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STEROIDOGENIC EFFECTS OF GIBBERELLIC ACID (GA3) ON CHICKS

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Abstract: *A total of 160 females and 160 males Gemizha strain, at one day of age were randomly assigned for 8 treatments of 4 replicates each, to investigate the steroidogenic effect of gibberellic acid on chicks and to compare its effects against that of both estradiol and testosterone treatments on female and male chicks. In both sexes chicks of the 2^{nd}, 3^{rd}, 4^{th} and 5^{th} groups were injected intramuscularly for 14 consecutive days with 0.1 ml of the injection solution containing 25, 50, 100 or 200 µg Gibberellic acid (GA3)/chick /day, while the 6^{th}, 7^{th} and 8^{th} groups were injected with the solution containing 20, 40, and 80 µg Estradiol 17-β/female chick/day or 20, 40, 80 µg testosterone /male chick/day for female and male chicks, respectively. The first group in both sexes served as control group. Results of the estrogenic bioassay revealed that gibberellic acid mimics estradiol effect on oviduct length after 7 and 14 injections with the effect of the 100 and 200 µg doses of GA3 reach the biological effects of 3 and 20 µg of Estradiol after 7 injections, and of 10 and 33 µg of Estradiol after 14 injections, respectively. Also, Gibberellic acid mimics Testosterone effect on comb's relative weight after 7 injections, with the effect of the 100 and 200 µg doses of Gibberellic acid reaches the biological effect of 34 and 46 µg of Testosterone after 7 injections, respectively. In both female and male chick's GA3 was capable of increasing live body weight as estradiol and testosterone treatments did. In female chicks GA3 treatments increased oviducts' weights, serum total lipids, serum calcium in a dose dependent manner, mimicking effects of estradiol injections on the same traits. In male chicks, gibberellic acid treatments induced effects on testes' weights that was similar to testosterone effects, as both reduced testes weights significantly. Also, GA3 was capable of inducing estradiol secretion in female chicks and testosterone secretion in male chicks. It can be concluded that gibberellic acid can have both estrogenic biological effects on female chicks and testosteronic biological effects on male chicks*

INTRODUCTION

Gibberellic acid (GA3) is a natural hormone that can be readily extracted from common plants and acts as growth promoter (Riley, 1987). The effect of gibberellic acid on various aspects of plant growth and development has been extensively researched (Riley, 1987; Baydar, 2002; Celik *et. al.,* 2007).

Because of the possible use of GA3 in spray applications for promoting plant growth in field crops and the presence of potentially high residual levels which can reach 630 µg. per lb of plant materials used in poultry feeds, subsequent studies were conducted to elucidate effects of GA3 on birds' performance (Anderson *et. al.,* 1982; Abdel-Hamid *et. al.,* 1994; Azza *et. al.,* 2003; and Elkomy 2003).

On the other hand, GA3 has been reported to have number of endocrine effects (Gawienowski *et. al.,* 1977 and Gawienowski and Chatterjee, 1980). Their studies have demonstrated that GA3 is estrogenic, androgenic and acts synergistically with estradiol, in rats, GA3 elicited an estrogen like response in uteri of ovarictomized females and kept them in continuous estrus.

The objective of this study was to further investigate the steroidogenic effect of GA3 on chicks and to compare its effects against that of both estradiol and testosterone treatments on both female and male chicks, in attempt to prove its both estrogenic and androgenic effects

MATERIALS AND METHODS

This study was conducted at the Poultry Research center, Faculty of Agriculture, Alexandria University, during the year of 2004. A total of 160 females and 160 males from Gimizah strain at one day of age were used in this study. Birds were fed a normal starter diet. Feed and water were provided *ad libtum* throughout the experimental period. Birds were randomly assigned to 8 treatments of 4 replicates each (20 birds each) for each sex and were kept in wire floored battery brooders.

Treatments:

In both sexes chicks of the 2nd, 3rd, 4th and 5th groups were injected intramuscularly for 14 consecutive days with 0.1 ml of the injection solution (1:11 ethanol : sesame oil solution with addition of 1 mg $NaHCO_3$ / 0.1 injection solution) containing 25, 50, 100 or 200 µg Gibberellic acid (GA3)/chick /day, while the 6th, 7th and 8th groups were injected with the solution containing 20, 40, and 80 µg Estradiol 17-β/chick/day or 20, 40, 80 µg testosterone /chick/day for female and male chicks, respectively. The first group in both sexes served as control group, and treated with ethanol-sesame oil mixture injection.

