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**THE EFFECT OF IODINE AND SELENIUM
SUPPLEMENTATION ON THYROID FUNCTION
AND SOME BIOCHEMICAL INDICES IN GOATS
AT ASSIUT GOVERNORATE**
(With 3 Tables and One Figure)

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تأثير إضافة اليود والسيلينيوم على نشاط الغدة الدرقية
وبعض المؤشرات البيوكيميائية في الماعز
بمحافظة أسيوط

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أستهدف البحث دراسة تأثير إضافة مركبات السيلينيوم أو اليود أو تعاونهما معاً على بعض مؤشرات الصحة في الماعز التي ترعى بالنظام التقليدي. لذلك تم اختيار عدد ٢٠ ذكراً حديثاً من الماعز ضعيفة النمو وقسمت بالتساوي إلى أربع مجموعات. أعطيت الأولى مركب السيلينيوم والثانية مركب اليود والثالثة الاثنان معاً يومياً لمدة ٤٥ يوم والرابعة تركت بدون إضافات كمجموعة ضابطة. أظهرت النتائج زيادة في وزن الماعز بإضافة السيلينيوم أو اليود عن المجموعة الضابطة ولكن إضافتهما معاً أدى إلى زيادة في الوزن عن إضافة كل منهما منفرداً كما كانت القياسات الدموية والتي شملت العدد الكلي لكرات الدم الحمراء والهيموجلوبين والحجم المصمت لكريات الدم لا تختلف بإضافة كل عنصر على حده ولكن بإضافتهما معاً زادت القيم الدموية عن المجموعة الضابطة. كما أوضحت النتائج أن إضافة السيلينيوم ليس له تأثير على هرمونات الغدة الدرقية ولكن زادت هذه الهرمونات بإضافة اليود. ولكن كانت هناك زيادة أكبر معنوياً في هذه الهرمونات في حالة إضافة السيلينيوم واليود معاً. وقد أوضحت النتائج أيضاً عدم وجود تأثير عند إضافة أي من اليود أو السيلينيوم على تركيز كل من البروتين الكلي والألبومين والجلوبولين وأنزيم الإنثالين أمينوترانزفيريز والكوليسترول ولكن إضافتهما معاً أدى إلى زيادة في البروتين والجلوبولين. وبناء عليه اتضح من الدراسة أثر الفائدة من اعطاء السيلينيوم واليود على صحة الماعز.

SUMMARY

This investigation manifested the effect of supplementation of selenium or iodine alone or together on some health indices of conventionally grazing premature goats. A total of twenty male Balady goats showed poor growth were classified equally into four groups (5 each). Feed stuff

of the first group was supplemented with selenium (Se), the second was supplemented with iodine (I), the third was supplemented with selenium and iodine (Se+I), while the fourth group was not supplemented and considered as control group (C). After 45 days experiment the body weight and gain between groups was differed. It increased ($P < 0.05$) than the control group, while the Se+I group showed significant increase ($P > 0.05$) in body weight gain than Se and I group. The haematological parameters (RBC, Hb and PCV) did not differ significantly in Se or I group if compared by the control group, but Se+I group showed significantly higher mean values ($P < 0.05$) than control. Supplementation with Se had no effect on the mean values of blood serum T_3 and T_4 concentrations, while there was significant variations in these parameters in the iodine supplemented group than control. The group supplemented with Se+I showed higher values of the mean values of blood serum T_3 and T_4 concentrations than the control, Se and I groups. The results showed also that supplementation with Se or iodine alone had no effect on the mean values of blood serum total protein, albumin, globulin, cholesterol or AST. However, the supplementation with both selenium and iodine resulted in significant increase in the mean values of blood serum total protein and globulin. This study clarifies the synergistic effect between selenium and iodine on thyroid function and biochemical indices of goats at Assiut Governorate.

Key words: Biochemical, parasites, goats.

