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The Influence of Age, Gender, Type of Pregnancy, and Climatic Variations on the Serum T3 and T4 Hormones Profile in Growing Awassi Sheep

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Abstract

Background: The growth of lambs is influenced by several nutritional, genetic, and metabolic endocrine factors. Lambs that are fed on a high-level nutrient-dense diet exhibit quicker growth than those on a less aliment-fed diet. In addition, 3-5-3′-triiodothyronine (T3) and thyroxine (T4) are the key hormones that regulate nutrient utilization and partitioning.

Objective: This study investigates the thyroid activity in Awassi lambs in relation to the sex of the animal, season, and the type of pregnancy (single & twin) by the direct measurement of the serum concentration of T3 and T4 at various growth stages.

Method: This study was conducted by utilizing a total of 19 animals of two-weeks old Awassi lambs (single and twins). The lambs were weaned gradually at the end of the second week of age and fed concentrate and hay. Blood samples were then collected, which was subsequently followed by the measurement of serum T3 and T4 concentrations by utilizing radioimmunoassay (RIA).

Results: Our data reveal a significant ($p<0.01$) drop in T3 at 14 weeks of age, while serum T4 in females was significantly higher ($p<0.05$) as compared to males. We conclude that the sex of the animal and the type of pregnancy had no impact on the thyroid hormonal values.

Discussion and Conclusion: Our results revealed variations in the levels of TH due to the impact of several determinants, including sex of the animal, type of pregnancy, and age of the lambs. Our data revealed TH mostly declines during warmer temperatures, and remains high at colder temperatures. Our study suggests that an increase in the ambient temperature between April-May in Iraq may play a significant role in the hormonal fluctuation process in lambs. The decline in the T3 and T4 values reflect the depression in thyroid activity.

Keywords: *Awassi Lambs, T3, T4.*

Introduction

The Awassi is the most widespread type of sheep in Southwest Asia and it's the dominant breed in Iraq, and Syria, and it's the only indigenous breed of sheep in Lebanon, and Jordan. One of the drawbacks of the Awassi is their rate of reproduction — ewes typically lamb just once/year and usually give birth to just one lamb. Furthermore, thyroid hormones (TH) are important modulators for developmental processes, general metabolism, and thermogenic adaptation to the environmental temperature in both humans and animals.[1,2] These hormones play a crucial role

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in productive performance such as milk secretion, growth, and hair fiber production in domestic farm animals, including small ruminants. Hence, TH blood concentration may potentially be considered as an indicator of the metabolic and nutritional status of these animals.[15] The effect of the sex of the animal on thyroid activity in newborn and growing animals is somewhat contradictory.[9]

While several studies have previously indicated that higher levels of T3 and T4 were found in male lambs and kids as compared to females[5], other findings have reported that both hormones were significantly higher in female lambs as compared to their male counterparts.[6,23] Furthermore, other studies have presented doubtless indication concerning the contribution of TH in the adaptation to NEB status in the course of certain endotoxin-mediated diseases, and in the process of resumption of cyclic ovarian function involving the postpartum dairy cows.[22] It has been reported that T3 level in both genders is almost identical to those in humans, however, whereas the T4 levels were higher in females than males, although other groups have reported inverse results.[7,8,9] Furthermore, due to its high sensitivity to climatic variations, the thyroid gland function has shown to be influenced by the presence of specific variations that occur at regular intervals for less than a year. Most of the abovementioned studies have concluded that the maximum values of hormonal levels were observed during the low temperatures of winter months as compared with the temperature of summer months in sheep[14,19], ram lamb[15,17], and goats.[3,18] The latter can be explained as high temperature depresses the thyroid gland activity.[10,12,11] However, in camels, the inverse result was recorded, and the levels of T3 and T4 hormones showed a higher value in summer months than those in winter.

Our investigation reveals a significant correlation between thyroid gland activity and the growth rate in rapidly growing lambs by maintaining metabolism in tissues at optimal values.[12,16] In addition, adverse effects on the growth rate have been indicated if the hormonal values fall out of range. It has been reported that when T3 hormone levels were higher during the first month in lambs and kids compared to those of the other three months.[5]

There is currently no comprehensive analysis pertinent to TH association with respect to, sex, season and climatic changes, or the pregnancy type in lambs. Our study investigates the levels of serum T3 and T4 in the growing male and female Awassi lambs (singleton and twin pregnancies) in Baghdad province at 2, 4, 6, 10, 14,18, 22, and 26 weeks of age.

Materials & Methods

A. Animals

This study was conducted by utilizing a total of 19 Awassi lambs, comprising 8 males and 11 females. The lambs were two weeks old and raised as flocks at Al-Shualla station, Agricultural Research, Iraq. All lambs were weaned gradually starting from the end of the second week of age by reducing milk intake. The weaning was complete at the 12th week of age and then it was replaced by concentrate and hay feeding. The lambs were housed in free stalls under normal ambient temperature.

