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RELATIONSHIP BETWEEN THE LEVELS OF TRIIODOTHYRONINE (T3), PARATHERMONE (PTH) HORMONES AND SOME BIOCHEMICAL CHANGES IN BLOOD SERUM OF BUFFALO CALVES AT ASSIUT GOVERNORATE.

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ABSTRACT

Thyroid hormones have been recognized to be important in establishing the animal performance as, growth, maturation, reproduction, production and adaptation. The aim of this work was the estimation of triiodothyronine (T3) and parathermon (PTH) hormones concentrations and their relations with some serum biochemical levels in buffalo calves. A total number of 50 male buffalo calves divided into two groups according to their age, 20 animals (3 to 6 months age) and the other 30 ones (6-9 months age). These animals were apparently healthy male buffalo calves selected from a privet farms at Assiut governorate. Blood serum sample were used for determination of triiodothyronine (T3) and parathermon (PTH) hormones concentrations and the total protein, albumin, globulin, glucose, cholesterol, calcium, phosphorus, and magnesium levels. The results indicated a significant decrease of both blood serum hormones (Triiodothyronine (T3) and Parathermone (PTH) concentrations in the older age group of buffalo calves were collected. There were a significant difference between the two age groups in both cholesterol and glucose levels. The mean values of calcium and magnesium showed significant difference between the two age groups. The correlation coefficient (r) between the estimated blood serum Triiodothyronine (T3) concentrations and the different biochemical parameters only showed significant changes for glucose and cholesterol levels. Also, there was negative correlation only between parathermone (PTH) and, calcium, phosphorus, magnesium levels. Based on the current study, it could be concluded that the recorded biochemical parameters found to be lower than that recorded by other studies and this may attributed to many factors. The nutritional factor could be controlled for buffalo calves in Assuit province by giving balanced ration to improve such parameters and consequently improving animal performance.

Key words: *Triiodothyronine, parathermon, buffalo calves, minerals.*

INTRODUCTION

The thyroid gland follicular cell produce thyroid hormones, (Triiodothyronine T_3 and Thyroxin T_4), The concentration of T3 is much less than T4 but its metabolic potency is much greater, released to the circulation and act at many different target cell in the body Jones *et al.* (1997). In ruminants the external Parathyroid lie cranial to the thyroid gland and the pair of internal Parathyroid are embedded in tissue and chief cells secrete Parathyroid hormone (Dybdal, 1996).

Thyroid hormones have been recognized to be important in establishing and maintaining several functions in the animal including growth, maturation, reproduction, lactation and adaptation. They don't have specific target organ, but exert their effects on almost every tissue or cell in the body (Jubb *et al.,* 1993 and Kaneko *et al.,* 1997).

It is possible that thyroid hormones affects blood serum chemistry in animals especially calf just like it does all systems in the body (Smyth *et al.,* 1996; Hammon and Blum1998a and Rozike, 2011).

Thyroid hormones are believed to have anabolic actions, because thyroid deficiency states are accompanied by poor muscle growth, development and function. The thyroid hormones maintain the homeostasis of energy and protein metabolism. Thyroid hormones have a biphasic effect on protein synthesis, at normal physiological levels it increases the rate of protein synthesis but in contrast their higher levels lead to breakdown of protein (Huszenicza *et al.,* 2002). Many factors (e.g., gender, age and other physiological status) have complex effect on their blood levels, there is a little information about the changes of plasma thyroid hormones concentrations during different ages of domestic animals (Todini, 2007).

Amin *et al.* (2004) concluded that the thyroid hormones involved in the regulation of glucose and cholesterol levels highest in hypothyroidism, so recommended monitoring serum total cholesterol and

glucose levels should be carried out periodically to early detect hypothyroidism before appearance of its symptoms. Moreover, these hormones also affect carbohydrate absorption, glycogenolysis, gluconeo-genesis, and lipid metabolism.

