

Oviductal Response to Gonadal Hormones

G.A.R. Kamar, M.A. Kicka and M.M. Elhabbak

*Department of Animal Science, Faculty of Agriculture,
Cairo University, Cairo, Egypt.*

THE OBJECT of this investigation is to study the responsiveness of the oviductal motility to gonadal hormones. Also, the interrelationship between vitamins and gonadal hormones was investigated.

Estradiol benzoate when injected in a dose of 2mg daily for 14 days stimulated the normal motility of the three regions: magnum, isthmus and uterus in all conditions. On the other hand injections of the same doses of either testosterone propionate or 17 α -hydroxy progesterone caproate for the same period, markedly inhibited the oviductal motility. Moreover, injections of 2 mg daily of estrogen, progesterone or testosterone for 14 days, consistently depressed egg production.

The relationship between vitamins and gonadal hormones on oviductal motility, showed that vitamin B₆ in doses of 3mg agonized the stimulant effect of estrogen when injected in doses of 2 mg daily for 14 days. However, vitamin B₆ acted synergistically with both testosterone and progesterone when used at the same levels, *i.e.* it inhibited the oviductal motility for hormone treated bird. Vitamin B₁₂ when used at a level of 0.9 mg was shown to act synergistically with estrogen and antagonistically with testosterone and progesterone, *i.e.* it stimulated the oviductal motility for all hormone treated groups. Vitamin C in this respect, seems to act synergistically with both of estrogen and progesterone since it produced stimulation for estrogen treated groups and inhibition for progesterone treated one. On the other hand, it stimulated the oviductal motility for testosterone treated group *i.e.* it antagonized the inhibitory effect of testosterone.

Exogenous gonadal hormones in the domestic fowl apparently affect the pituitary to depress the rate of gonadotropic secretion. This would be reflected in the mature female fowl by cessation of egg production. Breneman and Masson (1951) demonstrated that testosterone propionate when injected into young capons at the level of 25 mg twice a week caused a decrease in the gonadotropic content of pituitary. This may explain the action of androgen in the suppression of egg production as observed by Herrick and Admas (1955) who reported that two injections weekly of testosterone propionate at the level of 10-40 mg/week, produced a severe depression in egg production. Turner (1948) claimed that when pullets were fed estrogen at the level of 140 mg/kg for 20 weeks produced a cessation in egg production. Also, Gabuten and Shaffner (1953) noted that progesterone when injected into birds at level of 0.5-1.0 mg daily for two weeks depressed egg production markedly. Progesterone, estrogen and androgens may retard oviposition particularly of administered in large amount (Dunhan and Riddle, 1942).

This work is a trial to demonstrate the effect of gonadotrophic hormones on the oviductal motility of the chickens as compared with the normal motility in order to elucidate their relation to egg production.

Material and Methods

White baladi hens used in this study were taken at random from the flock bred by the Poultry Research Centre, Animal Science Department, Faculty of Agriculture, Cairo University, to study the effect of gonadal hormones and vitamins on the spontaneous motility of the oviduct using the glass jar bath apparatus described by ElHabbak (1975). After hens were sacrificed, the oviduct was carefully removed and immersed in a dish filled with Dale's solution. A strip of about one inch long from magnum, isthmus and uterus was suspended in the oxygenated physiological solution of the inner bath. Then the lever was left to record the normal motility on a smoked kymographic drum paper slowly moving and vitamins were added to the inner bath. The responsiveness of the oviduct to the gonadal hormones and vitamins were recorded.

Solutions and experiments investigated

1. Dale's solution

This solution was prepared by dissolving 90 g sodium chloride, 4.2 g potassium chloride, 2.4 g calcium chloride, and 0.05 g magnesium chloride in 1 l of distilled water. A 200 ml of this solution was completed to 2 l and 1 g of each of glucose and sodium bicarbonate was then added.

2. Gonadal-hormones

25 adult hens of the same rank, age and reproductive phase were used. They were reared under similar conditions and divided into four groups. Birds of the first group were injected with 2 mg of estrogen (estradiol benzoate) the second with 2 mg of testosterone (testosterone propionate) and the third with 2 mg of progesterone (17 α -hydroxyprogesterone caproate). Injection was made daily in the chest region for 14 days. The fourth group was kept as control and was injected with 2cc olive oil only daily for the same period. Birds were killed on the day following the last injection and their oviducts were dissected free, then the three segments were suspended in the oxygenated physiological solution of the inner bath, their rhythmic contractions were then determined.

