

**CORRELATION COEFFICIENT BETWEEN THYROID,
PITUITARY, ADRENAL GLAND WEIGHTS AND SOME
CARCASS QUALITY AS AFFECTED BY EXPERIMENTAL
HYPO- AND HYPER THYROIDISM IN FAYOUMI AND
DANDARAWI CHICKS**

RIZKALLA H. E.¹ AND M. S. GADO²

*1 Animal Production Research Institute, Agricultural Research Centre, Ministry of
Agriculture, Dokki, Giza, Egypt.*

2 Faculty of Agric., Zagazig Univ./Benha Branch.

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Abstract

A total of 36 chicks 20 weeks of age were taken by random from a basic population of 300 chicks of two native breeds, the Fayoumi (FF) and the Dandarawi (DD) (150 chicks each). The chickens were injected at hatch by Thyroxine Sodium (T_4) as 1st treatment, by Carbimazole (goitrogenic drug) as a 2nd treatment, and by distilled water as a control, to study the effect of Hypo- and Hyper Thyroidism on weight of some Endocrine Glands (Thyroid, Pituitary, Adrenal) and some carcass quality.

Correlation coefficient values were estimated between Thyroid and each of Pituitary and Adrenal. Correlation coefficient values between edible meat of carcass and each of Thyroid gland weight, Adrenal gland weight and Pituitary gland weight values were also estimated.

Results obtained indicated that, correlation coefficient value between thyroid and pituitary gland weights was high in Fayoumi male than female. The vice versa was noticed with Dandarawi breed.

Thyroid gland weight showed a highly positive correlation with the adrenal gland weight in both male and female chicks of the two breeds under study.

Positive correlation coefficient value was found between thyroid gland weight and edible meat weight of the carcass of either male and female chicks of the two breeds as a result of applying experimental hypo and hyperthyroidism with different rates depending on breed and sex of the chicks. However, these correlation coefficient values were insignificant magnitude.

Correlation coefficient value between adrenal gland weight and weight of edible meat of both Dandarawi and Fayoumi males was increased as a result of experimental hypothyroidism.

Edible meat weight was found to be negatively correlated with the weight of the Pituitary gland.

The obtained results showed responses to thyroid treatment on the correlation coefficient value between edible meat weight and each of adrenal and pituitary weights.

INTRODUCTION

Growth in poultry, as other species, is controlled by a multiplicity of hormones. However, final expression of growth is a result of interactions between nutritional, environmental, and genetic factors with the hormonal activity and control. Obviously, these interactions can be manipulated by management practices to maximize growth rate and feed efficiency and to optimize carcass characteristics. The importance of hormones has tacitly been long recognized by the poultry industry with the use of caponization. However, the considerable potential for further stimulating growth by endocrine manipulation is as yet unfulfilled. The area is likely to be a focus of interest in the coming years.

Growth hormone (GH) has a role in the control of growth and also in aspects of metabolism in poultry. The precise role of GH is not established in birds, although the presence of GH in the circulation is essential for a normal growth rate in domestic fowl and other poultry species .

The role of Thyroid hormones is required for normal growth. Although the relative role of T_4 or T_3 is not fully established, it is likely that T_4 have no major effect on growth, while T_3 depresses the growth rate (May, 1980).

There is abundant and overwhelming evidence that,exogenous-administered glucocorticoids cause a suppression of growth in poultry (Glick, 1960). Furthermore, it is likely that the reduction in growth rate observed in birds exposed to stressful conditions is due to increases in endogenous corticosterone . Glucocorticoids administration decreases nitrogen balance in quail due to largely increased nitrogen excretion (De La Cruz Mataix and Illera, 1981) . Similarly, in the domestic fowl, glucocorticoids increase uric acid excretion (Adams, 1968). It might be noted that the growth of muscle and bones is most dramatically affectedas Bellamy and Leonard (1965) observed no muscle and skeletal growth in cortisol-treated chicks . It is likely that the glucocorticoids exert a direct catabolic effect on the muscles favouring protein degradation over synthesis . However, it might be speculated that the reduction of skeletal growth is mediated by

glucocorticoids depressing somatomedin(s) production . The effect of glucocorticoids is unlikely to be due to changes in GH secretion as long-term glucocorticoid administrations have little effect on the plasma concentration of GH (Harvey and Scanes, 1979).

The hormonal control of growth in poultry and other species is complex . The available evidence supports the concept that growth hormone and the thyroid hormones are the principal hormones responsible for the attainment of normal growth in the domestic fowl . Other hormones, including somatomedins, epidermal growth hormone, sex steroids, and vitamin D metabolites, are also involved in the control of growth .

The present paper discusses the hormonal correlation with edible meat in some native breeds of fowl .