INTRODUCTION

In 1973 selenium was identified to be an important component of glutathione peroxidase (GSHPx), which is characterized as a tetrameric protein with four atoms of Se per molecule (Rotruck *et al.*, 1973). GSHPx assists in intracellular defense mechanisms against oxidative damage by preventing the production of active oxygen species (Ursini and Bindoli, 1987). Thereafter, selenoproteins were discovered which indicated that Se is not merely restricted to its role in antioxidant activity but also involved in other multiple aspects of mammalian metabolism and disease resistance (Smith, *et al.* 1988 and Gerloff, 1992).

Iodine is an essential dietary element which is required for synthesis of the thyroid hormones, thyroxine (T_4) and triiodothyronine (T_3). Thyroxine and triiodothyronine, which are iodinated molecules of the essential amino acid tyrosine, regulate cellular oxidation and hence they affect calorigenesis, thermoregulation, and intermediary

metabolism (Cooper, 1998). These thyroid hormones are necessary for protein synthesis, and they promote nitrogen retention, glycogenolysis, intestinal absorption of glucose and galactose, lipolysis, and uptake of glucose by adipocytes (Greg Kelly, 2000).

Since selenium, as selenocysteine, is a cofactor for type I hepatic 5'-deiodinase, this trace mineral has received the most attention with respect to peripheral metabolism of thyroid hormones. (Arthur *et al.*, 1993; Gladyshev and Hatfield, 1999; Greg Kelly, 2000).

More recently, selenium has been shown to be an important component of iodothyronine deiodonase, and also as a functional selenoprotein in thioredoxin reductase. If selenium was deficient, the deiodinase activity would theoretically be impaired, resulting in a decreased ability to deiodinate T₄ to T₃ and a decreased ability to degrade T₃ (Tinggi, 2003, Voudouri, *et al.* 2003 and Dhingra, *et al.* 2004).

For a long time, mineral requirements of goats have been extrapolated from those of cattle and sheep. To date advances in goat nutritional research allow more specific mineral recommendations. Practically, Wichtel, *et al.* (1996a,b) examined the effect of selenium and iodine supplementation on voluntary feed intake in Angora goat kids and its temporal relationship to alterations in the concentrations of thyroid hormones in plasma. Furthermore, Meschy (2000) reported that goats are highly sensitive to iodine and selenium and particular attention must be given to these elements in goat nutrition. The aim of this study was to investigate the effect of supplementation with selenium or iodine on thyroid function and some blood serum biochemical indices, and whether synergism of selenium and iodine preparations occur if jointly administered to conventionally grazing premature Balady goats at Assiut Governorate.

MATERIALS and METHODS

Animals: In a Balady goat flock at northern part of Assiut governorate, the animals alopecia and poor growth. A total of twenty male goats (5-6 month) were selected from these animals. The collectively mean initial weight of these animals was 15.9 ± 0.21 kg. Parasitological examination of these animals revealed absence of internal and external parasites.

Therapy applications: The selected animals were classified equally into four groups (5 each). The first group was supplemented with selenium (Se group) orally at a dose of 0.01mg/kg BW (0.2mg/animal daily). The second group was supplemented with iodine in the form of 3-4 µg

potassium iodate /kg BW daily (60-70 µg / animal daily) in drinking water (McDowell, 1992). The third group was supplemented with selenium and iodine (Se and I group), while the fourth group was not supplemented and considered as a control group. These animals were weighted again after 45 days.

Blood sampling: Blood was sampled from each goat by jugular vein puncture before and 45 days after therapy into two tubes. The first with Na-salt of EDTA for haematological studies namely total RBCs count, haemoglobin (Hb) content and packed cell volume (PCV). The second tube was without anticoagulant to obtain serum, which was used for determination of the concentrations of thyroid hormones (T₃ and T₄), protein, albumin, cholesterol (Henry *et al.*, 1974) and alanine aminotransferase (Reitman and Frankel 1957).

Statistical analysis: Obtained data were subjected to a software program (SPSS) according to Borenstein *et al.* (1997) using linear model one way analysis of variance (ANOVA) followed by ordinary student "t" test.