Parathyroid or parathormone elevated serum calcium level with increase calcium resorption from bone and increase phosphate excretion by the kidney aswellas ion exchange between the extracellular fluid and bone fluid across the osteocytic membrane Bekeova *et al.* (1997). Meanwhile, the action of parathyroid is calcium mobilizing and phosphate excretion, and stimulate osteoclastic activity and the action of vit Dincreasing calcium absorption from intestine and rsorption from bone are enhanced by parathormone and the magnesium ions appear to have asimilar regulatory action on parathyroid hormone secretion.

Improved buffalo production could significantly enhance the economy and the living standards of farmers in countries where buffaloes predominate, particularly, in countries with a tropical climate (Sharma *et al.,* 1985 and Kobeisy and Shetaewi, 1992).

The study of blood biochemical composition of the growing animals has received a great significance from the stand point of nutrition, because levels of various blood constituents often serve as a valuable guide in evaluating the nutritional adequacy of the diet as well as the nutritional status of the animal (Ingole *et al.,* 2012).

The aim of this work was to estimate the blood levels changes of the thyroid (triiodothyronine, T3) and parathyroid (parathermon, PTH) hormones and the effect of such hormonal changes on some serum biochemical levels in buffalo calves.

MATERIALS and METHODS

1- Animals:
A total number of 50male buffalo calves divided into two groups according to their age, 20 of them (3 to 6 months age) and the other 30 (6-9 months age). These calves were apparently healthy selected from a privet farms at Assiut governorate.

2- Samples:
Blood serum samples(without anticoagulants) were collected through jugular vein puncture to obtain clear non haemolysed sera and kept in clean dry 1.5 ml tubes (Eppendr of tubes), stored at 20°C until testing.

Blood serum sample were used for spectrophtometric determination of glucose (Garaway, and Watts, 1987) total protein (Henry *et al.,* 1974), albumin (Doumas *et al.,* 1971), (globulin mathematically), total cholesterol (Stein, 1986), calcium (Gindler, 1972), phosphorus (Goldenberg, 1966), magnesium (Bohuon, 1962) by using standared test kits supplied by (Spectrum Diagnostic).

The hormones assay:
Standard methods of biochemical analysis were used for determination of blood serum triiodothyronine (T3) and parathermon (PTH) hormones using Enzyme-Linked Immunosorbent Assay (ELISA) in all the blood serum samples using commercial test kits supplied by CDI (CAL-TECH DIAGNOSTICS, INC.) Chino, California, U.S.A Cat. #: MDO28-96 according to Chopra (1979) and manufacture instructions.

Statistical analysis: General linear model analysis of variance (GLM- ANOVA) was performed on the data using SPSS packageV.11.5 (SPSS, 2002). The means were compared with comparison-wise standard error (SE) after significant P- value. Pearson product moment correlation (PPMC) (r) was performed on the relation of T3 and PTH with the different biochemical parameters in this study.

RESULTS

The recorded mean values of blood serum Triiodothyronine (T3) and Parathermone (PTH) concentrations in the two age groups of buffalo calves are recorded in (table 1). The effect of age on the hormone levels was significant, it was found that both T3 and PTH were ignificantly ($p \leq 0.01$), ($p \leq 0.001$), decreased in the older group of calves (6-9) months than that of younger calves (3-6 months age).

The mean values of serum total protein, albumin, globulin, cholesterol, and glucose concentrations in two age groups of buffalo calves are recorded in (table 2). The effect of age was non-significant with total protein, albumin and globulin. While there were a significant ($p \leq 0.01$) increase of both cholesterol and glucose levels in older group of calves (6-9) months than that of younger ones.

The mean values of serum calcium, phosphorus, magnesium concentrations in two age groups of buffalo calves are recorded in (table 3). Where the mean values of calcium and magnesium showed significant increase ($p < 0.05$), ($p \leq 0.01$) respectively in older group of calves than of growing ones, but there was a non-significant changes of phosphorus mean values between the two age groups of calves.