MATERIALS AND METHODS

This study was obtained from two native Egyptian chicken breeds: the Fayoumi (FF) and the Dandarawi (DD) . Total of them was 300 pedigreed at hatch day .

Eighteen male and female Fayoumi and Dandarawi chicks hatched from eggs were injected by Thyroxine Sodium as 1st treatment, by Carbimazole (goitrogenic drug) as 2nd treatment and by distilled water (control) as 3rd treatment just before incubation . The total in the three treatments was 36 chicks taken by random from 300 hatched chicks .

A dose used to induce experimental hyper and hypothyroidism was 0.2 cm³ from solution containing μ g of either Thyroxine Sodium or Carbimazole injected into the air cell region of the incubated eggs .

Chicks of experimental treatment were fed starting ration (19 % crude protein and 2800 k cal / kg ME.) for the first 8 weeks, and then, switched to grower ration (15.37 % crude protein and 2770 k cal / kg ME.) till the 20 st weeks of age .

The chicks were reared in floor brooder up to 8 weeks of age under similar conditions . After brooding period, chicks were transferred to rearing houses till 20 weeks of age. All chicks were weighed for each breed, treatment and sex . The chicks were

slaughtered by cutting the gullet and the jugular veins between the first and the second cervical vertebrae without separating the head from the body . After bleeding, plucking and dressing were carried out . The legs, heads and viscera were separated and considered as inedible portions. The gizzards, livers and hearts were separated and considered as giblets . The carcass and giblets were weighed and considered as edible meat . The three Endocrine glands (Pituitary, Thyroid and Adrenal) were separated and weighed.

Data were analyzed by the use of general linear models (GLM) of stat view 512 + software package (1986 Abacus concepts, Inc.) and calculated the correlations between the glands and between edible meat and glands .

RESULTS AND DISCUSSION

Thyroid x pituitary

Thyroid gland weight was found to be insignificantly correlated with the weight of pituitary gland . Correlation coefficient value differed according to the chicks breed and sex . Its value was high in male Fayoumi than in female chicks of the same breed (Table 1) . However, Dandarawi female chicks had higher Correlation coefficient value between thyroid and pituitary weights 0.481 when compared with males 0.069. This is scientifically logic since thyroid activity and weight are directly controlled by hypophyseal thyrotrophic hormone . The mode of regulation depends mainly on the chicks need of energy to fulfill all the endothermic biochemical reaction in the chicks organism . The insignificant positive correlation coefficient value between thyroid hypophyseal weight may be attributed to variation existed in the metabolic activity which mainly differs according to the balance between anabolic and catabolic metabolism .

In case of either experimental hyper and hypo-thyroidism, the value of thyroid x pituitary correlation coefficient increased reaching a magnitude varied between 0.707 and 0.998 . However, correlation value was higher in case of inducing hyperthyroidism than in case of experimental hypothyroidism. In both cases, correlation value varied according to either chicks sex or breed . Female hyperthyroided chicks of both two breeds showed significantly higher thyroid x pituitary correlation value than females. The same result was obtained in hypothyroided chicks of the both two breeds, but with

lower magnitude (Table 1) .

Table 1. Correlation coefficient value between thyroid and pituitary weights in Fayoumi and Dandarawy male and female hyper - and hypo-thyroided chicks.

Breed	Sex	Control	Thyroxine sodium (Hyper)	Carbimazol (Hypo)
FF	Males	0.419 ns	0.836*	0.707 ns
	Females	0.305 ns	0.935*	0.986*
DD	Males	0.069 ns	0.924*	0.866*
	Females	0.481 ns	0.998**	0.846*

* p < 0.05

** P < 0.01

Thyroid x Adrenal

Thyroid gland weight was highly and positively correlated with the adrenal gland weight . This was quite true in both male and female chicks of both two breeds under study . Its value exceeded a magnitude of 0.9 in controls and varied between 0.919 to 0.999 (Table 2) . On the other hand, increasing thyroidal hormone (thyroxine) did not greatly affect the correlation coefficient value between the weights of the two glands . It varied between 0.919 to 0.999. However, response to treatment (experimented hyperthyroidism) varied according to birds sex and breeds . Treating Fayoumi male chicks with thyroxine slightly decreased value of correlation coefficient (from 0.999 to 0.984), while, it increased the correlation value in female chicks (from 0.919 to 0.999) . Opposite results were found in Dandarawi chicks in respect to the response of either female and male chicks to thyroid treatment . Correlation coefficient value slightly increased in males (from 0.979 to 0.981), while, it decreased in female chicks (from 0.999 to 0.919) .

