EFFECT OF INJECTING INCUBATED EGGS WITH GROWTH HORMONE OR ELTROXIN ON HATCHABILITY CHARACTERISTICS AND GROWTH PERFORMANCE OF HATCHED CHICKS.

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ABSTRACT

This study aimed to determine the effects of injecting incubated eggs; produced by 40-or 60-week-old of Mamourah and Gimmizah breeder hens, with either Growth hormone (0.02 or 0.04 IU) per egg or a thyroid-hormone (Eltroxin) (0.10 or 0.15 µg/egg), during the 9th, 15th or 17th day of the incubation period, on hatchability characteristics and growth performance of hatched chicks. Data of the treated eggs were compared with those of a control group (eggs injected with distilled water). Hatchability percentages and chicks hatch-weight were higher ($P \leq 0.01$) whereas embryonic mortality rate was lower ($P \leq 0.01$) in eggs produced by Mamourah than in those of Gimmizah breeder hens. Eggs produced by the 40-week-old hens showed higher ($P \leq 0.01$) hatchability and lower embryonic mortality and chicks hatch-weight than those produced by the 60-week-old hens. Hormonal *in ovo* injection on the 9th day resulted in the highest ($P \leq 0.05$) hatchability and chicks hatch-weight and the lowest ($P \leq 0.05$) embryonic mortality, followed by those obtained with *in ovo* injection on the 15th and the 17th day of incubation. Eggs injected with growth hormone (GH) gave significantly higher ($P \leq 0.05$) hatchability and chicks hatch-weight, and lower embryonic mortality than did those injected with Eltroxin. While the worst hatchability, chicks hatch-weight and embryonic mortality were attained with the control eggs. Regarding the post-hatch performance of chicks, body weights of Mamourah chicks were higher than those of Gimmizah chicks either at 4, 8 or 12 weeks of age. The post-hatch body weight of chicks hatched from eggs produced by the 60-week-old hens was heaver at 4 weeks of age and lower at 8 and 12 weeks of age, than that of chicks hatched from eggs produced by the 40-week-old hens. The *in ovo* hormonal injection on the 9th day of incubation resulted in superior body weight ($P \leq 0.05$) of chicks at 4, 8 and 12 weeks of age, followed by those obtained with *in ovo* injection on the 15th day and then those of the 17th day of the incubation period. The highest hatch weight of chicks was achieved by eggs injected with 0.02 IU (GH) while the lowest weight was recorded for the control group, and these significant differences were observed also in the post-hatch weight of chicks, and persisted to 12 weeks of age. The post-hatch feed intake and feed conversion of chicks were not affected by the age and strain of the breeder hens or time and dose of the *in ovo* hormonal injection. Viability of the post-hatch chicks was not significantly affected by strain or age of breeder hens. *In ovo* hormonal injection on the 9th and 15th days of incubation produced chicks of significantly higher post-hatch viability than that of chicks hatched from eggs injected on the 17th day of incubation. The post-hatch viability of chicks hatched from eggs injected with 0.02 IU GH did not differ significantly from that of the control. However, the other hormonal treatments gave

chicks of lower post-hatch viability, being the lowest with *in ovo* injection with 0.15 µg Eltroxin.

Keywords: Mamourah and Gimmizah chickens, growth hormone, Eltroxin, hatchability, growth performance

INTRODUCTION

The need for improving hatchability characteristics of incubated eggs has directed researchers to find solutions and methods that can decrease embryonic mortality, and improve hatchability rate and growth performance of post-hatch chicks.

Numerous studies were carried out to inject incubated eggs with various hormonal substances. Several investigators have found beneficial effects on hatchability characteristics of eggs injected with growth hormone (GH) and thyroid hormones (T3, T4 and Eltroxin) (Christensen, 1985; Gomma, 1990; Mabrouk, 1997 and Aly, 2000). In this respect, different types of GH have been used to inject chicken eggs during incubation period involving, chicken GH (Berghman *et al.*, 1989), mammalian growth hormones such as bovine GH (Leung *et al.*, 1984), ovine and porcine GH and GH (Hargis and Pardue, 1989) and human GH (Hsich *et al.*, 1952), and their recombinants. The obtained results depend on type and dose of the injected hormone, time of injection, and laying hens age and strain, as well as on conditions of incubation.

The current study aimed to evaluate the effects of injecting incubated eggs with different doses of either growth hormone or thyroid hormone (Eltroxin), injected at different times of incubation period, on hatchability characteristics and growth performance of post-hatch Mammourah and Gimmizah chicks.

MATERIALS AND METHODS

The experimental work was carried out at El-Gimmizah Poultry Researches Station (Gharbia Governorate), Animal Production Researches Institute, Agricultural Researches Center, Ministry of Agriculture.