The correlation coefficient (r) between the estimated blood serum Triiodothyronine (T3) concentrations and the different biochemical parameters measured in this study (table 4) were non-significantly changed between the two age groups of calves for calcium, phosphorus, magnesium, total protein, albumin, and globulin and it was significantly changed for glucose and cholesterol.

There was negative correlation between parathermone (PTH) hormones and the, calcium, phosphorus, and magnesium, contents, while cholesterol, glucose, total protein, albumin and globulin showed non-significant correlation.

Table 1: Serum Triiodothyronine (Tʒ) and Parathermone (PTH) hormones concentrations (Mean± S.E) in two age groups of male buffalo calves:

Parameters	3 - 6 month	6-9 month
Tʒ(ng/ml)	1.15±0.07	0.67±0.04**
PTH(pg/ml)	6.41±0.27	3.18±0.25***

= highly Significant (p≤ 0.01) * very highly Significant (p≤ 0.001)

Table 2: Mean values (Mean± S.E) of some serum biochemical parameters in two age groups of male buffalo calves:

Parameters	3 -6 month	6-9 month
Total protein (g/dl)	5.28±0.12	6.31±0.16ns
Albumin(g/dl)	2.41±0.03	2.90±0.05ns
Globulin(g/dl)	2.80±0.03	3.38±0.04 ns
Cholesterol(mg/dl)	39.85±1.57	66.15±4.01**
Glucose (mg/dl)	31.42±0.95	48.33±1.37**

**= highly Significant (p≤ 0.01) ns=non-significant

Table 3: Mean values (Mean± S.E) of some serum minerals in two age groups of male buffalo calves:

Parameters	3 - 6 month	6-9 month
Calcium(mg/dl)	8.53±0.29	10.16±0.16*
Phosphorus (mg/dl)	5.60±0.13	5.98±0.10ns
Magnesium (mg/dl)	1.84±0.038	2.14±0.035**

* = Significant (p< 0.05) **= highly Significant (p≤ 0.01) ns=non-significant

Table 4: The correlation coefficient (r) and level of significance (P) between the estimated blood serum Tʒ and PTH concentrations and the different biochemical parameters measured in this study.

Parameters	Tʒ		PTH	
	R	p	r	P
Calcium	-0.044	0.521ns	-0.291	0.039*
Phosphorus	-0.032	0.404 ns	-0.243	0.021*
Magnesium	-0.078	0.142ns	-0.375	0.022*
Glucose	-0.399	0.023*	-0.099	0.115ns
Cholesterol	-0.245	0.040*	-0.392	0.219ns
Total protein	-0.021	0.123 ns	-0.030	0.131ns
Albumin	-0.098	0.089ns	- 0.086	0.127ns
Globulin	-0.031	0.087ns	-0.024	0.103ns

* = Significant (p< 0.05) ns=non-significant

DISCUSSION

The judgment of the thyroid state under field practice was depending mainly on the values of thyroid hormones in the serum of farm animals (Sokkar *et al.,* 2000; McGavin *et al.,* 2001 and Abou El-Hassan., 2003) as an indicator of the thyroid activity.

The effect of age on plasma thyroid hormones levels was investigated in some farm animals and human. In most studies, the highest levels of thyroid hormones were reported during the first period of life, and with age advance adecrease of these hormone levels was recorded (Todini, 2007 and Eshratkhah *et al.,* 2010).

The present study showed that the mean value of triiodothyronine (Tʒ) concentration (table, 1) in male buffalo calves at 3-6 months and 6-9 months were 1.15±0.07 ng/ml and 0.67±0.04ng/ml respectively. these values were lower than those recorded by El-Barody *et al.,* 1998, who recorded 0.925 ng/ml at age from 6-9 months, while, Huszenicza *et al.,* 2002 recorded a range from 0.9 to 2.9 ng/ml as normal calve serum T3 levels and Behrad *et al.,* 2010, recorded 1.53±0.25ng/ml at age from 3-6 months.

