Effect of Hypothyroidism on the Growth of Black Bengal Goats*

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ABSTRACT : Hypothyroidism was induced in three age groups (8 months, 1 year and 2 years) of Black Bengal goats by administering thiourea subcutaneously for 30 days. From fourth day onwards the animals were observed to be in hypothyroid state. For 8 months age group, a control group of similar age was taken. For the 1 year and 2 years age groups there was no control group but the values obtained on the pre-treatment day were considered as control values. For confirming the establishment of hypothyroidism, peripheral plasma triiodothyronine (T_3) and thyroxine (T_4) were estimated in all the animals before and during the treatment period by radioimunoassay. In the thiourea treated 8 months age group the T_3 and T_4 levels were significantly ($p<0.001$) lower than those in the control group during the treatment period. In all the thiourea treated groups the T_3 and T_4 levels observed during the treatment period were significantly ($p<0.01$) lower than the pre-treatment levels. A nonsignificant loss in the body weight was observed in all the thiourea treated groups whereas there was a significant growth in the control group of animals. The study indicates that hypothyroidism has a negative effect on growth in goats. (*Asian-Aus. J. Anim. Sci. 1999. Vol. 12, No. 3 : 354-357*)

Key Words : Hypothyroidism, Triiodothyronine, Thyroxine, Growth, Black Bengal, Goats

INTRODUCTION

Thyroid gland is well known for its control over general body metabolism and growth. Positive role of thyroid hormone in growth of domestic animals is well documented (Rosemberg et al., 1989; Baishya et al., 1996; Leyva-Ocariz et al., 1997). Anderson and Harness (1975) correlated ($r=0.53$) body weight with thyroid hormone secretion rate and plasma T_4 concentration in goats. In hypothyroid condition, decreased synthesis of thyroid hormones *viz*: triiodothyronine (T_3) and thyroxine (T_4) occurs which leads to low availability of these hormones for tissue metabolism and growth. Goat is reported to be the most susceptible animal among all domestic animals to hypothyroidism (Manson and Wilkinson, 1973). Conflicting reports were made regarding the effect of hypothyroidism on growth in farm animals (Sreekumaran and Rajan, 1978; Chandrasekhar et al., 1985). Hence this experiment was conducted to know the effect of hypothyroidism on growth of Black Bengal bucks of three different age groups, inducing hypothyroidism by administering thiourea.

MATERIALS AND METHODS

In this study 14 healthy Black Bengal bucks were taken from the pure-bred stock of the institute and were divided into four groups. First and second group consisted of 3 and 4 animals of 8 months age, respectively. First group was kept as control over the second group. Third group consisted of three animals of one year age. Fourth group consisted of four animals of 2 years age. For both third and fourth group there was no control group of same age. Hence in these groups the pre-treatment day values were considered as control/normal values. Animals were maintained under normal management conditions in asbestos roofed shed. They were fed standard rations as specified by Ranjhan (1980) besides greens. Water and feed were given *ad lib.*

Hypothyroidism was induced in second, third and fourth groups by administering thiourea subcutaneously for 30 days as described by Gupta et al. (1990). In the first group (control) animals were given injections of normal saline as placebo. For confirming the hypothyroidism, blood samples were collected from the animals from the jugular vein on the days as mentioned in the table 1. The plasma total T_3 and total T_4 were estimated from the blood samples by radioimmunoassay (RIA). The RIA was done using kits supplied by Babha Atomic Research Centre, Mumbai, India. The minimum detectable level of T_3 and T_4 were 0.01 and 0.05 ng/ml, respectively.

Duncan's multiple range test as suggested by Montgomery (1984) was applied to make pair wise comparison between the values observed on pre-treatment days and the subsequent days in case the values were found to be significant by Analysis of variance.

RESULTS AND DISCUSSION

Induction of hypothyroidism

Induction of hypothyroidism in the animals was confirmed by the significantly ($p<0.01$) decreased T_3 and T_4 levels. The mean T_3 levels during the pre-treatment period in I group (control) and II group (treated) were 0.56 and 0.64 ng/ml, respectively (table 1). During the entire treatment period, T_3 levels in the treated group were observed to be significantly ($p<0.01$) lower than those in the pre-treatment level. But in the control

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Table 1. Plasma triiodthyronine levels (ng/ml) in control and thiourea treated (hypothyroid) male goats