Two developed strains of local chickens, namely Gimmizah and Mamourah were used in the present study. Each strain was housed in groups, of 500 hens and about 50 cocks each, in order to obtain fertile eggs. The birds received a commercial laying hens diets containing 16 % crude protein, metabolizable energy of 2800 kcal/kg, 3.50% calcium, 0.40% available phosphorus, 0.76% lysine and 0.32% methionine.

Eggs and hormonal treatment:

A total of 2400 fertile eggs produced by Gimmizah and Mamourah hens were used in this experiment.   Means of egg weight at 40 and 60 weeks of age were 53.55 and 54.12 g for Mamourah, and 52.15 and 52.85 g for Gimmizah strain, respectively. From each strain, 600 eggs were collected at 40 and 60 weeks of age. At each age (40 and 60 weeks), eggs of each strain were assigned to three injection times on the 9th, 15th or 17th days of

incubation (200 eggs each) and five levels of hormonal treatments (40 eggs each).

The hormonal treatments included injection of incubated eggs with either Eltroxin (at levels of 0.10 or 0.15 µg) or human growth hormone (hGH), having the tread name Genotropen (at levels of 0.02 or 0.04 IU/egg). Hormones were dissolved in 2 ml distilled water and the same amount of distilled water was used as a control dose. Injections were carried out justly into the air cell of each egg at all injection times investigated.

Eltroxin is a thyroid preparation as L-thyroxin sodium, which is considered preferable to thyroid gland preparation because of its unvarying potency. The injected solution was prepared by dissolving one tablet of Eltroxin (100 µg) in 1000 ml distilled water. About 1 or 1.5 ml from the prepared solution containing 0.10 or 0.15 µg, respectively was increased to 2 ml by adding distilled water as an injection dose per egg. Dosages of Genotropin were prepared by dissolving one tablet of Genotropin (4 IU) into 40 ml distilled water. About 0.5 or 1 ml from the prepared solution containing 0.02 or 0.04 IU was increased to 2 ml/egg by adding distilled water as an injection dose per egg.

Prior to injection, the large end of the egg was sterilized with 70% ethanol. Then an injection hole was created, over the air cell in this area of eggshell, with dental drill without penetrating the chorioallantoic membrane. The injection needle was also sterilized by severe heat and then cooled by a small piece of cotton wetted with alcohol. In ovo injections were performed on the 9th, 15th or 17th day of incubation periods, and the injection holes were sealed with paraffin wax. Similar incubation conditions were maintained for all groups of settable eggs during the different incubation periods. Eggs were turned automatically every two hours until the 18th day of incubation period, thereafter eggs were transferred to a single hatchery.

After hatching, all groups of chicks were wing-banded and reared under similar managerial conditions and vaccinated against diseases. The chicks were fed during the starting period (0-8 weeks of age) on a diet containing 2800 kcal/kg, 18% crude protein, 0.9% calcium, 0.43% available phosphorus, 0.9% lysine and 0.36% methionine. During the growing period (8-12 weeks of age) on a diet containing 2900 kcal/kg, 15% crude protein, 0.9% calcium, 0.43% available phosphorus, 0.7% lysine and 0.3% methionine.

Parameters estimated:

All eggs were individually candled using a hand candling ultraviolet lamp on the 18th day of incubation. All eggs showing no evidence of live embryos were removed to determine the embryonic mortality percentage (EM %) follows:

EM% = (Number of dead embryos/number of fertile eggs) x100

At the end of incubation period, hatchability rate (HR %) was calculated as follows:

HR% = (Number of healthy hatched chicks/number of fertile eggs) x100

Wing-banded chicks were individually weighed at hatch and then at 4, 8 and 12 weeks of age. During these age intervals records of feed consumption and

body weight gain were maintained to calculate the feed conversion of chicks. Viability percentage was also calculated.

Statistical analysis:

Data were analyzed using least-square means and maximum likelihood program of SAS (1996). Data of percentages of hatchability, embryonic mortality and viability were subjected to Arcsine transformation prior to statistical analysis. Significant differences among means were separated using Duncan's multiple range test (Duncan, 1955).

RESULTS

The analysis of variance revealed that all interactions among the main effects were not significant for all criteria studied. Therefore, only the main effects will be presented and discussed.

Hatchability characteristics:

Mamourah eggs had significantly ($P \leq 0.01$) higher hatchability percentage (84.42%) than that of Gimmizah (82.79%) ones. This was associated with significantly ($P \leq 0.01$) lower percentage of embryonic mortality in Mamourah (15.58%) than Gimmizah eggs (17.21%). However, no strain differences were observed in chicks body weight at hatch (Table 1).