B. Blood Sampling

Blood samples were collected from the jugular vein at 2-weeks of age and continued on a 2-week interval for a 6-month period (November-May). Blood samples were stored in the absence of anticoagulant factors, and the serum was collected from each sample after centrifugation and stored at -20^{o} C until analysis.

C. Radioimmunoassay

Serum T3 and T4 concentrations were measured by RIA kits (Amersham, UK).

D. Statistical Analysis

Data were analyzed by the analysis of variance (ANOVA), and means were further tested by Duncan's multiple range tests (as a post hoc test). A p-value <0.05 was considered statistically significant. Each result is the mean ± the standard deviation of the values obtained from six replicates.[20]

Results

Our study exhibits high T3 hormone values at 2 and 4 weeks of age. In addition, our investigation revealed a significant decrease (p<0.01) in the level of T3 hormone at 14 weeks of age in both sexes as compared to its levels at 2 and 6 weeks of age (Figs.1,2). Furthermore, our data indicate that thyroid hormone

levels at 18 weeks have returned to the same levels observed between 6 and 10 weeks of age. Moreover, T3 relapsed again and started to decline gradually from week 22 up to week 26 of age. Furthermore, our results indicate there were significant differences between the drop of T3 hormone levels at 14 and 26 weeks in both sexes (Fig.1, 2), while there were no variations seen in the level of the T3 hormone level between males and females (Fig.3). Our results revealed the absence of the sex of the animal impact on the thyroid T3 levels. It is worth mentioning that a high level of T4 was reported in female lambs which were significantly higher (p<0.05) than males (Fig.4). Our results have demonstrated that clear differences were observed between T4 levels at 2, 4, 10, and 18 weeks of age in both sexes (Fig.4), although there are no explanations for the sharp drop in the T4 level at 6 weeks. However, the gradual decline at 22 and 26 weeks referred to the increase in the ambient temperature. A significant difference (p<0.01) was reported between these values at 6 and 22 weeks in comparison with those of all other weeks of the study except for that of 26 weeks of age. Furthermore, no variations were seen in the levels of TH with respect to the type of pregnancy. Our statistical analysis has indicated there were no differences between the levels of TH in single and twin male or female lambs. Our results indicate that type of pregnancy had no impact on T3 and T4 hormones values (Figs.1, 2, 5, 6).

