulating its production of several releasing hormones the main ones being: the gonadotrophin releasing hormone (GnRH), the corticotrophin releasing hormone (CRH), and the thyrotrophin releasing hormone (TSRH).

With regards to gonadotrophin RH, clomid probably blocks the inhibitory influence of oestrogens on the hypothalamus and thus increases the production of GnRH. The excess release of gonadotrophins may be only sufficient to enhance yolk formation in the maturing follicles leading to a rapid maturation of many follicles as reported by Nalbandov (6); and Aitken (1) while reviewing the work of Fraps *et al.* (1971); and Opel and Nalbandov (1958) who found that FSH injected into hens leads to rapid maturation of many follicles. A similar effect has been noticed in the ovaries of clomid treated pullets (Fig. 1 & 2) where the number of matured follicles was apparently increased. Subsequently, ovulation of matured follicles tended to be enhanced due to the sudden increase of LH accompanied by the attainment of follicular maturation to the ovulatory size. Opel and Nalbandov (7) reported that multiple ovulations were obtained following injection of mammalian LH into the hypophysectomized hen.

In the present study it has been noted that 6% of the eggs laid by the clomid treated pullets, during the exerimental period, were double yolked, whereas no such eggs were laid by the control pullets. Some of these double yolked eggs differed from those usually obtained from any hen in that the two vitelline membranes were attached (Fig. 3) indicating the occurence of successive ovulations with nearly no time interval in between.

At oviposition, all eggs obtained from the treated group were of normal size and contained normal amounts of albumen. However in some instances where two eggs were laid during the same day the first egg usually had a normal fully calcified shell while the second egg tended to be less calcified. In 1% of the cases the eggs were shell-less. This is in argument with the results of Opel and Nalbandov (7) who noticed that, in the case of induced multiple ovulation by LH injection into hypophysectomized hens, only the first egg to reach the shell gland was fully calcified. From the foregoing discussion it clearly appears that the maturation and ovulation of many follicles as well as their passage through the oviduct occurs as a result of LH and FSH administration. It is most probable that, in the treated birds, clomid could have caused the same effect through acting on the hypothalamus with a net resultant increase in egg production.

Gland weights

From Table 2 it is clear that the average weights of each of the adrenal and thyroid glands of the clomid treated birds have significantly increased over those of the controls. This increase could be due to the over-stimulation of these glands brought about by the increased secretion of CTH and TSH from the pituitary so that the metabolites will be sufficient for the formation of the extra number of eggs produced.

It is also possible that the increase in the activity of these glands is accompanied by an increase in the activity of the hypothalamus and the neurohypophysis with a subsequent increase in the secretion of vasopression leading to vasoconstriction. This would then cause an increase in the nutrient pool around the secretory cells of the ovary and oviduct. The increased activity of the ovary and oviduct is also reflected in the significant increase in their weights as shown in Table 2.

Table 2 The effect of clomid on the weights of single glands, ovary and oviduct of White Leghorn pullets.[1]

Treatments	Thymus[2]	Thyroid[3]	Adrenal[3]	Ovary[4]	Oviduct[4]
	mg	mg	mg	gm	gm
Clomid	101[a]	98[a]	77[a]	72[a]	58[a]
Control	105[a]	65[b]	47[b]	60[b]	49[b]

[1] Means with different superscripts are significantly different at $P<0.05$.
[2] Average weight of 7 lobes of 8 birds.
[3] Average weight of two glands of 8 birds.
[4] Average weight of 8 birds.

Feed intake and efficiency of egg production

Average daily feed intake (gm/bird) and the efficiency of egg production data are shown in Table 3. A highly significant increase ($P<0.01$) in feed consumption was recorded in birds treated with clomid. This could be attributed to the increase in egg production. Treated birds consumed approximately 42 gm of feed per day more than the control.

Regarding the efficiency of egg production the administration of clomid had no significant effect on the amount of feed required to produce a dozen eggs ($P<0.05$). However, clomid had a highly significant increasing effect ($P<0.01$) in relation to the amount of feed required to produce a kilogram of eggs.