Eggs produced at 40 wk of age showed significantly ($P \leq 0.01$) higher hatchability (85.47%) and lower embryonic mortality (14.53%) percentages than those produced at the age of 60 wk (81.67 and 18.33%, respectively). However, average hatch weight of chicks derived from eggs produced by the 60-week-old hens (36.6g) was significantly ($P \leq 0.01$) heavier by about 2.8 % than that of chicks hatched from eggs produced at 40 weeks of age (35.6g) (Table 1).

Injection of eggs with the tested substances on the 9th and 15th days of incubation period significantly ($P \leq 0.01$) increased the hatchability percentages (87.96 and 84.19%, respectively) and live body weight of chicks at hatch (36.9 and 36.2g), respectively, and decreased the embryonic mortality percentages (12.04 and 15.81%, respectively) as compared to the corresponding values obtained with eggs injected on the 17th day of incubation (78.1 and 21.90% and 34.9 g, respectively) (Table 1).

Hatchability percentage and chicks body weight at hatch were significantly ($P \leq 0.05$) higher for GH treatments (T1 and T2) than those of Eltroxin treatments (T3 and T4), while the control treatment showed significantly ($P \leq 0.05$) the lowest values. The corresponding percentages of embryonic mortality showed significantly reversible trend to hatchability percentages. In response to the *in ovo* hormonal treatments, chicks' body weight at hatch surpassed that of the control ones by 9.22, 5.48, 3.46 and 1.44% for treatments (T) 1, 2, 3 and 4, respectively. Marked differences were found in the aforementioned traits between both levels of GH and Eltroxin treatments, being in favor of the low levels, although no significant difference

was detected in chicks' body weight at hatch due to the effect of injected Eltroxin level (Table 1).

Table (1): Means and standard errors of hatchability rate (HR), embryonic mortality (EM), weight of chicks at hatch and viability percentage affected by hen strain and age and time and dose of hormonal injection

Independent variables	HR (%)	EM (%)	Hatch weight Of chicks (g)	Viability % 0-12 week
Effect of strain:				
Mamourah	84.42 ± 0.09[A]	15.58 ± 0.09[B]	36.2 ± 0 08	95.2±.019
Gimmizah	82.79 ± 0 07[B]	17.21 ± 0.08[A]	36.0 ± 0.07	94.5±0.21
Effect of hen age (weeks):				
40 weeks	85.47 ± 0.10[A]	14.53 ± 0.01[B]	35.6 ± 0.07[B]	95.3±0.21
60 weeks	81.67 ± 0 05[B]	18.33 ±0.06[A]	36.6±0 08[A]	95.1±0.19
Effect of injection time:				
9th day	87.96 ± 0.01[a]	12.04 ±0.01[c]	36.9 ± 010[a]	97.1±0.32[a]
15th day	84.19 ± 0.08[b]	15.81±0.09[b]	36.2 ± 0.09[b]	95.3±0.13[a]
17th day	78.10 ± 0.03[c]	21.90 ±0.05[a]	34.9 ± 0.07[c]	92.7±0.25[b]
Effect of hormonal treatment:				
(T1): 0.02 IU GH (T2).	89.23 ± 0.03[a]	10.77 ± 0.02[e]	37.9± 0.11[a]	96.7±0.33[a]
0.04 IU GH (T3): 0.10 µg	85.76 ± 0.02[b]	14.24 ± 0.02[d]	36.6± 0.11[b]	95.5±0.12[b]
Eltroxin	83 40 ± 0.01[c]	16.60 ± 0.01[c]	35.9±0.09[c]	96.2±0.32[b]
(T4): 0.15 µg Eltroxin	80.62 ± 0.09[d]	19.38 ± 0.10[b]	35.2±0.14[c]	88.5±0.14[c]
Control	78.09 ± 0.09[e]	21.91 ± 0.09[a]	34.7± 0.09[d]	97.2±0.41[a]

[A & B] and [a, b.... e] Means having different superscripts within the same column for each criterion are significantly different at P≤0.01 and P≤0.05, respectively.

Post-hatch growth performance:

Data concerning the post-hatch growth performance of chicks are presented in Table 2. Mamourah chicks had significantly (P≤0.05) heavier weights by about 0.82, 1.19 and 0.39% than Gimmizah chicks at 4, 8 and 12 weeks of age, respectively. At 4 wk of age, average body weight of chicks hatched from eggs produced by the 60-week-old hens was significantly (P≤0.01) heavier by 2.98% than that of chicks hatched from eggs produced at 40 wk of age. However, post-hatch body weights of 8 and 12-week-old chicks which were hatched from eggs produced by the 40-week-old hens, were significantly (P≤0.01) heavier by 1.0% and 1.17%, respectively, than those hatched from eggs produced by the 60-week-old hens (Table 2).