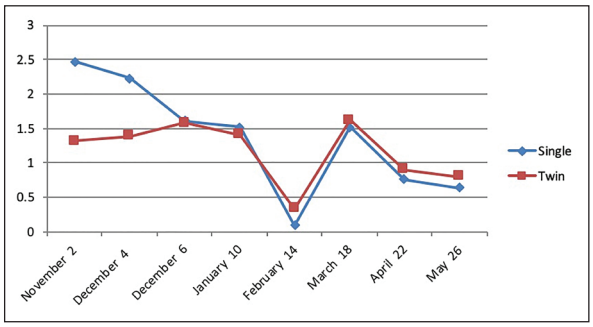

Fig. 1: T3 concentration (ng/ml) in male lambs

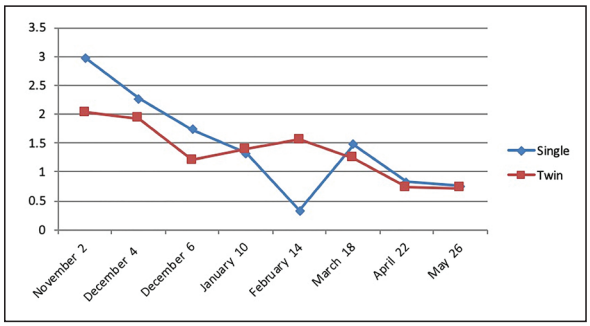

Fig. 2: T3 concentration (ng/ml) in female lambs

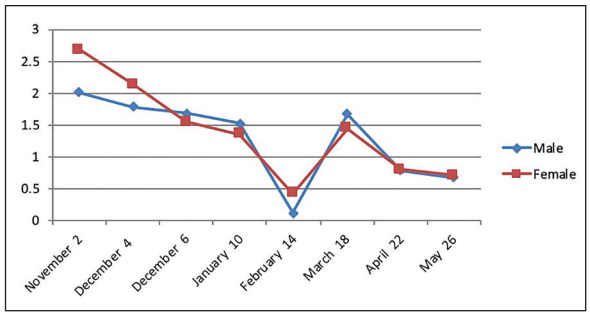

Fig. 3: T3 hormone levels (ng/ml) in male and female Awassi lambs

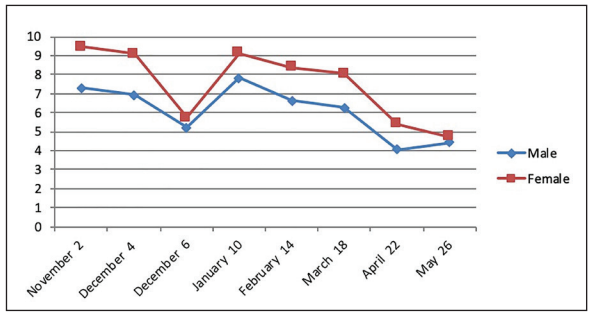

Fig. 4: T4 hormone levels (ng/ml) in male and female Awassi lambs

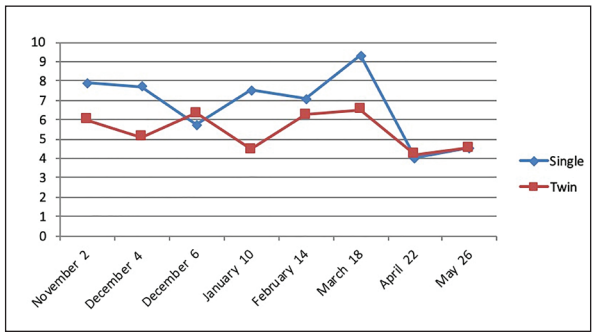

Fig. 5: T4 concentration (ng/ml) in male lambs

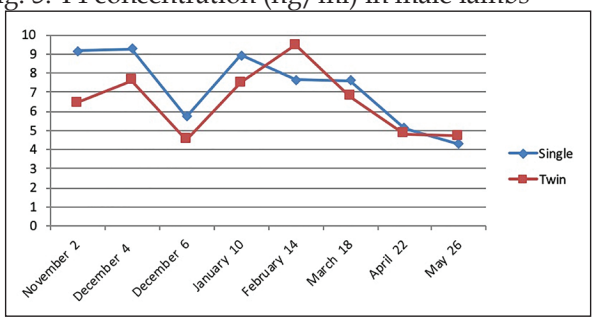

Fig. 6: T4 concentration (ng/ml) in female lambs

Discussion

Thyroid function in rapidly growing animals is

highly influenced by the stage of maturity, growth hormone secretion, and the differences in appetite.[12] This investigation revealed the presence of high T3 hormone values at 2 and 4 weeks of age. These findings are in agreement with previous studies, which also revealed high T3 hormonal levels in lambs and kids during the first month of age.[5] Furthermore, this study revealed a significant decrease in the T3 levels at 14 weeks of age in both sexes as compared to its levels at 2 and 6 weeks of age (Figs.1, 2). These variations in the hormonal levels have been indicated at weaning in previous studies.[21] The decline in the T3 and T4 values reflects the depression in thyroid activity[10,12]. Furthermore, no variations were seen in the level of the T3 hormonal level between males and females (Fig.3). These results revealed the absence of the impact of the sex of animals on the thyroid T3 levels which indicates that our results are in consonance with the findings of another study that was previously conducted in humans.[9,18] Moreover, our data which pertain to the T4 high levels in female lambs as compared to the male counterparts concur with results from previous studies.[6] However, other studies have reported that T3 and T4 were significantly higher ($p<0.01$) in males than females.[19] These results were also demonstrated that clear differences were observed between T4 levels at 2, 4, 10, and 18 weeks of age in both sexes (Fig.4). There is currently no explanation for the sharp drop in the T4 level at 6 weeks, however, the gradual decline at 22 and 26 weeks referred to the increase in the ambient temperature. A significant difference ($p<0.01$) was reported between these values at 6 and 22 weeks in comparison with those of all other weeks, except for that of 26 weeks of age.

Furthermore, no variations were seen in the levels of TH in regard to the type of pregnancy. Statistical analysis indicated no differences between single and twin male or female lambs. It is worth mentioning that little information is known concerning the relationship between thyroid hormone levels and type of pregnancy. Therefore, and according to the results of this study, it can be concluded that the type of pregnancy has no effect on T3 and T4 hormone values (Figs.1,2,5,6).

Conclusion

Our study revealed variations in the levels of TH due to the impact of several determinants, including sex of the animal, type of pregnancy, and age of the lambs. Our preliminary data reveal that TH mostly declines during warmer temperatures, and remains high at colder temperatures, which make this element worthy of further investigation. Awassi sheep represent an important economic component of the agricultural economy. Our data also suggests that an increase in the ambient temperature between April-May in Iraq may play a significant role in the hormonal fluctuation process in lambs. The decline in the T3 and T4 values reflects the depression in thyroid activity.[10,12] Hence, we recommend conducting further studies on a larger sheep population in various provinces to determine the elements that may impact the thyroid hormonal levels and their influence on the growth.

Ethical Clearance

This study was conducted according to the protocols of the Veterinary Directorate, which were ***adopted by the American Physiological Society.***

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Veterinary Directorate.

Conflict of Interest

None declared.

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