There were inverse relationship between age and serum T3 and parathermon (PTH) concentrations in buffalo calves in the present study as Tʒ and PTH decreased by increasing age. Such decrease in the concentration of Tʒ by increasing age may be explained by decrease iodothyronin deiodinase (D1 and D2) which convert T4 into T3, the conversion of thyroid hormones occurs by the action of iodothyronine-5-deiodinase enzyme, which is responsible for the deiodination of L-thyroxin (T_4) to its more active form 3,5,3-triiod-L-thyronine (T_3). Deiodinase enzyme are classified in to two enzymes, type l is the major deiodinase in the liver, kidney and skeletal muscles, and type ll is the major deiodinase in brain, pituitary and brown adipose tissue (Huszenicza *et al.,* 2002 and Behrad *et al.,* 2010). The low levels of T3, in this study may be attributed to the minerals supplementation in the diet which may prevent the appearance of clinical signs of hypothyroidism.

The mean values of parathermon hormone (PTH) concentration (table, 1) in buffalo calves at 3-6 month and 6-9 months were 6.41±0.27pg/ml and 3.18±0.25pg/ml respectively. These values were lower than those recorded by El-Sangary *et al.,* 2011, who recorded 9.71±1.42pg/ml and 5.93±0.17pg/ml for both normal and hypoparathyriod hormone level. The high level of PTH in the 3-6 month buffalo calves explained by the low calcium level at the same group (table, 3), where, in low calcium levels, adenylyl cycles are activated causing an increase in intracellular cyclic AMP. Phospholipase C is inhibited causing decrease in intracellular calcium; these processes stimulate high levels of PTH secretion (Kaneko *et al.,* 1997; Huszenicza *et al.,* 2002 and Radostits *et al.,* 2007).

The mean values of serum total protein, albumin, globulin, cholesterol, and glucose concentrations in two age groups of buffalo calves are recorded in (table 2). The effect of age was non-significant with total protein, albumin and globulin. The values of total protein, albumin and globulin in calves were almost near those values in adult animals which could be attributed to the fact that calves as growing animals possess relatively metabolic processes and growth rate than older age animals (Huszenicza *et al.,* 2002).

While there were a significant ($p \leq 0.01$) increase of cholesterol and glucose in older age groups of calves than in younger ones. These may be attributed to the serum glucose and cholesterol concentration higher in calves than their dams which might be probably due to the lower capacity and development of the rumen in calves, where rumen fermentation and volatile fatty acids production in dams were highly efficient (Amin *et al.,* 2004 and Mostaghni *et al.,* 2005).

The mean values of serum calcium, phosphorus, magnesium concentrations in two age groups of buffalo calves are recorded in (table 3). Where the mean values of calcium and magnesium showed significant ($p \leq 0.05$), ($p \leq 0.01$) increase respectively in older groups of calves than in younger ones, and non-significant changed of phosphorus between the two age groups. The reduction in magnesium level which was accompanied with reduction in calcium level is agreeable by Randal *et al.* (2002) that hypomagnesaemia is often associated with hypocalcaemia and magnesium deficiency may influence calcium hemostasis. Magnesium increases calcium release from the bone by displacing it from the hydration shell and by stimulating processes which involve the simultaneous catabolism of the matrix and mineral phase, thus magnesium deficiency would lead to decrease in calcium release from the bone and hence reduce its concentration (Odette, 2005).

The correlation coefficient (r) between the estimated blood serum triiodothyronine (Tʒ) concentrations and the different biochemical parameters measured in this study (table 4) were non-significantly changed for calcium, phosphorus, magnesium, total protein, albumin, and globulin and it was significant changed for glucose and cholesterol.

These results were in agreement with the reports of Walsh *et al.*(2005) and Chapize *et al.* (2006), who found that the serum glucose and cholesterol level generally varies inversely with thyroid activity and stated that the net effect of thyroid hormone on cholesterol metabolism to increase the rate of its catabolism by the liver and enhance the liver ability to excrete it in the bile thereby lowering the

cholesterol in hypothyroidism, the net effect is a decrease in cholesterol catabolism and increase in cholesterol.