Data collected:

Individual live body weights were recorded at the end of the first and the second weeks. After the seven and the fourteenth injections 8 chicks from each group were randomly chosen for slaughter. Carcasses were eviscerated and their oviducts and testes in female and male chicks, respectively were removed and individually weighted. Left oviduct lengths were also estimated. Blood samples were collected from the 8 chicks from each group at the end of the 7^{th} and 14^{th} days. Serum was submitted for determinations of total lipids, and calcium according to guidelines and recommendations of Bogin and Keller (1987). Serum Estradiol and testosterone was determined by enzyme immunoassay using commercial kits purchased from Biosource.

Statistical analysis:

Data were analyzed by analysis of variance using the general linear model procedure (Proc GLM; SAS institute, 1996). For the overall means, data was classified according to 8 treatments and the mean of each treatment was used. Differences among means were determined using Duncan test (Duncan, 1955).

RESULTS ANS DISCUSSION

Estradiol Bioassay:

The effect of estrogens on oviduct length is well established and had been used as the basis of relatively sensitive bioassay for estrogens (Asmundson and Wolfe, 1935; Munro and Kosin, 1943; Boogard and Finnegan, 1976). In this study, oviduct's lengths of chicks treated with either Estradiol or Gibberellic acid were estimated after 7 and 14 days of daily injections. Results (Table 1) prove a positive dose dependent significant (p=0.0001) response of oviduct length to either Estradiol or Gibberellic acid doses, compared to untreated birds. Whereas the 4 Gibberellic acid daily doses (25, 50, 100 and 200µg) caused significant (p=0.0001) increases in oviduct lengths which reached 233, 354, 434, 512% of the untreated group's length after 7 daily injections, the three Estradiol daily doses of 20, 40, 80µg resulted in significant (p=0.0001) increases of 516, 652, and 846% of the untreated group's length at the same age, respectively. Similar effects of both treatments were observed at 14 days of age. As the 4 Gibberellic acid daily doses (25, 50, 100 and 200µg) caused significant (p=0.0001) increases in oviduct lengths which reached 266, 390, 474, 558% of the untreated group's length after 7 daily injections. The three Estradiol daily doses of 20, 40, 80µg resulted in significant (p=0.0001) increases of 496, 614, and 746% of the untreated group's length at the same age, respectively.

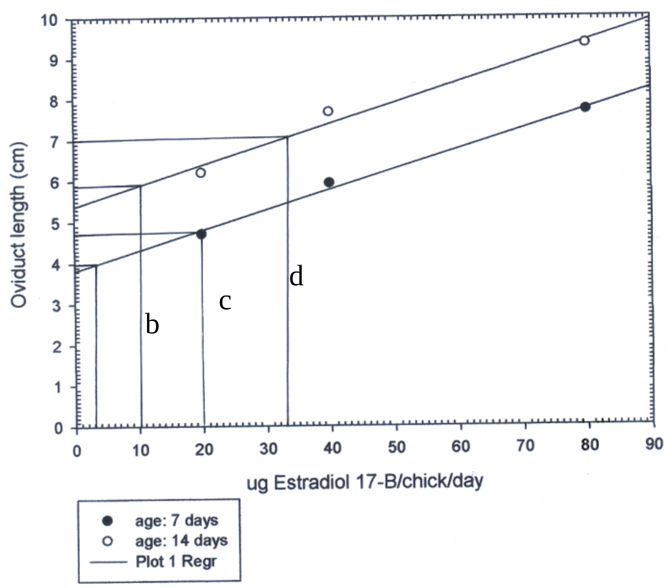

***Figure (1)**: Regression plot of Estradiol daily doses versus oviduct length of 7 and 14 days old female chicks. Drop lines: (a)oviduct length at 100µg GA3 at 7 days of age (b)oviduct length at 100µg GA3 at 14 days of age (c)oviduct length at 200µg GA3 at 7 days of age (d)oviduct length at 200µg GA3 at 14 days of age*

Figure (1) illustrates the regression plot of Estradiol daily doses versus oviduct length after 7 and 14 consecutive injections of female chicks. Drop lines on Figure (1) shows that Gibberellic acid mimics Estradiol effect on oviduct length after 7 and 14 injections with the effect of the 100 and 200 µg doses of Gibberellic acid reach the biological effects of 3 and 20 µg of Estradiol after 7 injections, and of 10 and 33 µg of Estradiol after 14 days of daily injections, respectively.