RESULTS

After 45 days experiment the body weight and gain between groups was differed. It increased ($P < 0.05$) in Se and I groups than the control group. Furthermore, the Se+I group showed significant increase ($P > 0.05$) in body weight and gain than Se and I group (Table 1).

As shown in table (2) and figure (1), the haematological parameters were not differ significantly in Se or I group if compared by the control one, but Se+I group showed significantly higher mean values ($P < 0.05$) than control, Se and I groups.

With regard to the biochemical variations (Table 3 and Fig. 1), it was noticed that the supplementation with Se had no effect on the mean values of blood serum T₃ and T₄ concentrations, while there was significant variations in these parameters in the iodine supplemented group than controls. The group supplemented with Se+I showed higher values of the mean values of blood serum T₃ and T₄ concentrations than the control, Se and I groups.

The results showed also that supplementation with Se or iodine alone had no effect on the mean values of blood serum total protein, albumin, globulin, cholesterol or AST (Table 3 and Fig 1). However, the supplementation with both selenium and iodine had resulted in significant increase in the mean values of blood serum total protein and globulin.

DISCUSSION

The obtained results concerning the increased body weight in goats supplemented with iodine or selenium came in agreement with Meschy (2000) in goats and Gate, *et al.* (2000) in lambs. However, the administration of both selenium and iodine in the current study resulted in more increase in the body weight gain, which was significantly increased than the supplementation of selenium or iodine alone. These results confirm those reported by Wichtel *et al.* (1996b).

In the current work, there was a significant increase in the mean values of blood serum thyroid hormones (T3 and T4) than in iodine supplemented group, which agreed with the results of Laurberg *et al.* (2000 & 2001), Markou, *et al.* (2001) and Singh, *et al.* (2002). The supplementation with selenium and iodine in the current study resulted in more concentrations of these hormones in the blood serum, which was higher ($P < 0.05$) than the increase arising from supplementation with iodine alone. These results agreed with the findings of Wichtel *et al.* (1996b). In this way, selenium acts as selenocysteine, which is a cofactor for type I hepatic 5'-deiodinase, and increases the ability of deiodination of T4 to T3 and increases the ability to degrade rT3 (Gladyshev & Hatfield, 1999; Greg Kelly, 2000; Tinggi, 2003; Voudouri, *et al.* 2003 and Dhingra, *et al.* 2004).

On the other hand, the supplementation with either selenium or iodine had no effect on the mean values of blood serum protein, albumin, globulin, AST or cholesterol. Meanwhile, the addition of both iodine and selenium resulted in increased total protein and globulin values than control, iodine and selenium supplemented groups, which indicated a synergism of selenium and iodine preparations had occurred when they jointly administered which might enhance the metabolic processes in the liver and other tissues. These results came in agreement with those reported for other ruminants by Offiah, *et al.* (1992), Jain (1993), Al-Dehneh, *et al.* (1994), Kaneko, *et al.* (1997), Tenant (1997), Slosrkov, *et al.* (1998), Radostits, *et al.* (2000) and Pattanaik, *et al.* (2001).

This study clarified that the administration of jointly preparations of selenium and iodine had a beneficial effect on the body weight gain and some biochemical indices in Balady goats.

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Table 1: Summary statistics (Means \pm SE) and Duncan's new multiple range test* of the initial body weight and body weight gain in control and supplemented goats with selenium and iodine after 45 days experiment.

	Control	Supplemented groups		
		Se	I	Se + I
Initial kg	15.6 \pm 0.44 ^a	16.1 \pm 0.39 ^a	15.9 \pm 0.14 ^a	16.0 \pm 0.37 ^a
Final kg	17.5 \pm 0.36 ^a	19.6 \pm 0.44 ^b	18.9 \pm 0.51 ^b	22.6 \pm 0.45 ^b
Gain kg	1.9 \pm 0.09 ^a	3.5 \pm 0.12 ^b	3.0 \pm 0.10 ^b	6.6 \pm 0.16 ^c

* Values with unlike superscript letters in the same row are significantly differing at P<0.05.