At all ages studied, chicks hatched from eggs injected on the 9th day of incubation had significantly (P≤0.05) heavier weights by about 23.11, 11.29 and 9.97% at 4, 8, and 12 weeks of age, respectively, than those hatched from eggs injected on the 17th day. At the same ages, body weights of chicks hatched from eggs injected on the 15th day of the incubation were heavier by 17.50, 9.12 and 7.81%, respectively, as compared to those of chicks hatched from eggs injected on the 17th day. However, chicks hatched from eggs injected on the 9th day of incubation had significantly heavier (P≤0.05) body weights at 4, 8 and 12 weeks of age than those of chicks hatched from eggs injected on the 15th day (Table 2).

The significantly (P≤0.05) heaviest body weight at 4, 8 and 12 wk of age was attained by chicks hatched from eggs of T1, followed by those of T2,

T3 and T4, in a descending order, respectively. Meanwhile the lightest weights were recorded for chicks of the control group (Table 2). Due to the effect of the hormonal treatments, body weights of post-hatch chicks were heavier than that of the control by 20.74, 15.59, 12.62 and 6.82 % at 4 wk, 13.79, 10.8, 9.50 and 6.54 % at 8 wk, and 10.29, 7.64, 5.62 and 2.83 % at 12 weeks of age for T1, T2, T3 and T4, respectively (Table 2).

On the other hand, neither feed intake nor feed conversion of post-hatch chicks was affected by any variable of this study (Table 2). Viability of the post-hatch chicks was not significantly affected by strain or age of the breeder hens (Table 1). It is worth noting that hormonal injection of eggs on the 9th and 15th days of incubation gave chicks of similar viability percentages which were significantly (P≤0.05) higher than that of chicks hatched from eggs injected on the 17th day of the incubation period (Table 1).

Table (2): Means and standard errors of post-hatch chicks body weight (BW), daily feed intake (DFI) and feed conversion ratio (FCR) as affected by hen strain and age, and time and dose of hormonal injection

Independent variables	Post-hatch chicks BW; g			DFI; g	FCR
	at 4 wk	at 8 wk	at 12 wk	0-12 wk	0-12 wk
Effect of strain:					
Mamourah	307.8 ± 1.09[a]	767.1±2.00[a]	1202.1±2.48[a]	40.94±1.41	2.95±0.10
Gimmizah	305.3 ±1.15[b]	758.1±1.69[b]	1197.4±2.35[b]	41.45±1.61	3.00±0.16
Effect of hen age:					
40 weeks	302.0±1.11[B]	766.1±2.04[A]	1206.7±2.47[A]	41.24±1.21	2.96±0.10
60 weeks	311.0±1.12[A]	758.5±1.63[B]	1192.8±2.36[B]	41.13±1.09	2.99±0.16
Effect of injection time:					
9th day	329.2±0.99[a]	794.4±2.19[a]	1245.5±2.52[a]	38.40±1.58	2.67±0.15
15th day	314.2±1.13[b]	778.9±1.88[b]	1221.1±2.55[b]	39.07±1.74	2.77±0.15
17th day	267.4±1.00[c]	713.8±0.39[c]	1132.6 ±1.13[c]	38.40±1.54	2.94±0.18
Effect of hormonal treatment:					
(T1): 0.02 IU GH	333.0±1.92[a]	802.3±2.85[a]	1256.3±3.65[a]	41.04±1.06	2.83±0.01
(T2): 0.04 IU GH	318.8±1.39[b]	781.1±0.68[b]	1226.8±3.24[b]	40.92±1.85	2.89±0.01
(T3): 0.10 µg Eltroxin	310.6±1.27[c]	772.1±2.22[c]	1203.7±3.29[c]	40.01±1.24	2.88±0.38
(T4): 0.15 µg Eltroxin	294.6±1.39[d]	751.2±2.94[d]	1171.9±2.34[d]	40.83±1.20	3.02±0.01
Control	275.8±0.86[e]	705.1±2.48[e]	1139.7±1.35[e]	37.34±1.51	2.84±0.28

A & B and a, b.... e Means having different superscripts within the same column for each criterion are significantly different at P≤0.01 and P≤0.05, respectively.

In response to the hormonal treatments, viability percentage of chicks hatched from eggs injected with 0.02 IU GH (T1) did not differ significantly from that of the control, but chicks hatched from eggs of the other hormonal treatments (T2, T3 and T4) exhibited significantly (P≤0.05) lower viability percentages with the lowest one recorded with the 0.15 µg Eltroxin treatment (Table 2). Injection of eggs with this dose of Eltroxin (0.15 µg/egg), also increased the embryonic mortality in comparison with the other hormonal treatments (Table 1).

At 12 weeks of age, data of live body weight of post-hatch male and female chicks were separated. Even though male chicks had heavier body weight than female chicks, it appeared that female chicks responded differently from male chicks in their growth, to the effect of the *in ovo* hormonal treatments. In both the two strains, either male or female chicks

hatched from hormonally-injected eggs surpassed their counterparts of the control in live body weight at 12 weeks of age with different accretion rates, being significantly higher within females than within males (Fig. 1A).