Estrogenic effects of Gibberellic acid:

Body weight (g):

Effects of Gibberellic acid on body weight of female chicks compared to those of Estradiol treated are presented in table (2). As expected, exogenous Estradiol caused a significant (p=0.0001) increase in female chicks body weights both at 7 and 14 days of age on a dose dependent manner. In compare to the untreated birds, the increases observed were by 31, 54, and 78% at 7 days of age and by 55, 71, and 96% at 14 days of age with the three 20, 40, and 80µg Estradiol 17-β/chick/day treatments, respectively. The increase in body weight as a result of Estradiol treatment has been also reported by Rath *et. al.,* (1996) in broilers.

Gibberellic acid treatments followed the same trend, as body weight increased significantly (p=(0.0001) by 2, 14, 25 and 39% at 7 days of age and by 19, 33, 51, and 69% at 14 days of age with the four 25, 50, 100 and 200µg (GA3)/chick /day treatments, respectively. Such increase in body weight due to GA3 treatments was also found by Alkhiat *et. al.,* (1981); Anderson et. al., (1982); Abdel-Hamid *et. al.,* (1994) and Azza *et. al.,* (2003) with broiler chicks, hens and quails, respectively.

Oviduct relative weight (%):

Estradiol treatments resulted in significant (p=0.0001) increases in the relative oviduct weight at 7 and 14 days of age compared to the untreated groups (Table 2). Oviduct relative weight reached 418, 450, and 603% with the 20, 40, and 80 µg Estradiol 17-β/chick/day treatments, of that of the control group, at 7 days of age, respectively. Similar trend was observed at 14 days of age but with the magnitude of the effect being lower than that at 7 days of age, as oviduct relative weight reached 285, 371, 437% with the three Estradiol treatments respectively. This effect comes in agreement with the findings of Lien *et. al.,* (1985) on female quails fed oestradiol benzoate.

Gibberellic acid treatments also resulted in significant (p=0.0001) increases in oviducts relative weights compared to the control group but to a lighter extent compared to the Estradiol treatments as 25, 50, 100, and 200 µg (GA3)/chick /day treatments caused 132, 175, 261, and 296% at 7 days of age, and 186, 224, 243, and 267% at 14 days of age, increases in oviducts relative weights compared to the untreated birds, respectively. This effect of GA3 on oviducts' weight has been also reported by Azza et. al., (2003) on quails and by

Elkomy (2003) on chickens. Results herein substantiate the previous work of Gawienowski and Chatterjee, (1980) who concluded that GA3 is estrogenic when compared by mouse uterine bioassay with the natural hormone.

Serum Estradiol (pg/ml):

Not surprisingly, daily estradiol injections elevated circulating Estradiol at both 7 and 14 days of age (Table 2). The increase in serum estradiol reached 125, 135, and 152% with the 20, 40, and 80 µg Estradiol 17-β/chick/day treatments, of that of the control group, at 7 days of age, respectively. Similarly at 14 days of age with a higher magnitude, as circulating Estradiol reached 138, 145, 160% with the three Estradiol treatments, respectively.

Gibberellic acid treatments also resulted in significant (p=0.0001) increases in circulating Estradiol compared to the control group but significantly lower compared to the Estradiol treatments as 25, 50, 100, and 200 µg (GA3)/chick /day treatments caused 106, 112, 115, and 119% at 7 days of age, and 110, 114, 122, and 135% at 14 days of age, increases in circulating Estradiol compared to the untreated birds, respectively. This effect of GA3 on circulating Estradiol has been also reported by Elkomy (2003) who reported that GA3 can stimulate estrogen secretion in hens.

Serum calcium(mg/dl):

The effect of exogenous estrogen on calcium absorption is well documented as it increases calcium absorption in a dose dependent manner resulting in elevated circulating calcium in quails and chicks (Grunder *et. al.*, 1983; Tsang and Grunder, 1985; Sommerville *et. al.*, 1989; Qin *et. al.*, 1993; Afifi and Abo-Taleb, 2002; Beck and Hansen, 2004). Our findings are no exception, as daily estradiol injections elevated circulating calcium at both 7 and 14 days of age (Table 2). The increase in serum calcium reached 131, 145 and 153% with the 20, 40, and 80 µg Estradiol 17-β/chick/day treatments, of that of the control group, at 7 days of age, respectively. Similarly at 14 days of age circulating calcium reached 123, 139, 151% with the three Estradiol treatments, respectively.

