Effect of Clenbuterol on Growth, Food Efficiency and Carcass Composition in Fattening Lambs

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SUMMARY: Investigations have been concluded on male lambs weaned at an age of 45 days and fed on from weaning until the end of experiment on different energy levels (4.3; 5.1 and 6.0 MJ) and proteins (160.2 and 200 g/kg) of complete mixture. After reaching 27 kg of live weight, animals of experimental groups in each trial received for 42 days additionaly 10 mg clenbuterol per kg of complete mixture.

No essential differences were established in final weight, average daily gain between animals of control and experimental groups respectively, regardless of feeding type. Clenbuterol incorporation in diet leads to a redused food intake (energy and protein, respectively) in each experiment, in proportion to the ennergy density of diet. At a high-concentrated feeding clenbuterol improves food efficiency, in contract to low-concentrated one, where a reverse trend was observed. Clenbuterol applied in a high-energy value of diet is favourable for obtaining more meat. An opposite effect is observed at a low energy level feeding. Results obtained show that a dependence exists between the effect of clenbuterol and feeding type.

INTRODUCTION: Intensive fattening of lambs is accompanied with deposition of more fats in the carcass, which worsens the quality of production and is associated with over-expenditure of concentrated feed. In our previous investigations (SHINDARSKA et al.,1990) we have established that through changes of feeding schemes an effect could be exerted in some measure on forming less lipids in the carcass. However this leads to both prolongation of fattening process and passing of animals to another age-class.

Through applying the B-agonists in both monogastric and ruminant animals, an improvement of fats/protein ratio in the carcass has been reached regardless of the sex, dose and duration of treating (WILLIAMS et al.,1987; BEERMANN et al., 1986). The effect of B-agonists probably depends on feeding conditions, age and genetic capacities of animals. In the investigation of THORNTON et al. (1985) it was pointed out that regardless of feeding kind (pasture or in manger) clenbuterol leads to 30 % reducing of fats in the carcass of lambs. Other investigations on the interaction between kind of feeding and effect of B-agonists have been not published and this gave us reason for the present study. The aim was to examinate the effect of clenbuterol on some carcass characteristics efficiency of nutrients in lambs fattened under different energy and protein levels.

MATERIALS and METHODS: Three experiments have been concluded on male lambs weaned at 45-day age, average live weight - 15.4 kg. Animals of all three experiments - from weaning to the end of experiment - have received diets containing different levels of energy (4.3; 5.1 and 6.0 MJ) and protein (160; 200 and 200 g), kg complete mixture.Composition of diet was presented in our previous study "SHINDARSKA et al.(1990). After reaching 27 kg of average live weight, lambs of each experiment were divided into three groups - a control and two experimental of
eight animals of each group and in next 42 days they have received the same complete mixture. Animals of experimental groups also received at the rate of 10 mg clenbuterol. Lambs were fed in group "ad libitum" at a free access to water. Feed quantity for control group was determined daily through the intake of both experimental groups, live weight being controlled every 14 days.

Before starting the treating, three animals of each experiment were slaughtered, and at the end of experimental period - four ones of both the control and the first experimental groups. Lambs of the second experimental groups were slaughtered a week later during this time they received no clenbuterol. A complete carcass analysis was made 24 hours "post mortem". After deboning and grinding of the left carcass half, mean samples have been taken, where the contents of fats and proteins were determined by using routine methods (Soxlet and Kjeldal). For statistical treating of results obtained, t-criterium of Student was applied.

RESULTS and DISCUSSION: During the experiment lambs were in good health. Clenbuterol incorporation in diet started after reaching 27-28 kg of live weight. Duration of preparatory period (from weaning to basic live weight choosen) was different for each experiment and depended on feeding type. Clenbuterol treating of animals of 1-st experiment (lowest energy level of feeding) started 28 days after that of animals at high-concentrated feeding.

Treating with clenbuterol leads to no significant changes of final live weight and average

daily gain between animals of control and experimental groups in each of all the three experiments (Table 1). Trends observed toward increasing the average daily gain for third experiment, respective decreasing for the first one are insignificant. Analogical for lambs are shown by other authors, too "BOHOROV at al.(1987); BEERMANN et al.(1986); BAKER et al. (1984)", while for calves data are contraductory "WHILLIAMS et al.(1987); MILLER et al.(1988); SCHIAVETTA et al (1990)". In contrast to low-energy feeding (1-st experiment), clenbuterol supplement leads to decreased consumption of energy and protein for animals of 3-rd experiment (Table 2). In that feeding type, for reaching equal final live weight, different quantities of nutrients have been used. In high-energy feeding, clenbuterol is favourable for feed efficiency in diet. Investigations of MILLER at al. (1988) on calves show a worsened efficiency at a comparatively equal consumption, probably also conditioning lower average daily gain. In a low-energy feeding, clenbuterol intake has a negative effect on feed efficiency - energy and protein inputs increase by about 40 %.

Carcass characteristics are presented in Table 3. At an equal final live weight, carcass weight and meat quantity are significantly more in experimental groups of 3-rd experiment. Absolute protein quantity in the meat increases, and fat content decreases, similarly to that reported for lambs, sheep and calves "BOHOROV et al. (1987); WILLIAMS et al. (1987).