Table 2: Summary statistics (Means \pm SE) and Duncan's new multiple range test* of the haemogram in control and supplemented goats with selenium and iodine after 45 days experiment.

	Control	Supplemented groups		
		Se	I	Se + I
RBC $\times 10^6/\mu\text{l}$	7.83 \pm 0.33 ^a	8.22 \pm 0.29 ^a	8.44 \pm 0.37 ^a	9.12 \pm 0.27 ^b
Hb gm/dl	8.11 \pm 0.26 ^a	8.61 \pm 0.41 ^a	8.87 \pm 0.32 ^a	9.41 \pm 0.29 ^b
PCV %	26.0 \pm 1.28 ^a	28.8 \pm 1.11 ^a	27.9 \pm 0.99 ^a	31.1 \pm 1.10 ^b

* Values with unlike superscript letters in the same row are significantly differing at P<0.05.

Table 3: Summary statistics (Means \pm SE) and Duncan's new multiple range test* of the some biochemical parameters in control and supplemented goats with selenium and iodine.

	Control	Supplemented groups		
		Se	I	Se + I
T ₃ ng/ml	0.91 \pm 0.05 ^a	1.10 \pm 0.06 ^a	1.41 \pm 0.06 ^b	1.66 \pm 0.05 ^c
T ₄ μ g/dl	2.86 \pm 0.12 ^a	3.01 \pm 0.14 ^a	4.12 \pm 0.27 ^b	5.23 \pm 0.18 ^c
T. protein gm/dl	6.77 \pm 0.18 ^a	7.11 \pm 0.21 ^a	6.69 \pm 0.17 ^a	7.51 \pm 0.19 ^b
Albumin gm/dl	3.51 \pm 0.15 ^a	3.49 \pm 0.14 ^a	3.38 \pm 0.17 ^a	3.54 \pm 1.13 ^a
Globulin gm/dl	3.26 \pm 0.17 ^a	3.62 \pm 0.18 ^a	3.31 \pm 0.16 ^a	3.97 \pm 0.18 ^b
Cholest. gm/dl	81.6 \pm 7.1 ^a	91.2 \pm 6.91 ^a	68.9 \pm 7.21 ^a	83.4 \pm 6.63 ^a
ALT IU/l	41.6 \pm 3.40 ^a	39.7 \pm 2.92 ^a	40.6 \pm 3.14 ^a	38.7 \pm 2.71 ^a

* Values with unlike superscript letters in the same row are significantly differing at P<0.05.

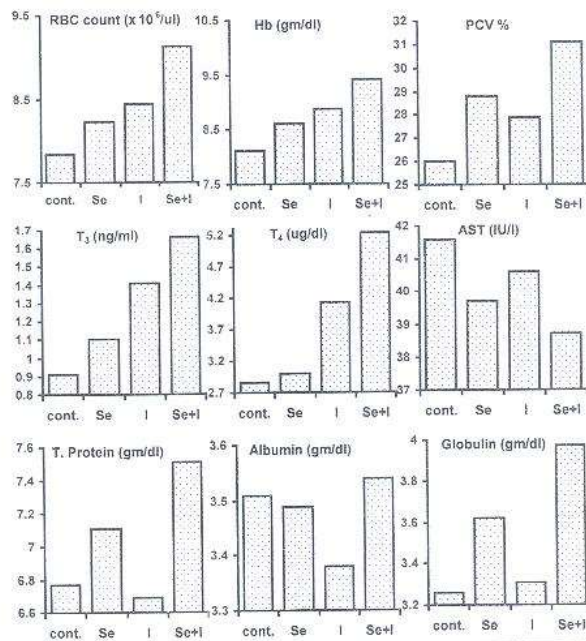


Fig. 1: The effect of supplementation with iodine, selenium or both on some haematological and biochemical changes in goats