Body weight and rectal temperature

Average body gain and rectal temperature during the 3-week period is shown in Table 3. Body weight of treated birds was not significantly effected by the drug ($P<0.05$). Despite the fact that the treated birds had a higher tendency to store more fat, as was observed after killing and birds at the end of the experiment, there was a decreasing trend in body weight gain.

Clomid significantly increased rectal temperature however ($P<0.05$). This is probably related to the fact that egg production was higher in the treated group than that of the control. This suggestion is in agreement with the suggestion of Heywang (1938) and Hillerman and Wilson (1955) as reported by Freeman (3).

Table 3 The effect of clomid on feed intake, efficiency of egg production, body gain and rectal temperature.[1]

Treatments	Feed intake	Efficiency egg production		Body gain	Rectal temp[2]
	gm/bird/day	kg feed/kg eggs	kg feed/Dozen eggs	gm	C°
Clomid	130[a]	2.26[a]	1.99[a]	50[a]	41.9[a]
Control	88[b]	1.55[b]	1.57[a]	58[a]	41.4[b]

[1] Means with different superscripts are significantly different at $P<0.01$.
[2] Mean of rectal temperature is significantly different at $P<0.05$.

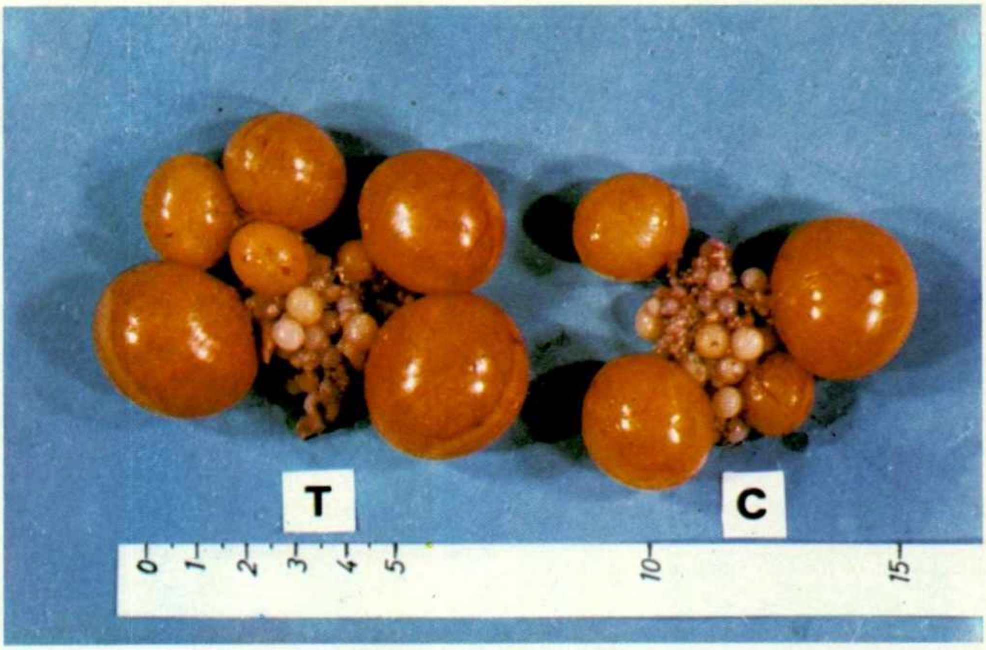

Fig. 1. Ovary of clomid treated bird (T) and that of a control (C). The maturation of many follicles is clearly shown in the ovary of the treated pullets.