Gibberellic acid treatments (25, 50, 100, and 200 µg (GA3)/chick /day) exhibited similar effects on serum calcium, as serum calcium has significantly (p=0.0001) increased to reach 111, 122, 133, and 142% at 7 days of age and to reach 113, 118, 125, and 136% at 14 days of age, in compare to control, respectively. This comes in good agreement with Abdel Hamid *et. al.,* (1994);

Azza *et. al.*, (2003) and Elkomy (2003) who indicated that broiler chicks, quails and immature hens exhibited hypercalcaemia when fed or injected with GA3.

Serum total lipids(g/dl)

The effect of exogenous estrogen on serum total lipids is well documented as exogenous estrogen is known to elevate all the circulating lipid fractions (Sturkie, 1965; Pearce and Johnson, 1986; Rath *et. al.*, 1996; Elghalid, 2005). Following the same trend, our results show that daily estradiol injections elevated serum total lipids at both 7 and 14 days of age (Table 2). The increase in serum total lipids reached 162, 204 and 253% with the 20, 40, and 80 µg Estradiol 17-β/chick/day treatments, of that of the control group, at 7 days of age, respectively. Similarly at 14 days of age serum total lipids reached 136, 169, 207% with the three Estradiol treatments, respectively.

Gibberellic acid treatments (25, 50, 100, and 200 µg (GA3)/chick /day) exhibited similar effects on serum total lipids, as it has significantly (p=0.0001) increased to reach 142, 144, 163, and 142% at 7 days of age and to reach 131, 161, 166, and 196% at 14 days of age, in compare to control, respectively. This comes in good agreement with the findings of Elkomy (2003) who reported that immature hens treated with GA3 had higher plasma total lipids in a dose dependent manner.

From the above discussed results it can be concluded that GA3 not only mimics estradiol biological effect on oviduct length in the estrogenic bioassay, but also have been proven to have effects similar to those of estrogen on female's body weight, oviduct weight, serum total lipids and serum calcium. With a suggestion that GA3 can also stimulate estrogen secretion.

Testosterone Bioassay:

The effect of androgens on comb growth is well established and had been used as the basis of relatively sensitive bioassay for androgens (Munson and Sheps, 1958). Testosterone, 5α-DHT and androstenedion are equally active in inducing comb development (Nakamura and Tanabe, 1973; Young and Rogers, 1978). In this study, combs weights and relative weights of chicks treated with either Testosterone or Gibberellic acid were estimated after 7 and 14 days of daily injections. Results (Table 1) proves a positive dose dependent significant (p=0.0001) response of combs weights and relative weights to either Testosterone or Gibberellic acid doses, compared to untreated birds. Whereas the 4 Gibberellic acid daily doses (25, 50, 100 and 200µg) caused significant (p=0.0001) increases in combs relative weights which reached 194, 218, 250, 259% of the untreated group relative weights after 7 daily injections, the three Testosterone daily doses of 20, 40, 80µg resulted in increases of 224, 284, and 308% of the untreated group relative weights at the same age, respectively. Similar effects of both treatments were observed at 14 days of age. As the 4 Gibberellic acid daily doses (25, 50, 100 and 200µg) caused significant (p=0.0001) increases in combs relative weights which reached 119, 127, 129, 121% of the untreated group relative weights after 7 daily injections, the three Testosterone daily doses of 20, 40, 80µg resulted in increases of 167, 241, and 300% of the untreated group relative weights at the same age, respectively.