As for the effect of breeder hens' age and irrespective of strain, female chicks showed higher rate of accretion in live body weight over that of their counterparts of the control than male chicks hatched from eggs produced by hens of 40 or 60 weeks of age. However, this sex difference was significant ($P \le 0.05$) only for chicks hatched from eggs produced by the 60-week-old hens (Fig. 1B).

Concerning the effect of hormonal injection time on body weight of post-hatch male and female chicks, the results revealed inconsistent trend for the accretions in body weight of chicks hatched from hormonally-injected eggs as a percentage of their controls. Within female chicks higher rate of accretions in live body weight was observed than that found within males hatched from eggs injected on the 9th and 17th days, however, a reversible trend was observed in chicks hatched from eggs injected on the 15th day of the incubation period. Yet these sex differences were not significant (Fig 1C).

Regardless of the aforementioned variables, both male and female chicks hatched from hormonally-injected eggs (T1, T2, T3 and T4) exhibited the same rate of accretion in body weight over their counterparts of the control, with no sex differences (Fig. 1D).

DISCUSSION

The present results indicated pronounced differences in hatchability characteristics and growth performance of hatched chicks as affected by the hormonal treatment (Eltroxin or growth hormone), and the dose of each hormone and time of injection during the incubation period.

In respect with the effects of strain and age of the breeder hens, results of hatchability characteristics are in agreement with those reported by Rizkalla (1996), who found strain differences in egg hatchability and embryonic mortality percentages, hatch weight, and post-hatch growth performance of Fayoumi, Dandarawi and Rhode Island Red (RIR) chicks when the incubated eggs were injected with either Eltroxin or Neo-Mercazole. Also, Aly (2000) found that incubated RIR-eggs had significantly higher hatchability percentage, and lower embryonic mortality rate, and gave chicks of heavier body weight at hatch, when being injected with GH or Eltroxin, as compared to Gimmizah ones.

Mamourah eggs showed a higher hatchability rate and a better growth performance of post-hatch chicks than those of Gimmizah ones. This may be mainly attributed to strain differences in egg weight. Differences in egg weight among various lines or strains of laying hens have been attributed to differences in yolk, albumen, and shell weight (Carey, 1988). Weight of the albumen component has the largest effect on egg weight (Benoff and Renden, 1983). On the other hand, Bray and Iton (1962) stated that initial weight of incubated eggs may act as a temporary influencing factor that may

mask the true genetic differences in embryonic growth among strains of domestic fowl.

Eggs produced by the 40-week-old hens showed a significantly higher hatchability rate and a lower embryonic mortality than did those produced at 60 weeks of age. This may be due to that, egg components of incubated eggs produced by the younger laying hens are in a fairly suitable proportion that can enhance the development of embryos. In contrast, the opposite was observed for hatched-chicks body weight and post-hatch growth performance of chicks. It is known that age of the breeder hen affects egg weight (Reinhart and Hurnik, 1984) and consequently egg components and their ratios (Hussein *et al.*, 1993). Egg weight increases as the laying hen advances in age. The correlation coefficient between egg weight and embryo weight increases to maximum (r=0.90) at hatch (Bray and Iton, 1962). Thus, larger eggs always produce heavier chicks.

With all hormonal treatments, it was found that the heavier egg weight of eggs produced by the older laying hens (60 weeks of age) was reflected in a heavier chicks' hatch-weight. Consequently, this was associated with a higher post-hatch growth performance of chicks as compared to those hatched from eggs produced by the younger hens (40 weeks of age).

As for the effect of injection time, the present study showed that injection of eggs with GH or Eltroxin at the 9th or the 15th day of incubation, gave better results; concerning hatchability, embryonic viability and post-hatch growth performance of chicks, than when injected at the 17th day of incubation. Results of average body weight at hatch agree with those obtained by Mabrouk (1997), who showed that chicks hatched from eggs injected with GH or Eltroxin on the 9th day of incubation had heavier body weight at hatch and achieved a better post-hatch growth performance, compared with other injection times. On the contrary, El-Gendi *et al.* (1997) found that injection of eggs; produced by broiler-type Arbor Acres breeder hens, with either GH or Eltroxin before setting into the incubator reduced the embryonic mortality and increased the hatchability rate, in comparison with injection at the 9th day of incubation.

Regarding the effects of hormonal treatments of the present study, similar results were obtained by Gomaa (1990), Mabrouk (1997) and Aly (2000), who found highly significant increase in hatchability percentage and post-hatch growth performance of chicks hatched from eggs injected with GH or Eltroxin compared with the controls. *In ovo* injection of either ovine or porcine GH increased post-hatch growth in male broilers (Hargis and Pardue, 1989). Kocamis *et al.* (1998) demonstrated that *in ovo* administration of recombinant human IGF-1 altered body weights and tissue development of 42-day-old broiler.