3. Relation between vitamins and hormones as demonstrated on the oviductal motility

To determine such relation, experiments were performed on three groups of hens, each of which was injected with estrogen, progesterone and testosterone respectively. The dose used was 2 mg for the three hormones and the treatment lasted for 14 days. On the 15th day birds were sacrificed, the oviducts were carefully dissected free, and segments representing magnum, isthmus and uterus were suspended in Dale's solution, then its rhythmic contractions were established. Effective doses of vitamins (3mg for Vit B₆, and Vit C and 0.9 mg for Vit B₁₂) were added to the inner bath.

4. *Gonadal hormones and egg production*

To study the effect of estrogen, progesterone and testosterone on egg production, 20 adult hens of the same age and the same productive capacity were used. They were classified at random into four groups each of 5 birds. The 1st was injected with 2 mg estrogen, the 2nd with 2 mg testosterone, the 3rd progesterone and the 4th was kept as a control and was injected with 2 ml olive oil only. Injection was made daily for a period of 14 days. Eggs were calculated individually, using trapnests. Egg production / hen, for each group through the 14 days of injection was calculated.

Results and Discussion

1. *Gonadal hormones and oviductal motility*

This work showed that the activity of the oviduct is consistently higher in the hens with ovulated egg in the tract than the non-ovulated and immature birds. It is very interesting to notice that injection of gonadal hormones affected the oviductal nature and changed its motility (*in vitro*) (Table 1). In this respect, injection of 2 mg of estradiol benzoate daily for 14 days stimulated the oviductal motility in birds in an inactive phase. On the other hand injection of progesterone or testosterone for 14 days produced on all birds a quiescent condition of the oviduct, *i.e.* they reduced the oviductal motility.

TABLE 1. Effect of gonadal hormones injections on the oviductal motility (*in vitro*).

Treatments	Stages	Oviductal motility
Estrogen	Egg in uterus	Nearly on effect
	During pause	Marked stimulation
Progesterone	During pause	Marked inhibition
Testosterone	During pause	Marked inhibition

Results obtained in this investigation concerning the effect of estrogen on the oviductal motility confirm those obtained by Juhn and Gustavson (1930) Munro and Kosin (1943), and Loreng *et al.* (1962) who claimed that the smooth muscle development of the oviduct and oviductal hypertrophy in

immature chicks depend on the ovarian hormones specially estrogen. Moreover, Chen and Hawes (1967) reported that the tract motility in immature birds was augmented by exogenous estrogen to resemble that of mature ones. Brant and Nalbandove (1952) in this respect, reported that estrogen alone was unable to bring the oviducts of pullets to full functional activity, as measured by the secretion of albumen, which may suggest that it is primarily concerned with inducing morphological changes in the oviduct of puberal pullets, while the other sex hormones are concerned with inducing functional changes. On the other hand, these results are in contrast with those reported by Galan *et al.* (1964) who claimed that oviducts were smallest in groups of hens injected with the estrogenic substance diethylstilbestrol when compared with controls.

Moreover, results in this present study, showed an inhibitory action of both progesterone and testosterone on the oviductal motility. This agrees with Grad *et al.* (1966), who noted that progesterone suppressed the development of the oviduct, and also agrees with Brant and Nalbandove (1956), Zarrow *et al.* (1960), who reported that testosterone is an effective inhibitor of the oviducts growth. However, those present results are contrary to those stated by Herrik (1944) and Panda and Juhn (1961) who obtained a growth response in immature chick oviduct with testosterone propionate.

2. Relation between hormones and vitamins on the oviductal motility

When vitamin B₆ was added to the inner bath containing oviductal strep at a level of 3 mg consistent inhibition was obtained in all conditions, inhibition was marked on the uterus of such hormone treated birds. It will be seen that inhibitory effect of Vit B₆ on the oviductal motility is still after injection of estrogen which has been shown to stimulate the movement. This indicates that Vit. B₆ in doses of 3 mg and agonized the stimulation effect of estradiol benzoate when injected in doses of 2 mg daily for 14 days (Table 2). On the other hand, Vit. B₆ acts synergistically with both testosterone and progesterone when used in a dose of 2 mg daily for 14 days (Table 2).

Vitamin B₁₂ in this respect when used at a level of 0.9 mg resulted in marked stimulation to the three regions of the tract for the hens of the three hormones treated groups (Table 2). It is also interesting to notice that Vit B₁₂ which of inhibitory effect on the normal oviductal motility, produced stimulation to this motility in the hormonal treated birds, *i.e.* synergistically acts with estrogens and antagonistically with testosterone and progesterone.

Vitamin C was shown to have inhibitory effect on the normal oviductal motility. It is interesting to demonstrate that this vitamin stimulated the oviductal motility for both estrogen and testosterone treated groups, while it inhibited that for progesterone treated one (Table 2). In other words, this vitamin seems to act synergistically with both of estrogen and progesterone and antagonistically with testosterone.