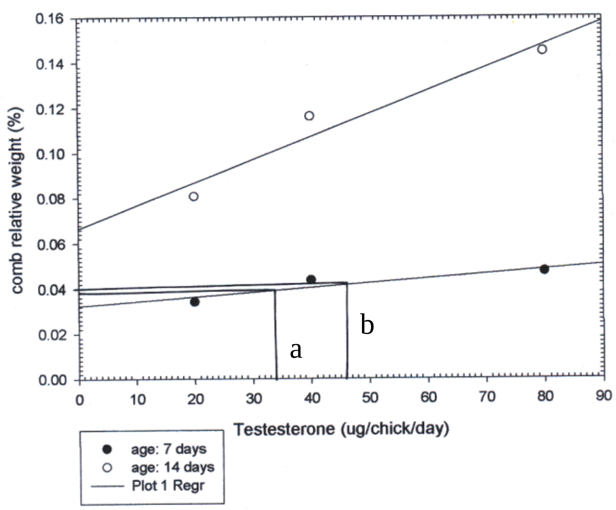

***Figure (2)**: Regression plot of Testosterone daily doses versus comb's relative weight of 7 and 14 days old male chicks. Drop lines: (a)comb's relative weight at 100µg GA3 at 7 days of age (b)comb's relative eight at 200µg GA3 at 7 days of age*

Figure (2) illustrates the regression plot of Testosterone daily doses versus combs relative weights after 7 and 14 consecutive injections of male chicks. Drop lines on Figure (2) shows that Gibberellic acid mimics Testosterone effect on comb's relative weight after 7 injections, with the effect of the 100 and 200 µg doses of Gibberellic acid reaches the biological effect of 34 and 46 µg of Testosterone after 7 injections, respectively. The ability of GA3 to stimulate comb growth has been reported early by Gawienowski *et. al.* (1977).

Testosteronic effects of Gibberellic acid:

Body weight:

Testosterone's busting effect on growth and live body weight is well known (Leite *et. al.*, 2004). Hereby, daily Testosterone injections to male chicks caused a significant (p=0.0001) increase in chicks body weights both at 7 and 14 days of age on a dose dependent manner (Table 3). In compare to the untreated birds, the increases reached 118, 126, and 155% compared to control at 7 days of age and 125, 137, and 152% at 14 days of age with the three 20, 40, and 80µg Testosterone/chick/day treatments, respectively.

Gibberellic acid treatments followed the same trend, as body weight increased significantly (p=(0.0001) in compare to untreated birds to reach 110, 115, 125 and 134% at 7 days of age and 115, 124, 133, and 152% at 14 days of age with the four 25, 50, 100 and 200µg (GA3)/chick /day treatments, respectively. Such increase in body weight due to GA3 treatments was also found by Alkhiat *et. al.*, (1981); Anderson et. al., (1982); Abdel-Hamid *et. al.*, (1994) and Azza *et. al.*, (2003) with laying hens, broiler chicks, and quails, respectively.

Testes relative weight (%)

Testosterone treatments resulted in significant (p=0.0001) decreases in relative testes weights at 7 and 14 days of age compared to the untreated group (Table 3). Testes relative weight reached 82, 78, and 51% with the 20, 40, and 80 µg testosterone/chick/day treatments, of that of the control group, at 7 days of age, respectively. Similar trend was observed at 14 days of age as testes relative weight reached 81, 77, 75% with the three testosterone treatments respectively. This effect comes in agreement with the findings of Rath *et. al.*, (1996) on male broiler chickens implanted with copolymers containing testosterone.

Gibberellic acid treatments also resulted in significant (p=0.0001) decreases in testes relative weights compared to the control group but to a lighter extent compared to the testosterone treatments as 25, 50, 100, and 200 µg (GA3)/chick /day treatments reduced testes relative weights to reach 99, 94, 88, and 87% at 7 days of age, and 97, 92, 89, and 88% at 14 days of age, that of the untreated birds, respectively. This effect of GA3 on testes' weight has been also reported by Elkomy (2003).

Serum testosterone (ng/ml)

As expected, daily testosterone injections elevated circulating testosterone at both 7 and 14 days of age (Table 3). The increase in serum testosterone reached 105, 112, and 119% with the 20, 40, and 80 µg testosterone/chick/day treatments, of that of the control group, at 7 days of age, respectively. Similarly at 14 days of age as circulating Estradiol reached 104, 111, and 117% with the three testosterone treatments, respectively.

Gibberellic acid treatments also resulted in significant (p=0.0001) increases in circulating testosterone compared to the control group as 25, 50, 100, and 200 µg (GA3)/chick /day treatments caused 103, 107, 111, and 117% at 7 days of age, and 103, 106, 108, and 113% at 14 days of age, increases in circulating testosterone compared to the untreated birds, respectively. This effect of GA3 on circulating testosterone has been also reported by Elkomy (2003).