In respect with the aforementioned aspects, Kikuchi *et al.* (1991) reported that serum GH was first detectable on day 12 of embryonic development, but remained under 10 ng/ml until day 20 of incubation. Receptors of GH and its signal transcription mechanisms are developed, starting on about the 12th day of incubation (Porter *et al.*, 1995).

Several authors have found that, in chickens somatotrophs are differentiated during the embryonic stage at day 12-14 and reach a significant level by day 16 (Barabanov, 1991 and Porter *et al.*, 1995).

Moreover. some reports in the literature showed that the localization of GH in the brain and other neural tissues has been determined in chick embryos before and after the differentiation of pituitary somatotrophs. In the brain, GH immuno-reactivity is clearly abundant and widespread during the first third of incubation (Harvey *et al*, 2001). The same authors indicated that GH participates in the growth and differentiation of the chick embryonic brain, cranial nerves, eye, and ear. It is therefore likely that the exogenous GH may improve the growth of the previous organs when it is injected at early stages compared with the later stages of incubation period. So, it was suggested that the improved hatchability rate and weight of chicks at hatch and consequently post-hatch growth performance, may be attributed to an increase in the level of GH in blood circulation of the chicks' embryo. It was reported also that, growth hormone may enhance growth by enhancing the effectiveness of the immune system (Scanes *et al.*, 1984).

In addition, it was reported that in the chicken, there is evidence that exogenous mammalian GH stimulates tibial growth of chicks during embryonic development. Growth hormone has a growth promoting and diabetogenic effect in chick embryos (Hsieh *et al.*, 1952). Holoprotein and glycosylated chicken GH were shown to be effective in increasing the hepatic 5-deiodinase activity in chick embryos (Berghman *et al.*, 1989). Although systematic GH administration increased circulating concentration of other hormones, that influence bone, such as somatomedins which have now been chemically characterized as insulin-like growth factor-1 (IGF-1), and the active vitamin D metabolite in pigs (Klindt *et al.*, 1996), GH stimulated bone formation via direct interaction with bone tissue in rats (Hedner *et al.*, 1996). Recently. Sonksen (2001) reported that GH stimulates many metabolic processes in all cells, but one of its best-known actions is the generation of (IGF-1) which is required for normal growth in chickens (Proudman *et al.*, 1994). However, during chicken embryonic development, IGF-1 gene expression is GH-independent, but in bone tissue is not GH-independent either before or after hatching (Tanaka *et al.*, 1996). Growth hormone stimulates the proliferation of osteoblasts and the differentiation functions of these cells, such as collagen synthesis, osteocalcin expression, and alkaline phosphatase activity (Ernst and Froesch, 1988).

On the other hand, in chicks the thyroid is functional early during the embryonic stage and becomes pituitary-dependent at day 10 to 12 of embryogenesis (Thommes and Jameson, 1980). Maraud *et al.* (1983) stated that during the development of the chick embryo, the thyroid concentrates iodine and synthesizes colloid up to about day 7 and can produce hormones at day 8.5. However, the lack of hypothalamic direction of the thyroid causes it to be quiescent until approximately day 17 in the chick embryo (Christensen, 1978). In the present study, the observed significant increase in hatch weight of chicks due to the *in ovo* injection of the thyroid hormone (Eltroxin) as compared to the control, may be attributed to its effects on the level of energy available for embryonic development, because the thyroid hormones are

known to be the main hormones affecting the energy metabolism. Additionally, thyroid hormones may play a significant role in the embryonic development of gastrointestinal tract in general, and duodenal morphology in particular, and induce the production of the digestive enzymes, maltase, and alkaline phosphatase (Black *et al.*, 1980).

In the present study, the observed less beneficial effects of *in ovo* administration of the thyroid hormone (Eltroxin) than GH on hatchability characteristics indicate the significance of adjusting the suitable injection time of each hormone into eggs. As reported previously that the beneficial effect of GH occurs at the early stage of incubation (Harvey *et al.*, 2001), an asynchronous relationship may persist therefore between the hatching process and metabolic rates of the embryos.

The differences between the physiological effect of GH and thyroid hormone may be related to variations in their half-life period in blood plasma (Hendrick and Turnei, 1967). Also, Murphy *et al.* (2000) found that the distribution of GH immuno-reactivity in chick embryos was very different from the distribution of thyrotropin immuno-reactivity. Furthermore, GH regulates thyroxin secretion and regulates the circulating concentration of T3 in embryos by inducing 5-monodeiodinase activities within the liver cells (Darras *et al.*, 1990).

