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Research Article

COMPARATIVE EFFICACY OF BETA-AGONISTS ON *IN VIVO* BODY COMPOSITION AND RESTING HEAT PRODUCTION IN GROWING KIDS

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ABSTRACT
In vivo body composition and resting heat production was determined in male growing kids treated with beta agonists – clenbuterol, salbutamol and terbutaline on day-0, day-21 and day-42 of the treatment period. There was marked difference in body water and body fat percentage, however it was not significant. Resting heat production (kcal/$kg^{0.75}$/hr) did not differ significantly between groups as well as between periods.

Key Words: *Beta-Agonists, Goat, Body Composition, Total Body Water, Resting Heat Production*

INTRODUCTION
The application of beta-agonists in anabolic dose in animals results in a significant increase in lean body mass and a significant decrease in the amount of body fat, better utilization of food and increased growth of animals (Anderson *et al.,* 2005). Beta-agonists alter the body composition favorably (Williams, 1987) in various species. However, very few information is available about their effect on *in vivo* body composition and resting heat production. Hence, in the present investigation, comparative efficacy of beta-agonists on body composition and resting heat production was made in goats, which contribute vital role in the Indian rural economy.

MATERIALS AND METHODS
Twenty four farms bred male kids of Barbari and Black Bengal breeds of about 6 months old were selected and divided equally and randomly into four groups, namely salbutamol group, terbutaline group, clenbuterol group along with control group. Animals were maintained under standard managemental conditions in well ventilated asbestos roofed shed with concrete flooring.

All the animals under trial were offered standard ration as per Kearl (1982) with concentrate and roughage (Oat hay, *Avina sativa*) in the ratio of 50:50 on the basis of dry matter requirement. *Ad libidum* water was offered to the animals twice a day. All the animals were adapted to the experimental ration one month before starting the experiment and were fed individually.

Based on the availability and reported action salbutamol, terbutaline and clenbuterol were chosen and administered *per os* to the respective groups @ 0.3 mg/ Kg B.wt/ day for 6 weeks period. Control group received no drug. During the period under trail no other drug was administered to these animals.

Body composition can be determined from the body water, which was estimated *in vivo* by marker dilution technique. In the present study, body water at day-0, day-21 and day-42 of the treatment period was estimated by dilution technique using antipyrine (1 phenyl-2, 3-dimethyl pyrazolone 5 one) as indicator as described by Shukla and Pal (1972a). The total body fat was worked out from the total body water as described by Panaretto (1964)

Resting heat production was determined as oxygen consumption at day-0, day-21 and day-42 of the treatment period by indirect calorimetry. Closed circuit spirographic mask method was used to find out the oxygen consumption with Benedict Roth metabolism apparatus (Warren E. Collins, Inc, Boston, USA). The feed was removed in the previous day evening and the animals were not allowed to take anything including water till the observations were complete next day. All the observations of heat

production were recorded at 9.00 am in the morning after 16 hrs of fasting as described by Shukla and Pal (1972b).
The data obtained were analyzed statistically according to Snedecor and Cochron (1994).

RESULTS AND DISCUSSION

The total body water as a percent of body weight and total body fat percentage calculated from the body water percentage for the control and treatment groups are presented in table. Though there was trend for decreasing body fat with beta agonists treatments, the maximum being with clenbuterol , the difference were not statistically significantly. Beta-agonists have been reported to have lipolytic action in many species (Reeds and Mersmann, 1991) and this has been ascribed to their action on beta-adrenoceptor to stimulate cAMP production resulting in reduced lipogenesis and enhanced lipolysis (Steinbert, 1976). Whereas Sankar De (1997) reported significant ($P<0.05$) increase in the body water and decrease in the body fat percentage in salbutamol treated kids. Beermann *et al.,* (1987) also reported reduced body fat in beta-agonist treated lambs. Ractopamine, a beta agonist, supplementation resulted in enhanced lean deposition and reduction in fat content in pigs (Hinson *et al.*, 2011).

Table 1: Total body water, total body fat and heat production in control and treatment groups

	Total Body Water (%)			Total Body Fat (%)			Heat production (kcal/kg$^{0.75}$/h)		
Groups	**Day-0**	**Day-21**	**Day-42**	**Day-0**	**Day-21**	**Day-42**	**Day-0**	**Day-21**	**Day-42**
Control	66.38±3.73	67.01±3.71	65.84±5.18	9.19±4.85	8.38±4.82	9.90±6.73	8.57±1.10	8.40±0.89	8.86±1.44
Salbutamol	64.60±0.84	65.99±0.14	67.44±1.37	11.50±1.10	9.68±0.12	7.17±0.80	7.42±0.04	9.23±1.09	10.30±1.64
Terbutaline	63.95±5.05	65.71±3.52	65.76±3.15	12.36±6.57	10.14±6.54	10.00±5.79	8.63±1.23	8.78±1.51	8.89±1.54
Clenbuterol	62.98±1.37	65.91±1.27	68.46±0.27	13.65±2.53	9.81±2.35	6.49±0.49	7.42±0.26	8.91±0.95	8.29±0.29

The resting heat production in terms of kcal/kg$^{0.75}$/hr as recorded by indirect calorimetry method are presented in the table. The values were in the range of 7.42±0.04 to 10.30±1.64 kcal/kg$^{0.75}$/hr. It is observed that there was no significant difference between groups and also between periods. The values were in close agreement with Shukla and Mahapatro (1992) for the goats. The observations of this study was supported by Hansen *et al*. (1997) who reported salbutamol had no effect on oxygen consumption whereas only somatotropin differentially increased oxygen consumption. Additionally supported by Yen *et al*., (1990) that overall increased energy expenditure did not seem to extend to fasting heat production. Whereas MacRae *et al.* (1986) recorded 8% increase in energy expenditure in clenbuterol treated wether lambs.

Conclusion

The results revealed that resting heat production was not affected by beta-agonist treatment. Body composition as reflected from water and total body fat though altered by treatment in favorable manner in goats as well, they were statistically insignificant.

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