From the above discussed results it can be concluded that GA3 not only mimics testosterone biological effect on combs' weight in the testosterone bioassay, but also have been proven to have effects similar to those of testosterone on male's body weight, and testes weight. With a suggestion that GA3 can also stimulate testosterone secretion.

Table (1): Gibberellic acid (GA3), Estradiol and Testosterone daily doses effects on oviduct's length of female chicks and comb's weight and relative weight of male chicks at 7 and 14 days of age. (Mean ± S.E.)

Female chicks		Control	µg (GA3)/chick /day				µg Estradiol 17-β/chick/day			*P*. value
			25	50	100	200	20	40	80	
Oviduct length (cm)	7 days	0.910 ± **G** 0.0608	2.120 ± **F** 0.1212	3.220 ± **E** 0.1212	3.950 ± **D** 0.0750	4.660 ± **C** 0.1270	4.700 ± **C** 0.1328	5.930 ± **B** 0.1097	7.700 ± **A** 0.0693	0.0001
	14 days	1.250 ± **G** 0.0923	3.320 ± **F** 0.2136	4.870 ± **E** 0.1327	5.920 ± **D** 0.0750	6.970 ± **C** 0.1732	6.200 ± **D** 0.1790	7.673 ± **B** 0.1645	9.32 ± **A** 0.1848	0.0001
Male chicks		**Control**	**µg (GA3)/chick /day**				**µg Testosterone/chick/day**			***P*. value**
			25	**50**	**100**	**200**	**20**	**40**	**80**	
Comb weight (g)	7 days	0.0123 ± **F** 0.0003	0.0263 ± **E** 0.0009	0.0310 ± **D** 0.0012	0.0387 ± **C** 0.0015	0.0430 ± **B** 0.0017	0.0327 ± **D** 0.0019	0.0443 ± **B** 0.0018	0.0590 ± **A** 0.0017	0.0001
	14 days	0.0540 ± **H** 0.0011	0.074 ± **G** 0.0017	0.0847 ± **F** 0.0013	0.0920 ± **E** 0.0017	0.0993 ± **D** 0.0020	0.1133 ± **C** 0.0018	0.1747 ± **B** 0.0015	0.2453 ± **A** 0.0015	0.0001
Comb relative weight (%)	7 days	0.0153 ± **F** 0.0005	0.0297 ± **E** 0.0012	0.0333 ± **D** 0.0014	0.0383 ± **C** 0.0015	0.0397 ± **C** 0.0017	0.0342 ± **D** 0.0016	0.0435± **B** 0.0013	0.0471 ± **A** 0.0005	0.0001
	14 days	0.0482 ± **G** 0.0012	0.0574 ± **F** 0.0009	0.0612 ± **DE** 0.0006	0.0620 ± **D** 0.0011	0.0584 ± **EF** 0.0014	0.0807 ± **C** 0.0014	0.1161 ± **B** 0.0002	0.1446 ± **A** 0.0007	0.0001

A, B, C Different letters within a row denote significant differences between treatments

Table (2): Gibberellic acid (GA3) and Estradiol daily doses effects on body weight, slaughter and serum biochemical traits of female chicks at 7 and 14 days of age. (Mean ± S.E.)