Concerning the effect of the hormonal doses which were used in the present study, it is worth noting that, *in ovo* injection of the higher hormonal doses showed less marked effects on all hatchability characteristics than the lower doses, being pronounced with GH than with Eltroxin treatments. Booker and Sturkie (1949) reported that the injection of one µg of T4 into the albumen after 6 days of incubation was found to be very toxic. Also in the work of Singh et al. (1968), when T4 was given to chicks in toxic doses, an accelerated catabolism and a depressed body weight were reported. On the other hand, the insignificant effect of increasing the *in ovo* injection dose of T4 or GH may be a function of hypothalamo-hypophyseal- thyroid axis co-ordination (Leung *et al.*, 1984).

Sex differences which were observed in the growth of post-hatch chicks (fig. 1:A, B, C and D), in response to the hormonal treatment of the present study are in partial accordance with those reported by Kocamis et al. (1998) who found that *in ovo* administration of IGF-1 on the 15th or 16th days of incubation period increased the body weight of female broilers, but that of male broilers was increased by the *in ovo* administration of the hormone on day one of the incubation period.

CONCLUSION

From the foregoing results, it could be concluded that several factors can affect the results obtained, following the *in ovo* hormonal treatments designed to improve the hatchability characteristics of incubated eggs. Such factors included genotype (strain), age of breeder hens, injection time and dose, and type of the hormonal substance used.
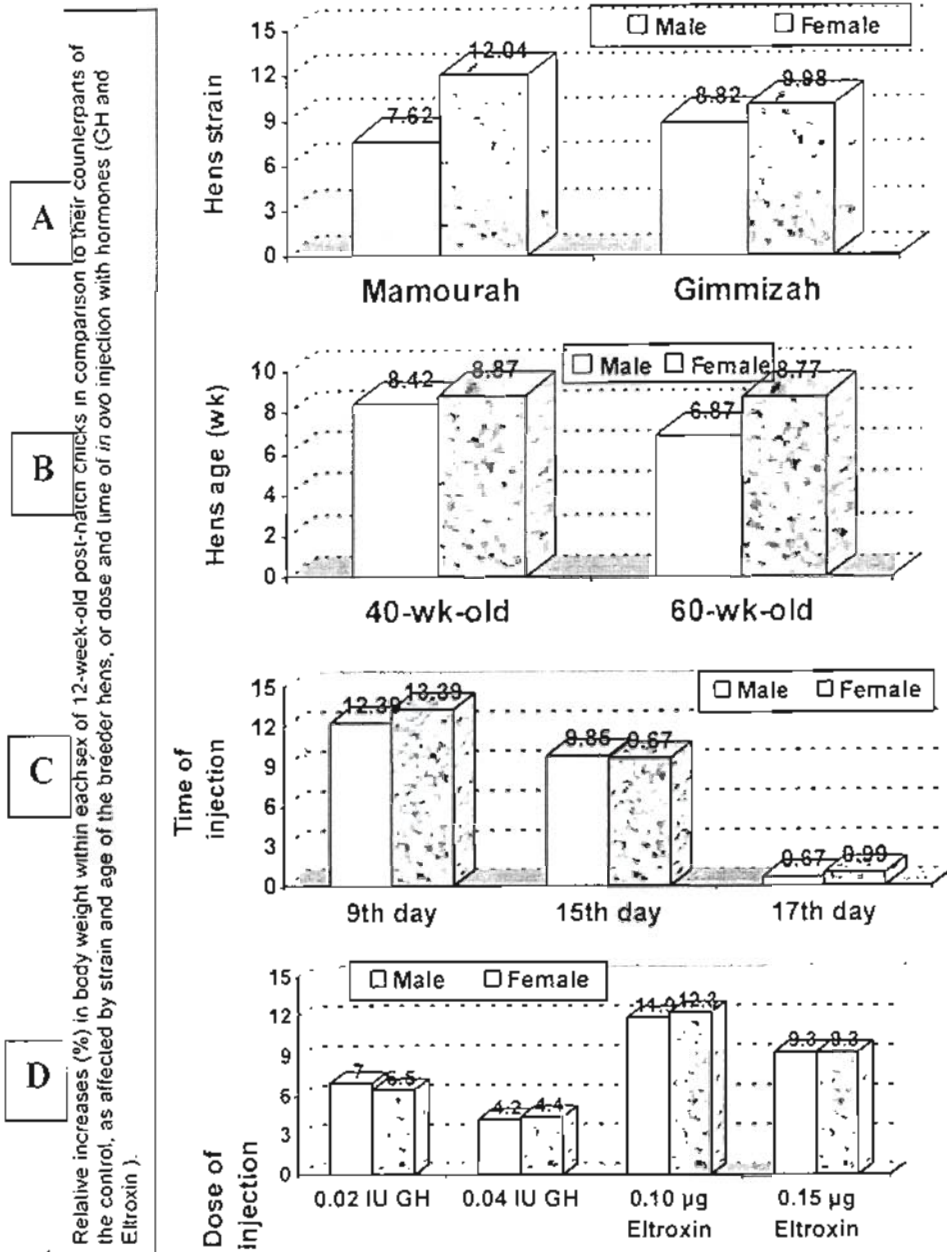
Figure (1): Rate of accretion in post-hatch live body weight within male or female chicks relative to their counterparts of the controls at 12 weeks of age as affected by strain (A), hen age (B), injection time (C) and hormonal treatment(D).