Experimental hyperthyroidism greatly decreased the magnitude of correlation coefficient value between thyroid and adrenal weights in Fayoumi male and female chicks . It decreased from 0.999 and 0.919 in male and female controls to 0.394 and 0.378 in male and female hypothyroided chicks, respectively. Dandarawi chicks showed quite different response to the induction of thyroid hypofunction. Correlation coeffi-

cent value between thyroid and adrenal weight slightly decreased and maintained around a value of 0.9 in either male and female Dandarawi chicks .

High and significant correlation coefficient value between thyroid and adrenal gland weights may be attributed to the sinergetic action between the activity of the two glands in the process of supplying energy sources needed to the biological activity of the chicks organism. Any changes or modifications in one gland may affect the activity rate of the other . It is well known that there is a certain relation between the energy metabolism and the level of cortisol output . Cortisol is activated in case of insufficient carbohydrate for energy metabolism . It facilitates the process of energy metabolism from noncarbohydrate soures in case of carbohydrate deficiency (Gado, 1996) .

Table 2. Correlation coefficient value between thyroid and adrenal weights in Fayoumi and Dandarawy male and female hyper - and hypo-thyroided chicks

Breed	Sex	Control	Thyroxine sodium (Hyper)	Carbimazol (Hypo)
FF	Males	0.999**	0.984*	0.394 ns
	Females	0.919*	0.999**	0.378 ns
DD	Males	0.979*	0.981*	0.927*
	Females	0.999**	0.919*	0.937*

* p < 0.05

** P < 0.01

Correlation coefficient between edible meat of carcass and :

1. Thyroid gland weight

correlation coefficient value between thyroid gland and edible meat weight of carcass seemed to be of low and insignificant values in male and female Fayoumi and male Dandarawi chicks (Table 3) . However, its magnitude was significantly high in female Dandarawi birds . This may be attributed to effect of the sexual hormones that increased the nitrogen retention and fat mobilization in a certain adipose tissues, specially under the skin . This may affect the weight of the edible meat . Experrimental hypo and hyperthyroidism increased the value of the correlation coefficient between thyroid

weight and the weight of edible meat. However, negative significant ($p < 0.05$) and high correlation was found in hyperthyroided male Fayoumi (- 0.985), while, negative high but insignificant correlation coefficient value was high in male Dandarawi chicks. Applying experimental hypothyroidism resulted in high and significant positive correlation coefficient value between thyroid weight and weight of edible meat of the male and female carcass of Fayoumi. The correlation was high but with insignificant magnitude in male and female Dandarawi chicks .

Thus, it could be concluded that, in spite of low correlation coefficient value found between thyroid gland weight and edible meat of carcass of either male and female Fayoumi and Dandarawi chicks, it was increased as a result of applying experimental hypo- and hyperthyroidism with different rates depending on breed and sex of the chicks .

Table 3. Correlation coefficient value between thyroid and edible meat in Fayoumi and Dandarawi male and female hyper - and hypo-thyroided chicks.

Breed	Sex	Control	Thyroxine sodium (Hyper)	Carbimazole (Hypo)
FF	Males	-0.370 ns	-0.985*	0.981*
	Females	0.178 ns	0.906*	0.932*
DD	Males	-0.122 ns	-0.832 ns	0.960 ns
	Females	0.922*	0.998*	0.866 ns

* $p < 0.05$

2. Adrenal gland weight

Except female Dandarawi chicks which showed high positive and significant correlation coefficient value (0.904) low insignificant correlation values were found in male Dandarawi and Fayoumi chicks of both sexes (Table 4) .

Hypothyroidism increased correlation coefficient value between adrenal gland weight and weight of edible meat of male Dandarawi and Fayoumi . It showed 0.938 and 0.924, respectively . On the other hand, female chicks of both breeds showed negative low insignificant correlation coefficient value . It was observed - 0.0687 and 0.259 for female Fayoumi and Dandarawi chicks, respectively. On the other hand, insig-

nificant correlation as a result of inducing experimental variable magnitudes were found hypothyroidism . The highest correlation values in this case were found in female Fayoumis (- 0.688) and male Dandarawi chicks (0.785) treated with a goitrogenic material . However, both male Fayoumi chicks and carbimazol female Dandarawi ones showed the lowest correlation coefficient values that not exceeded magnitude of 0.2, (it weighed - 0.211 and - 0.269 for female Fayoumi and male Dandarawi chicks, respectively) .

Table 4. Correlation coefficient value between adrenal and edible meat in Fayoumi and Dandarawy male and female hyper - and hypo-thyroided chicks.

Breed	Sex	Control	Thyroxine sodium (Hyper)	Carbimazole (Hypo)
FF	Males	-0.320 ns	0.938*	-0.211 ns
	Females	0.093 ns	-0.067 ns	- 0.688 ns
DD	Males	0.083 ns	0.924*	0.785 ns
	Females	0.904*	-0.259 ns	-0.269 ns

* p < 0.05

3. Pitintary gland weight

Edible meat weight was found to be negatively correlated with the weight of the Pituitary gland . It reached a value of - 0.999 in males of both Fayoumi and Dandarawi chicks and showed -0.991 in female Fayoumi . However, insignificant and relatively low correlation coefficient value was found in female Dandarawi chicks (- 0.768) (Table 5).