Parameters		Control	µg (GA3)/chick /day				µg Estradiol 17-β/chick/day			*P*. value
			25	50	100	200	20	40	80	
Body weight (g)	7 days	78.43 ± **G** 0.867	79.83 ± **G** 0.808	89.75 ± **F** 0.771	97.68 ± **E** 0.808	109.30 ± **C** 0.928	102.80 ± **D** 0.924	120.83 ± **B** 0.700	139.70 ± **A** 1.039	*0.0001*
	14 days	105.5 ± **F** 1.327	125.3 ± **E** 1.501	140.40 ± **D** 1.847	159.53 ± **C** 2.107	178.47 ± **B** 2.252	163.83 ± **C** 2.137	180.30 ± **B** 2.252	206.47 ± **A** 1.674	*0.0001*
Oviduct relative weight %	7 days	0.0114 ± **E** 0.0013	0.0150 ± **ED** 0.0013	0.0200 ± **D** 0.0018	0.0297 ± **C** 0.0026	0.0338 ± **C** 0.0013	0.0477 ± **B** 0.0021	0.0513 ± **B** 0.0007	0.0687 ± **A** 0.0018	*0.0001*
	14 days	0.0124 ± **G** 0.0013	0.0231 ± **F** 0.0011	0.0278 ± **E** 0.0016	0.0301 ± **DE** 0.0011	0.0331 ± **CD** 0.0002	0.0354 ± **C** 0.0015	0.0460 ± **B** 0.0007	0.0542 ± **A** 0.0007	*0.0001*
Estradiol (pg/ml)	7 days	50.452 ± **H** 1.1547	53.560 ± **G** 1.2413	56.616 ± **F** 1.6423	58.132 ± **E** 1.876	59.863 ± **D** 1.767	62.960 ± **C** 1.208	68.286 ± **B** 1.872	76.762 ± **A** 2.326	*0.0001*
	14 days	50.799 ± **H** 1.1840	55.955 ± **G** 1.7309	58.050 ± **F** 1.7360	62.070 ± **E** 1.1951	68.782 ± **D** 1.7782	69.987 ± **C** 1.6339	73.670 ± **B** 1.8822	81.190 ± **A** 2.309	*0.0001*
Calcium (mg/dl)	7 days	6.51 ± **H** 0.1155	7.23 ± **G** 0.2193	7.96 ± **F** 0.2309	8.68 ± **D** 0.1386	9.26 ± **C** 0.1963	8.54 ± **E** 0.1732	9.43 ± **B** 0.1905	9.96 ± **A** 0.2309	*0.0001*
	14 days	7.19 ± **H** 0.1386	8.13 ± **G** 0.2309	8.48 ± **F** 0.1963	8.99 ± **D** 0.1848	9.76 ± **C** 0.2309	8.86 ± **E** 0.2424	9.96 ± **B** 0.1501	10.83 ± **A** 0.2483	*0.0001*
Total lipids (g/dl)	7 days	1.89 ± **F** 0.0981	2.64 ± **E** 0.0923	2.72 ± **E** 0.1501	3.09 ± **D** 0.0693	4.11 ± **B** 0.0577	3.06 ± **D** 0.1155	3.86 ± **C** 0.1212	4.78 ± **A** 0.1386	*0.0001*
	14 days	2.46 ± **G** 0.0808	3.23 ± **F** 0.1155	3.96 ± **D** 0.1039	4.09 ± **C** 0.0635	4.83 ± **B** 0.1270	3.34 ± **E** 0.0693	4.16 ± **C** 0.0866	5.08 ± **A** 0.1154	*0.0001*

A, B, C Different letters within a row denote significant differences between treatments

Table (3): Gibberellic acid (GA3) and Testosterone daily doses effects on body weight, and serum biochemical traits of male chicks at 7 and 14 days of age. (Mean ± S.E.)

Parameters		Control	µg (GA3)/chick /day				µg testosterone/chick/day			*P*. value
			25	50	100	200	20	40	80	
Body weight (g)	7 days	80.57 ± **F** 0.4333	88.80 ± **E** 0.7000	93.03 ± **D** 0.9207	100.83 ± **C** 0.7688	108.23 ± **B** 0.9820	95.37 ± **D** 1.0170	101.87 ± **C** 1.1465	125.20 ± **A** 2.4576	*0.0001*
	14 days	112.0 ± **E** 0.6807	128.8 ± **D** 1.124	138.36 ± **C** 0.9837	148.47 ± **B** 0.9955	170.17 ± **A** 1.0913	140.53 ± **C** 0.4176	150.37 ± **B** 0.9838	169.70 ± **A** 1.8502	*0.0001*
Testes relative weight %	7 days	0.0570 ± **A** 0.0016	0.0563 ± **A** 0.0008	0.0538 ± **AB** 0.0010	0.0500 ± **BC** 0.0016	0.0494 ± **BC** 0.0012	0.0465 ± **CD** 0.0015	0.0444 ± **D** 0.0017	0.0290 ± **E** 0.0019	*0.0001*
	14 days	0.0425 ± **A** 0.0009	0.0415 ± **A** 0.0013	0.0390 ± **AB** 0.0008	0.0378 ± **BC** 0.0010	0.0375 ± **BC** 0.0011	0.0346 ± **CD** 0.0012	0.0330 ± **CD** 0.0012	0.0320 ± **D** 0.0015	*0.0002*
Testoster. (ng/ml)	7 days	1.291 ± **F** 0.0058	1.334 ± **E** 0.0088	1.380 ± **D** 0.0115	1.427 ± **C** 0.0145	1.507 ± **B** 0.0176	1.360 ± **DE** 0.0115	1.450 ± **C** 0.0173	1.540 ± **A** 0.0115	*0.0001*
	14 days	1.397 ± **E** 0.0088	1.433 ± **D** 0.0088	1.483 ± **C** 0.0120	1.510 ± **C** 0.0153	1.577 ± **B** 0.0088	1.450 ± **D** 0.0115	1.550 ± **B** 0.0115	1.630 ± **A** 0.0152	*0.0001*