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تأثير حقن بيض التفريخ بهرمون النمو أوالإثروكسين على خصائص الفقس و نمـــو الكتاكيت الفاقسة

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أستهدف هذا البحث دراسة تأثير حقن بيض التفريخ المتحصل عليه من دجاجات سلالتي المعمورة والجميزة عند عمر ٤٠ و ٦٠ أسبوع بمستويات مختلفة من هرمون النمو (٠,٠٢ أو ٠,٠٤ وحدة دولية) أو مستحضر الإثروكسين (٠,١ أو ٠,١٥ ميكروجرام) على خصائص الفقس ونمو الكتاكيت الفاقسه. تم الحقن في اليوم التاسع أو الخامس عشر أو السابع عشر من التفريخ. تم حقن بيض مجموعة الكنترول بالماء المقطر. حقق بيض المعمورة نسبة فقس ووزن فقس أعلى ونسبة نفوق جنيني أقل من بيض الجميزة. أعطى بيض الأمهات عمر ٤٠ أسبوع نسبة فقس أعلى ونسبة نفوق جنيني ووزن فقس أقل مـن بيض الأمهات عمر ٦٠ أسبوع. حقق الحقن الهرموني في اليوم التاسع من التفريخ أعلى نسبة فقس وأعطى وزن فقس وأقل نسبة نفوق جنيني يليه الحقن في اليوم الخامس عشر ثم الحقن في اليوم السابع عشر. حقق الحقن بهرمون النمو نسبة فقس ووزن فقس أعلى ونسبة نفوق جنيني أقل من الحقن بالإثروكسين وكلاهما أفضل من مجموعة الكنترول. كانت أوزان كتاكيت المعمورة أعلى منها السلالة الجميزة عند أعمار ٤ و ٨ و ١٢ أسبوع. حققت الكتاكيت الفاقسة من بيض الأمهات التي عمرها ٦٠ أسبوع أوزانا أعلى عند عمر ٤ أسابيع من الكتاكيت الفاقسة من بيض الأمهات التي عمرها ٤٠ أسبوع ولكن أظهـرت الكتاكيت الناتجة من بيض الأمهات التي عمرها ٤٠ أسبوع تفوقا في وزن الجسم عند أعمار ٨ و ١٢ أسبوع عن الكتاكيت الفاقسة من بيض الأمهات التي عمرها ٦٠ أسبوع.

أثر ميعاد الحقن معنويا على وزن الجسم عند أعمار ٤ و ٨ و ١٢ أسبوع حيث تفوقت الكتاكيت الفاقسة من البيض الذي تم حقنه في اليوم التاسع من التفريخ عن الكتاكيت الفاقسة من البيض الذي تم حقنه في اليوم الخـامس عشـر ثـم تليهـا الكتاكيت الفاقسة من البيض الذي تم حقنه في اليوم السابع عشر من التفريخ. تفوقت أوزان الكتاكيت الناتجة من بيض معامـل بهرمون النمو بتركيز ٠,٠٢ وحدة دولية سواء عند الفقس وعند أعمار ٤ أو ٨ أو ١٢ أسبوع عن بقي المعاملات الهرمونية. وكانت الكتاكيت الناتجة من بيض غير معامل (الكنترول) أقل المعاملات في متوسط وزن الجسم سواء عند القس أوعند أعمار ٤ أو ٨ أو ١٢ أسبوع. لم يتأثر تدريتأثر استهلاك الغذاء أو معدل التحويل الغذائي بسلالة أو عمر الأمهات وكذلك بوقت أو جرعة الحقن الهرموني. لم تتأثر الحيوية بسلالة أو عمر الأمهات. حقق الحقن في اليوم التاسع و الخامس عشر معدل حيوية أفضل للكتاكيت الفاقسة عن الحقن في اليوم السابع عشر من التفريخ. تم تختلف حيوية الكتاكيت الناتجة من البيض المعامل بهرمون النمو بمستوى ٠,٠٢ وحدة دولية معنويا عن بيض الكنترول. كانت حيوية الكتاكيت الناتجة مـن البيض المعامل هرمونيا أعلى منه لمجموعة الكنترول وكانت أقل للكتاكيت الناتجة مـن البيض المحقون بالإثروكسين بمسـتوى ٠,١٥ ميكروجرام.