Group No.	Age	0 day	Treatment (days)										
			4	8	12	16	18	20	22	24	26	28	30
Control	8 months	0.56	0.28	0.37	0.21	0.73	0.39	0.38	0.46	0.33	0.29	0.33	0.19
I		(0.30)	(0.08)	(0.11)	(0.11)	(0.31)	(0.18)	(0.12)	(0.02)	(0.11)	(0.07)	(0.15)	(0.03)
Treated	8 months	0.64	0.10*	0.11*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*
II		(0.14)	(0.06)	(0.10)									
III	1 year	0.83	0.12*	0.10*	<0.01*	<0.01*	-[1]	<0.01*	-[1]	<0.01*	-[1]	<0.01*	<0.01*
		(0.28)	(0.08)	(0.07)									
IV	2 years	0.70	0.17*	0.17*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*
		(0.11)	(0.04)	(0.07)									

Figures in parenthesis are standard errors; Values with asterik differ significantly from their respective pre-tretment values.
* $p<0.01$; [1] These samples could not be analyzed.

Table 2. Plasma thyroxine levels (ng/ml) in control and thiourea treated (hypothyroid) male goats

Group No.	Age	0 day	Treatments (days)										
			4	8	12	16	18	20	22	24	26	28	30
Control	8months	21.40	15.88	19.68	17.13	14.18	13.55	18.84	15.95	17.65	17.14	18.06	15.67
I		(0.73)	(1.28)	(2.10)	(1.98)	(0.91)	(0.77)	(4.13)	(4.28)	(1.87)	(2.58)	(0.90)	(0.98)
Treated	8months	26.19	6.98*	1.20*	0.65*	<0.05*	<0.05*	<0.05*	<0.05*	<0.05*	<0.05*	<0.05*	<0.05*
II		(3.16)	(2.13)	(0.16)	(0.18)								
III	1 year	17.79	13.13*	5.67*	2.48*	1.64*	-[1]	<0.05*	-[1]	<0.05*	-[1]	<0.05*	<0.05*
		(0.59)	(0.91)	(1.99)	(1.59)	(0.87)							
IV	2years	30.10	11.82*	11.18*	5.03*	1.32*	0.64*	0.59*	<0.05*	<0.05*	<0.05*	<0.05*	<0.05*
		(2.76)	(0.74)	(2.86)	(1.70)	(0.40)	(0.17)	(0.17)					

Figures in parenthesis are standared errors; Values with asterik differ significantly from their respective pre-treatment vales.
* $p<0.01$; [1] These samples could not be analyzed.

group, the T_3 levels during the corresponding treatment period were not significantly different from the level observed on the Pre-treatment day. In treated group the T_3 levels on the fourth and eighth day during the treatment were 15.6% and 17.2% of the pre-treatment levels, respectively. From the 12th day onwards the hormone levels were found to be below the detectable limit of the assay (<0.01 ng/ml). Further the comparison between the first and second group revealed that the T_3 levels during the treament were significantly ($p<0.001$) lower in the treated group than those in the control group. In third and fourth groups also the same patterns in T_3 levels were observed as in the second group (table 1).

The mean plasma T_4 levels during the pre-treatment period in I group (control) and II group (treated) were 21.40 and 26.19 ng/ml, respectively. During the treatment period, T_4 levels in the treated group were found to be significantly ($p<0.01$) lower than those in the pre-treatment level. But in the control group the T_4 levels were not significantly different from the levels observed on the pre-treatment day (table 2). In the treatment group the T_4 concentrations on days 4, 8 and 12 were 26.7%, 4.6% and 2.5% of the pre-treatment level, respectively. From 16th day onwards T_4 levels were below the detectable level of the assay (<0.05 ng/ml or <1.9% of the pre-treatment level). Similar pattern in the T_4 levels was also observed in the other two teated groups (III and IV), during the treatment period (table 2). Further the comparison between the first and second group revealed that the T_4 levels during the treatment were significantly ($p<0.001$) lower in the treated group than those in the control group. By observing the T_3 and T_4 levels in the treated animals, we conclude that from fourth day onwards the animals were observed to be in hypothyroid state by virtue of the treatment.

Effect of hypothyroidism on growth

In first group (control) there was a significant growth during the treatment period (table 3). But in the second group, a nonsignificant weight loss was noticed during the 10th to 20th day of the treatment period. Thereafter, a stagnation in the growth was observed (figure 1). In third and fourth groups, a nonsignificant weight loss was noticed either (table 3). For these two groups though there was no control group to compare with, the weight observed during the treatment period were compared with the pre-treatments.