A, B, C Different letters within a row denote significant differences between treatments

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الملخص العربي

تأثيرات استيرودية لحمض الجيبريلك علي الكتاكيت

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يهدف البحث لدراسة التأثير الهرموني لحمض الجيبريلك و المشابة لتأثير الاسترويدات علي الكتاكيت النامية. أجريت هذه الدراسة بمركز بحوث الدواجن التابع لقسم انتاج الدواجن- كلية الزراعة – جامعة الاسكندرية عام 2004.

استخدم في البحث عدد 160 كتكوت جميزة انثي و 160 كتكوت ذكرمن عمر يوم حتي عمر 14 يوم. قسمت كل مجموعة الي 8 معاملات و قسمت كل معاملة الي 4 مكررات و ربيت في بطاريات خاصة تحت ظروف بيئية مناسبة من الحرارة و التهوية و التغذية. في كلا الجنسيين حقنت المجاميع رقم 2 ، 3 ، 4 في العضل يوميا بـ 0.1 مل محلول حقن ليعطي 25 ، 50 ، 100 ،200 ميكروجرام حامض الجيبريلك /كتكوت/يوم لمدة 14 يوم متواصلة. بينما حقنت المجاميع 6 ، 7 ،8 بمحلول يحتوي علي 20 ، 40 ، 80 ميكروجرام من هرمون الاستراديول بيتا 17 /كتكوت/يوم للانا ث او 20 ، 40 ، 80 ميكروجرام من هرمون التيستوستيرون /كتكوت/يوم للذكور و المجموعة الاولي من كل جنس استخدمت كمجموعة مقارنة.

و قد اوضحت نتائج التأثير البيولوجي ان حمض الجيبريلك له تأثير يضاهي تأثير هرمونات الاستروجين و التيستوستيرون علي كل من طول قناة المبيض في الاناث و نمو العرف في الذكور. حيث اظهر تأثير الجرعات 100 ، 200 ميكروجرام من حمض الجيبريلك نفس التأثير البيولوجي لجرعات 3 ، 20 ميكروجرام من الاستراديول علي الكتاكيت الإناث عند عمر 7 ايام و مماثل لجرعات 10 ، 33 ميكروجرام من الاستراديول عند عمر 14 يوم علي طول قناة المبيض في الاناث. كذلك اظهر تأثير الجرعات 100 ، 200 ميكروجرام من حمض الجيبريلك نفس التأثير البيولوجي لجرعات 34 ، 46 ميكروجرام من التيستوستيرون عند عمر 7 ايام علي وزن العرف في الذكور.

توضح النتائج ايضا ان حمض الجيبريلك تأثير ايجابي علي وزن الجسم حيث زاد وزن جسم الكتاكيت (ذكور و اناث) عند عمر 7 و 14 يوم كما حدث مع هرمونات الاستراديول و التيستوستيرون. و في اناث الكتاكيت ارتفع كل من وزن قناة البيض و نسبة الدهون الكلية بالدم و نسبة الكالسيوم و كان ذلك طرديا مع زيادة الجرعةالمستخدمة و حدثت نفس التأثيرات عند الحقن بهرمون الاستراديول. و في الذكور كان تأثير حمض الجيبريلك علي وزن الخصية مماثل لتأثير هرمون التيستوستيرون تماما حيث كان هناك انخفاض معنوي في وزن الخصية طرديا مع الجرعات المستخدمة. كذلك وضح ان هناك تأثير منبه لحمض الجيبريلك لافراز هرمون الاستروجين في الاناث و التيستوستيرون في الذكور حيث ارتفعت النسب في الدم جوهريا.

و في النهاية قد اثبت البحث ان حمض الجيبريلك له تأثير بيولوجي يضاهي تأثير الاستيرويدات علي الكتاكيت.