3. Effect of gonadal hormones on egg production

The average egg production/hen for groups treated with estrogen, progesterone, testosterone and control were 3.2, 3.0, 2.4 and 4.6 egg respectively. It is evidently noticed from these results that administration of gonadal hormones reduced egg production significantly. Also, it is very interesting to demonstrate in this experiment that as a results of hormone sadministration, treated hens ceased egg laying at varing times. Estrogen treated group continued to lay till the 12th day of injection, while progesterone group laid the last egg on the 11 th day and testosterone treated group ceased egg laying by the end of the 10 th day of treatment.

Results regarding the depressive effect of gonadal hormones agree with Turner (1948) and Herrick *et al.* (1955) who claimed that estrogen treatment caused cessation of egg production. Cook and Warnick (1961 and 1962) reported that progesterone caused depression in egg production when injected or orally administered to hens.

TABLE 2. Effect of vitamins on the oviductal motility of hormone treated hens.

Vitamins	Hormone	Dose mg	Dilution	Effect on		
				Magnum	Isthmus	Uterus
B ₆ . . .	Estrogen	3	1:16666	SI	SI	VSI
	Testosterone	3	1:16666	SI	SI	VSI
	Progesterone	3	1:16666	VSI	VSI	VSI
B ₁₂ . . .	Estrogen	0.9	1:55555	VSS	VSS	VSS
	Testosterone . . .	0.9	1:55555	VSS	VSS	VSS
	Progesterone . . .	0.9	1:55555	VSS	VSS	SS
C	Estrogen	3	1:16666	S	S	SS
	Testosterone	3	1:16666	VSS	SS	VSS
	Progestrone	3	1:16666	SI	SI	SI

S = Stimulation.
 SI = Strong Inhibition.
 SS = Strong Stimulation.
 VSI = Very Strong Inhibition.
 VSS = Very Strong Stimulation.

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استجابة حركة قناة المبيض للهرمونات الجنسية

جمال قمر ، مختار عبد الفتاح قيعة و محمد الحبال

كلية الزراعة ، جامعة القاهرة

تتضمن هذه الدراسة مدى استجابة الأجزاء الثلاثة (المعظم ، الاتمس ، الرحم) للهرمونات الجنسية (الاستروجين ، البروجسترون ، التستستيرون) ، وكذلك مدى تأثير هذه الهرمونات على إنتاج المبيض . كذلك درست العلاقة بين تأثير بعض الفيتامينات (فيتامين ب₆ ، ب₁₂ ج) والهرمونات الجنسية على حركة قناة المبيض وكانت النتائج كما يلي :

١ - عند حقن الهرمونات الثلاثة الاستروجين والبروجسترون والتستستيرون في ثلاث مجموعات من الدجاج مقدارها ٢ مجم لمدة ١٤ يوم وجد أن الاستروجين ذو تأثير منشط على حركة المناطق الثلاثة لقناة المبيض بينما على العكس من ذلك كان للبروجسترون والتستستيرون تأثير مثبط عليها . إلا أنه من المهم أن نذكر أن الهرمونات الثلاثة سببت نقصا في إنتاج البيض بدرجة ملحوظة .

٢ - عند دراسة العلاقة بين الفيتامينات والهرمونات الجنسية على حركة قناة المبيض وجد أنه على الرغم من أن كل من الفيتامينات الثلاثة كان له تأثير مثبط على حركة قناة المبيض عند اضافته بمفرده الى الاعضاء المأخوذة من الطيور العادية . إلا أن هذه الفيتامينات أظهرت تباينا واضحا عند دراسة تأثيرها على الدجاج المحقون بالهرمونات الجنسية فلقد وجد أن ٣ مجم من فيتامين ب₆ كانت ذات تأثير مثبط على حركة أجزاء القناة في كل من الطيور المعالجة بالهرمونات الثلاثة مما يفيد أنه يضاد تأثير الاستروجين المنشط بينما على العكس من ذلك يعارض ذلك التأثير المثبط لكل من البروجسترون والتستستيرون وبالنسبة لفيتامين ب₁₂ فعندما أضيف بجرعة مقدارها ٩ ركجم وجد أنه ذو تأثير معارض لفعل الاستروجين ومضاد لفعل كل من البروجسترون والتستستيرون أي أنه كان ذو تأثير منشط في الحالات الثلاثة أما عن فيتامين ج فقد وجد أنه ذو تأثير مضاد لتأثير التستستيرون أي تسبب في تنشيط حركة القناة في هذه الحالة ، بينما كان له تأثير معارضا لكل من الاستروجين والبروجسترون أي أنه كان تأثير منشط في الأول ومثبطا في الثاني .