

EFFECTS OF COTTONSEED CAKES (GOSSYPOL) ON LIVELWEIGHT OF TEDDY MALE GOATS

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ABSTRACT

The effects of gossypol on liveweight of teddy male goats were studied. Nine teddy male goats were randomly divided into three equal groups A, B and C. Animals in all groups were fed concentrate ration without cottonseed cakes at the rate of 3% of their liveweight for a period of 30 days and it was named as pre-treatment period. Just after the completion of this period, animals in group A were fed control ration (without gossypol), those in group B were fed ration which contained unboiled cottonseed cakes as a source of free and bound gossypol, while animals in group C were given ration containing cottonseed cakes boiled at 100°C for 1 hour as a source of bound gossypol. These experimental rations were fed to animals of respective groups at the rate of 3% of their liveweight for a period of 90 days. This period was named as treatment period. Immediately after the termination of treatment period, the right testis of each experimental animal was removed surgically for an other study to record the effects of gossypol on histology of testes. Animals in all groups were fed ration without cottonseed cakes (without gossypol) at the rate of 3% of their liveweight for a period of 120 days. This period was named as withdrawal period. The first 30 days of it was named as post-operational rest period, during which liveweight measurements were not recorded while during next 90 days, liveweight measurements of all the experimental animals were recorded. The mean (\pm SE) values for liveweight (kg) of teddy male goats at the conclusion of pre-treatment period in groups A, B and C were 26.61 ± 0.33 , 26.33 ± 0.33 and 26.52 ± 0.18 , respectively. These values at the termination of treatment period in groups A, B and C were 28.22 ± 0.18 , 28.25 ± 0.18 , and 28.23 ± 0.18 , respectively. Statistical analysis revealed non-significant differences in the liveweight of male goats fed diets containing unboiled or boiled cottonseed cakes compared with those in control group. At the conclusion of withdrawal period the mean (\pm SE) values for liveweight (kg) of teddy male goats in groups A, B and C were 30.24 ± 0.20 , 29.73 ± 0.20 and 30.37 ± 0.20 , respectively. Statistical analysis revealed non-significant differences in the liveweight of male goats of groups A and B and groups A and C while these differences in liveweight of male goats of groups B and C were significant ($P < 0.05$). It may be due to the residual effect of previously fed gossypol.

Key words: Gossypol, liveweight, cottonseed cakes, teddy male goats

INTRODUCTION

Gossypol is a yellow pigment, toxic in nature, found in various parts of the cotton plants, including seeds, of the genus *Gossypium* (Adams *et al.*, 1960). There are conflicting reports regarding the effects of gossypol on the growth and liveweight in different species of animals. Chase *et al.* (1989) reported that feeding of diets containing gossypol at the rate of 600 ppm or more in diet adversely affected growth of Brahman bulls. However, Stahnke (1986) observed no

adverse effect on the liveweight of Brangus bulls fed gossypol containing ration for 60 days.

Cottonseeds and their by-products, e.g. cottonseed cakes (CSC) and cottonseed meals (CM), being an inexpensive and rich source of high quality protein, have been used extensively for supplementing dairy animals' rations to increase fat and milk production in these animals (Ahmad, 1993). Cottonseed cakes contain 0.28 ± 0.02 per cent free and 1.44 ± 0.04 per cent total gossypol (Zahid, 2002). The present study was, therefore, carried out to determine the adverse effects of gossypol on liveweight of teddy male goats.

MATERIALS AND METHODS

In the present study, nine healthy (10–11 months of age) teddy male goats were used. The animals were randomly divided into three groups A, B and C, with three animals in each group. Animals in all groups were kept under the same managerial and environmental conditions. Animals in all groups were fed concentrate ration without cottonseed cakes at the rate of 3% of their liveweight for a period of 30 days, in addition to good quality chaffed seasonal green fodder and clean water *ad libitum*. This period was named as pre-treatment period. Just after the completion of this period, animals were fed experimental rations. Animals in group A were fed control ration (without gossypol), those in group B were fed ration which contained unboiled cottonseed cakes as a source of free and bound gossypol (620 and 1750 ppm respectively), while animals in group C were given ration containing cottonseed cakes boiled at 100°C for 1 hour as a source of bound gossypol (2370 ppm). These rations were fed to animals of respective groups at the rate of 3% of their liveweight for a period of 90 days, in addition to good quality chaffed seasonal green fodder and clean water *ad libitum*. During pre-experiment and the treatment period, liveweight measurements of all the experimental animals were recorded weekly using a portable weighing scale.