There was negative correlation between parathermone (PTH) and, calcium, phosphorus, magnesium, levels while cholesterol, glucose, total protein, albumin and globulin showed non-significant correlation. The results explained by the lower values of magnesium accompanied by decrease in the formation and activity of PTH, where hypomagnesaemia cause target organ resistance to the physiologic effects of PTH which ultimately results in hypocalcaemia (Martens and Schweigel, 2000).

It could be concluded that the values reported to all of the studied parameters that recorded in table 2 and 3 found to be lower than that recorded by (Neama *et al.,* 2002; Amin *et al.,* 2004; El-sangary, 2011 and Rozike, 2011) and this perhaps attributed to many factors such as location, nutrition, management, seasons, genetic factors or other undefined deferent factors between these different studies so that it could be recommended that nutritional factors should be controlled to be in balance status for improving all studied parameters and consequently improving the animal performance.

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علاقة مستوى هرمون الترای ایودوثیرونین والباراثرمون ببعض التغیرات البیوکیمائیة في مصل دم عجول الجاموس بمحافظة أسیوط

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هدفت هذة الدراسة إلى تقدیر مستوى ترکیز هرمون (الترای ایودوثیرونین) و (الباراثرمون) فی عجول الجاموس وعلاقته ببعض التغیرات البیوکیمیائیة فی مصل الدم. تم إجراء الدراسة على عدد ٥٠ من عجول الجاموس تم تجمیعها من مزارع خاصة بمحافظة أسیوط. هذه الحیوانات مقسمة الى مجموعتین المجموعة الاولى ٢٠ حیوان من سن ٣-٦ شهور والمجموعة الثانیة ٣٠ حیوان من ٦-٩ شهور. وقد تم تجمیع عینات الدم (للحصول على مصل الدم النقی) وحیث تم قیاس مستویات هرمون ممثل لنشاط الغدة الدرقیة (الترای ایودوثیرونین) والجاردرقیة (الباراثرمون) باستخدام اختبار الالیزا وکذلك قیاس ترکیز کلامن البروتن الکلسی والالبیومین والجلوبیولین والکولیستیرول والجلوکوز وایضا تقدیر ترکیز الکالسیوم والفسفور والماغنیسیوم. وقد أوضحت النتائج وجود نقص معنوی فی متوسط ترکیز هرمونات الغدة الدرقیة (الترای ایودوثیرونین) والجار درقیة (الباراثرمون) فی المجموعة الاکبر عمرا (٦- ٩ شهور). فی حین عدم وجود تغیر معنوی فی متوسط ترکیز کل من البروتین الکلی والالبیومین والجلوبیلوین فی المجموعتین العمریتین قید الدراسة. کما ان هناك تغیر معنوی فی متوسط ترکیز کل من الکالسیوم والماغنیسیوم بینما لا یوجد تغیر معنوی فی متوسط ترکیز الفسفور. وقد اوضح معامل ارتباط بیرسون عدم وجود علاقة بین ترکیز هرمون (الترای ایودوثیرونین) وکلا من البروتن الکلسی والالبیومین والجلوبیولین والکالسیوم والفسفور والماغنیسیوم. بینما یوجد ارتباط معنوی مع کلا من الکولیستیرول والجلوکوز. کما اوضح معامل ارتباط بیرسون وجود ارتباط سلبی بین ترکیز هرمون الباراثرمون وکلا من والکالسیوم و الفسفور والماغنیسیوم. بینما لا یوجد ارتباط مع کلا من البروتین الکلی والالبیومین والجلوبیلوین والکولیستیرول والجلوکوز. وحیث انه لا توجد اعراض ظاهریة لتضخم الغدة الدرقیة فی هذه العجول فانها تعانی من نقص الافراز الدرقی تحت الاکلینیکی والذی له تاثیر بارز على التغیرات البیوکیمیائیة .