In hyperthyroided chicks, significant possitive correlation coefficient values were observed in male Fayoumi (0.821) and female Dandarawi (0.994) chicks only .

However, applying experimented hypothyroidism resulted in negative significant (p < 0.05) correlation coefficient in female Fayoumi, (- 0.857) and positive significant (p < 0.01) correlation coefficient in female Dandarawi chicks (0.999) only .

Obtained results showed responses to thyroid treatment on the correlation coefficient value between edible meat weight and each of adrenal and hypopheseal weights. This may be accepted from the physiological side of view . The thyroid gland activity

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mainly affects the level of energy metabolism which was correspondingly reflected as a modification in various biochemical reactions including rate of growth.

Table 5. Correlation coefficient value between pituitary and edible meat in Fayoumi and Dandarawy male and female hyper - and hypo-thyroided chicks.

Breed	Sex	Control	Thyroxine sodium (Hyper)	Carbimazole (Hypo)
FF	Males	-0.999**	0.821*	0.559 ns
	Females	-0.991**	-0.375 ns	-0.857*
DD	Males	-0.999**	0.558 ns	0.144 ns
	Females	-0.768 ns	0.994*	0.999**

* p < 0.05

** P < 0.01

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معامل الارتباط بين وزن كل من الغدة الدرقية والنخامية وفوق الكلية وبعض صفات الذبيحة تحت تأثير زيادة أو قلة نشاط الغدة الدرقية التجريبي في دجاج كل من الفيومي والدندراوى

حكيم أرنست رزق الله^١، محمد صفوت جادو^٢

^١ معهد بحوث الإنتاج الحيوانى، مركز البحوث الزراعية، وزارة الزراعة، الدقى، جيزة، مصر
^٢ كلية الزراعة، جامعة الزقازيق، فرع بنها.

تم انتخاب ٣٦ طائراً عمر ٢٠ أسبوع بطريقة عشوائية من القطيع الأساسى المكون من ٢٠٠ كتكوت من سلالتى الفيومي والدندراوى (١٥٠ كتكوت لكل منهما). حققت الكتاكيت عند الفقس بمستحضر ثيروكسين الصوديوم (معاملة أولى)، كريمازول "مضاد الثيروكسين" (معاملة ثانية) وبماء مقطر "مجموعة مقارنة" (معاملة ثالثة) وذلك لدراسة تأثير زيادة أو نقص نشاط الغدة التجريبي على معاملات الارتباط بين كل من الغدتين الدرقية والنخامية، وكذا الدرقية وفوق الكلية وبين الجزء المأكول من الذبيحة وكل من وزن الغدة الدرقية، وزن غدة فوق الكلية، وزن الغدة النخامية. أشارت النتائج التى تم التوصل إليها إلى ارتفاع قيمة معامل الارتباط بين وزن الغدتين الدرقية والنخامية فى ذكور الفيومي عند مقارنتها بالإناث بينما كانت النتائج عكسية بالنسبة للدندراوى حيث تفوقت الإناث على الذكور. كان معامل الارتباط عالياً وموجباً بين كل من الغدتين الدرقية وفوق الكلية فى كل من ذكور وإناث النوعين تحت الدراسة. إزداد معامل الارتباط بين وزن كل من الغدة الدرقية ومحصول اللحم فى ذكور وإناث الفيومي والدندراوى كنتيجة لتطبيق زيادة أو نقص نشاط الغدة الدرقية التجريبي على الرغم من عدم معنوية هذا المعامل. بالرغم من انخفاض قيمة معامل الارتباط بين وزن الغدة الدرقية ومحصول اللحم فى ذبيحة كل من ذكور وإناث الفيومي والدندراوى إلا أن النتائج تشير إلى زيادة فى المعاملة سواء بالمستوى المنخفض أو المرتفع من الثيروكسين مع اختلاف المعدل الذى يعتمد على النوع والجنس فى الكتاكيت. أدى استعمال مضاد الثيروكسين إلى زيادة قيمة معامل الارتباط بين وزن الغدة فوق الكلية ومحصول اللحم لذكور الدندراوى والفيومي وكان معامل الارتباط سالباً بين وزن محصول اللحم ووزن الغدة النخامية. لوحظ من النتائج المتحصل عليها شدة استجابة معامل الارتباط بين وزن محصول اللحم وكل من وزن الغدتين فوق الكلية والنخامية بالمعاملات التجريبية للغدة الدرقية.