Immediately after the termination of treatment period, the right testis of each experimental animal was removed surgically for an other study, to record the effects of gossypol on histology of testes of teddy male goats. Animals in all groups were fed ration without cottonseed cakes (without gossypol) at the rate of 3% of their liveweight for a period of 120 days, in addition to good quality chaffed seasonal green fodder and clean water *ad libitum*. This period was named as withdrawal period. The first 30 days of this period was named as post-operational rest period, during which liveweight measurements were not recorded while during next 90 days, liveweight measurements of all the experimental animals were recorded. The reversible effects of gossypol on liveweight of teddy male goats were studied. Statistical analysis was performed using analysis of variance (ANOVA) technique (Steel and Torrie, 1984) under completely randomised design. For this purpose, general linear model (GLM) procedure under SAS computer programme (SAS, 1990) was

adopted. Least significant difference (LSD) test was used for comparison of means (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

At the completion of pre-experimental period of the study, the mean (\pm SE) values for liveweight were 26.61 ± 0.33 , 26.83 ± 0.83 and 26.52 ± 0.33 kg for male goats of groups A, B and C, respectively (Table-1), the difference was non significant. At the conclusion of the treatment period, the highest values of liveweight (28.25 ± 0.18 kg) were noted in male goats of group B fed diet containing unboiled cottonseed cakes and the lowest (28.22 ± 0.18 kg) in male goats of control group, the difference was, however, non-significant. During the withdrawal period, the highest values of live weight (30.57 ± 0.20 kg) were observed in male goats of group C, previously fed diet containing boiled cottonseed cakes while the lowest (29.73 ± 0.20 kg) in the male goats of group B previously fed diet containing unboiled cottonseed cakes. Statistical analysis of the data revealed that liveweight of male goats of group B was significantly ($P < 0.05$) lower than that of animals of group C. However, it did not differ from the liveweight of animals of the control group.

Monthwise grouping of the data indicated that the body weight of bucks increased significantly ($P < 0.05$) from the first to the third month of the treatment period and from the fifth to the seventh month of the withdrawal period. However, this trend was noted in animals of all groups including control. The results on the liveweight indicated that boiled or unboiled CSC did not affect this parameter in male goats. However, previously fed ration containing both (free and bound) forms of gossypol showed its residual effect during withdrawal period of study.

Information on the effects of gossypol feeding on liveweight of teddy male goats and other species of goats is scanty. However, in a study Zahid *et al.* (2002a) reported that feeding of gossypol adversely affected the spermatogenic tissue in teddy male goats. The findings of the present study are not in agreement with the results recorded by these workers. In a subsequent study Zahid *et al.* (2002b) reported that feeding of diets containing gossypol did not show any effect on weight of testes and epididymides in teddy bucks. The results of these workers are in line with the

Table 1. Effect of feeding gossypol on liveweight (mean \pm SE) of teddy male goats

Periods of the study	Months of the study	Liveweight of teddy male goats (kg)		
		Group A	Group B	Group C
Pre-treatment period	0	26.61 \pm 0.33	26.83 \pm 0.33	26.52 \pm 0.33
Treatment period	1	27.48 \pm 0.33 ^b	27.70 \pm 0.33 ^b	27.39 \pm 0.33 ^b
	2	28.22 \pm 0.33 ^{ab}	28.27 \pm 0.33 ^{ab}	28.31 \pm 0.33 ^{ab}
	3	28.96 \pm 0.29 ^a	28.79 \pm 0.29 ^a	28.99 \pm 0.29 ^a
	Overall	28.22 \pm 0.18 ^A	28.25 \pm 0.18 ^A	28.23 \pm 0.18 ^A
Withdrawal period	5	29.51 \pm 0.35 ^b	29.12 \pm 0.35 ^b	29.57 \pm 0.35 ^b
	6	30.04 \pm 0.35 ^b	29.66 \pm 0.35 ^{ab}	30.33 \pm 0.35 ^{ab}
	7	31.19 \pm 0.34 ^a	30.40 \pm 0.31 ^a	31.21 \pm 0.31 ^a
	Overall	30.24 \pm 0.20 ^{AB}	29.73 \pm 0.20 ^B	30.37 \pm 0.20 ^A

A = Animals were fed ration (without gossypol) during the treatment period.

B = Animals were fed ration containing unboiled cottonseed cakes (combination of free and bound gossypol) during the treatment period.

C = Animals were fed ration containing boiled cottonseed cakes at 100°C for 1 hour (bound gossypol only) during the treatment period.

Values bearing different small letters in the same column for each period differ significantly ($P < 0.05$) and values bearing different capital letters in the same column or row also differ significantly ($P < 0.05$), while values with no superscript in the same column or row for each period differ non-significantly.

findings of present study. Chase *et al.* (1989) reported that feeding of gossypol at the rate of 600 ppm or more in diet adversely affected growth rate of Brahman bulls. Similarly, Lin *et al.* (1992) recorded a reduction in the liveweight of mature rats treated with gossypol. The results of present study are not in line with the findings of these workers. Many other workers (Kalla *et al.*, 1981; Stahnke, 1986; Jimenez *et al.*, 1989; Singh and Rath, 1990 and Akhtar, 1997) reported non-significant effect of gossypol feeding on liveweight of rats, Brangus bulls, Holstein bulls, mice and Nili-Ravi buffalo bulls, respectively. The results of present study are in agreement with the findings of these workers.

It was concluded that 90-days period of treatment was not sufficient for the gossypol to show its effects. Further studies to assess the effects of gossypol on liveweight, are suggested and advised for longer duration of about 12 months. Although gossypol did not affect the liveweight of male goats in the present study but keeping in view the findings of the previous studies it may be concluded that indiscriminate use of diets containing gossypol should not be encouraged in dairy animals.

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