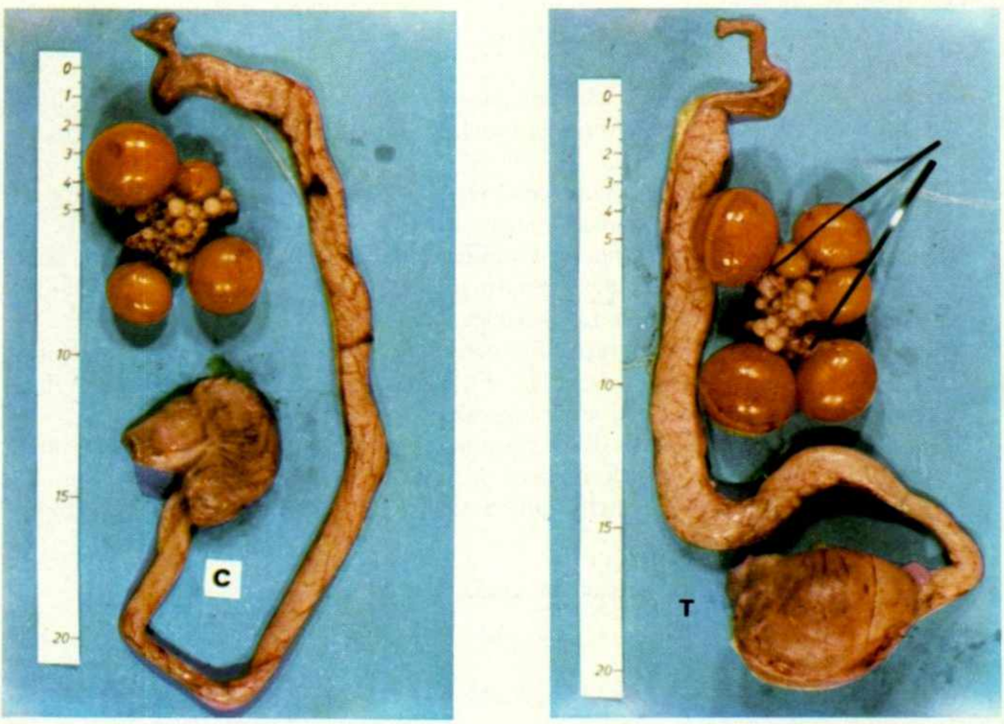

Fig. 2. Ovary and oviduct of a control pullet (C) and those of a clomid treated pullet (T). The arrows show the number of the ovulated follicles. The oviduct is thicker and shorter in the treated pullet than that of the control. An egg is present in the shell gland of the treated pullet.

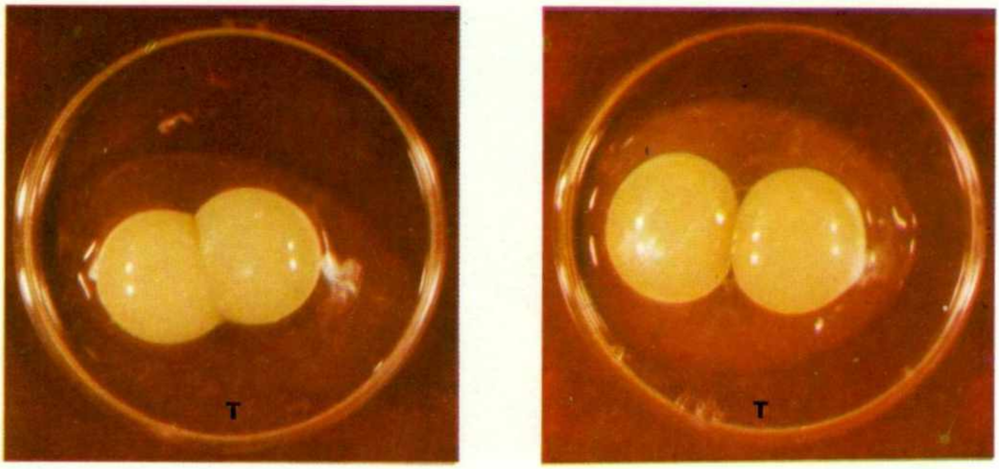

Fig. 3. Normal double-yolk egg (*left*) laid by a treated pullet during the period of drug administration. Double-yolk egg (*right*) laid by a clomid treated pullet which shows the attachment of the two vitelline membranes.

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تأثير عقار الكلوميد على الدجاج
١ — إنتاج البيض

م . م . شنواني ، ع . ك . الخزرجي ، ع . حامد المستخلص

إن عقار الإخصاب (كلوميد) ، المعطى للدجاج البيوض ، زاد من إنتاج البيض واستهلاك العلف . أما بالنسبة للتأثيرات الفسيولوجية فقد زاد هذا العقار من وزن المبيض وقناة البيض ، وكذلك الغدد الكظرية والدرقية .