Hence we can derive that hypothyroidism would adversely affect growth of goats. Loss in the body weight observed in this study is in agreement with the reports made by Nasseri and Prasad (1987) in sheep and Sreekumaran and Rajan (1978) in crossbred goats.

Table 3. Record of body weights (kg) in control and thiourea treated (hypothyroid) male goats

Group No.	Age	0 day	Treatment (day)					
			5	10	15	20	25	30
Control	8 months	7.70	8.04	8.47*	8.67**	8.87**	9.17**	9.57**
I		(0.7)	(0.7)	(0.9)	(1.0)	(1.0)	(1.1)	(1.1)
Treated	8 months	8.37	8.40	8.50	8.00	7.95	7.95	7.95
II		(0.7)	(0.6)	(0.7)	(0.8)	(0.8)	(0.9)	(0.9)
III	1 year	12.70	12.84	12..34	12.37	12.70	11.80	12.17
		(2.3)	(2.1)	(2.3)	(2.3)	(2.4)	(2.1)	(2.0)
IV	2years	19.82	19.92	19.92	19.67	19.75	19.40	18.92
		(0.7)	(0.7)	(0.7)	(0.4)	(0.5)	(0.5)	(0.4)

Figures in parenthesis are standard errors; Values with asteick differ significantly from their respective pre-treatment vales.
* $p<0.05$; ** $p<0.01$.

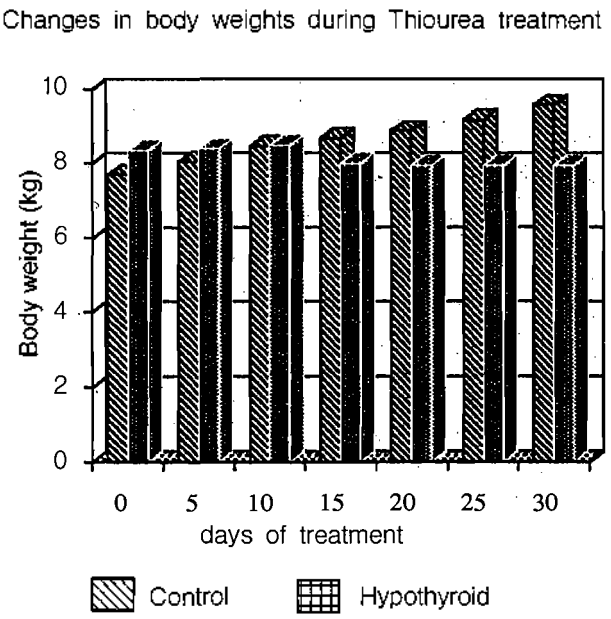

Figure 1. Profile of body weights in control (I group) and thiourea treated (II group) goats

But Chandrasekhar et al. (1985) did not observe any negative effect of hypothyroidism on growth of sheep. Thyroid hormones/thyroid activity and growth were positively correlated in domestic animals. Anderson and Harness (1975) reported that for every unit increase in body weight, there was a 0.69 unit increase in the thyroid secretion rate. It was reported that T3 was significantly ($p<0.01$) high during the period when higher weight gains were recorded in calves (Shukla et al., 1994). Thyroid hormones are known to influence production of somatotropin, somatomedin, epidermal and nerve growth factors which are essential for the growth of animal. Thyroid hormones influence the action of growth hormone by controling the production of somatomedin. In hypothyroid animals somatotropin does not stimulate somatomedin production (Cabello and Wrutniak, 1989). Nalbandov (1976) observed in cows that both testosterone and thryroid hormones exert control over the growth and development. Testosterone was reported to have a positive effect on growth in domestic animals (Hunter, 1989 and Faulkner et al., 1989). And hypothyroidism was reportedly caused decreased testosterone levels in sheep (Chandrasekhar et al., 1985).

It appears that hypothyroidism inhibits body growth at least by three modes. First is directly by affecting the growth due to lack of availability of thyroid hormones and the second mode of action may be by decreasing the production and action of growth hormones and the third mode of action may be through decreasing the synthesis of an important anabolic hormone i.e. testosterone. This study implies that hypothyroidism has an adverse and negative effect on growth in goats. It is suggested that further elaborate and long term studies are required to explore this important area and the effect of hypothyroidism on different parameters like somatomedins and growth factors has to be studied to confirm the role of thyroid in growth of goats.

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