Clenbuterol has a reducing effect only in high-concentrated feeding, typical with an increased lipid deposition in adipose tissue "SCHIAVETTA et al.(1990)", 30 % decrease of body lipids observed are analogical to that reported by THORNTON et al.(1985) for lambs and sheep, and RICKS et al.(1985) establish 40 % decrease of fat layer. In contrast to former author, in our experiments growth rate of experimental lambs did not change (Table 1). Data also show an increased protein deposition in the carcass, almost adequate to the change observed in fat contents. Applying of B-agonists in high-concentrated feeding is of an exceptionally favourable effect on slaughter carcass composition and for obtaining more and leaner meat. Our results about both quantity and fatty-acid composition of TG from different fat depots support the affirmation for reduced lipogenesis in adipose tissue "THORNTON et al.(1985); MILLER et al.(1988)". On the other hand, clenbuterol increases the rate of maximum muscular growth and total protein mass "EMERY et al.(1984)". It is supposed that in high-concentrated feeding B-agonists direct metabolic processes in the organism toward a preferable using of energy through the diet for muscular growth, and not for synthesis of lipids.

Worsened using of nutrients (Table 2) in low-energy feeding (1-st experiment) is also accompanied by negative changes in carcass characteristics (Table 3). Applying of the same clenbuterol quantity in that feeding type is of radically opposite effect compared to the 3-rd experiment. In experimental animals a trend is even observed toward decreasing the deposition rate of protein in the carcass, parallely to some major reduction of body lipids (by about 40 %). An higher water content was also established. Drastic changes in reserve lipids for animals, also being of lowest fat contents in the carcass before treating (Table 3), supposes that using of clenbuterol places the lambs of that experiment under conditions of discomfort, compared to control ones. Mechanisms controlling the effect of B-agonists under low-energy feeding have not been studied.

B-agonists considered to be degraded quickly in the organism "HOVELL et al.(1988)" and probably shortly after termination of treating they have low metabolic activity in the organism. Results presented in Tables 1, 2, 3 show that no significant differences exist between both experimental groups regardless of feeding type. This supposes that the effect of clenbuterol on metabolic processes dies down not quickly. On the other hand, it could be considered that 7-day withdrawal period after treating guarantees elimination of eventual metabolities derived from degradation of clenbuterol. For nearly reasons, further investigation are necessary for optimizing needed with drawl period after treating with B-agonists.

Results obtained in all the three experiments show that different feeding conditions predetermine the effect of clenbuterol, both regarding feed efficiency and carcass characteristics.

Its using would make sense only in intensive fattening associated with reducing the surplus fats in the carcass. The results also show the complexity of interaction of B-agonists with metabolic processes in the organism and require further investigations.

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Table 1:Weight growth and gain

Experiments	I			II			III		
Groups	control	exp.1	exp.2	control	exp.1	exp.2	control	exp.1	exp.2
I tems									
Live weight,kg									
-initial body weight	26.9±1.5	26.5±1.0	26.2±1.0	28.4±1.5	28.8±1.3	28.8±1.3	27.4±1.1	27.3±1.1	27.3±1.0
-final body weight	37.6±2.2	36.8±1.2	37.6±1.2	38.6±1.7	39.0±1.6	39.0±1.8	38.5±3.5	39.0±1.0	39.5±1.0
Average daily gains,g	241±58	205±11	209±18	253±43	247±16	245±28	265±46	293±10	302±10

Table 2:Consumation and feed conversion efficiency in the carcass

Experiments	I			II			III		
Groups	control	exp.1	exp.2	control	exp.1	exp.2	control	exp.1	exp.2
I tems									
Intake:									
-feed,kg	1.30	1.23	1.25	1.40	1.30	1.30	1.40	1.15	1.15
-energy,MJ	5.68	5.30	5.40	7.14	6.63	6.63	8.40	6.90	6.80
-crude protein,g	185	172	173	280	260	260	274	225	225
Feed conversion efficiency,kg	4.74	6.55	6.40	5.70	5.15	5.40	5.30	3.80	4.00
Energy conversion efficiency,MJ	20.40	28.18	27.70	29.07	26.27	27.54	31.82	22.85	23.84
Crude protein efficiency,g	0.66	0.91	0.90	1.14	1.03	1.08	1.04	0.75	0.78

Table 3:Carcass analysis,protein and fats contents in the carcass

Experiments	I			II			III		
Groups	control	exp.1	exp.2	control	exp.1	exp.2	control	exp.1	exp.2
I tems									
Live weight before slaughtering,kg	39.5±2.2	36.8±1.2	36.9±1.2	39.6±2.2	39.1±2.6	41.5±2.6	39.5±1.5	39.0±1.0	39.5±1.0
Empty body weight,kg	16.2±1.0	14.4±0.3[1]	14.2±0.8[2]	16.4±1.2	18.8±1.2	20.1±1.5	16.4±0.5	19.3±0.5[1]	19.0±0.4[4]
Meat,kg	10.8±0.7	9.1±0.2	9.2±0.6	10.7±0.6	11.4±0.7	12.6±0.9	11.1±0.2	12.5±0.3[1]	12.4±0.3[3]
Bones,kg	3.8±0.1	3.6±0.1	3.5±0.2	4.0±0.1	4.2±0.2	4.0±0.2	3.6±0.2	3.6±0.2	3.8±0.4
Dressing percentage,%	43.54	39.10	38.48	41.40	48.08	48.30	44.70	50.39	45.80
Protein in carcass,kg	1.9±0.1[1]	1.8±0.1[2]	1.8±0.1[2]	1.8±0.1	2.1±0.1	2.4±0.2	1.8±0.1[1]	2.1±0.1[1.3]	2.3±0.1[3]
Fats in carcass,kg	1.5±0.1[1]	1.0±0.2[2]	1.0±0.1[2]	2.0±0.1	1.8±0.2	1.5±0.2	2.5±0.1[1]	1.9±0.3[2]	2.1±0.2[2]

If the smallest possible difference between the superscrips(D)is:D=1,p<0,05;D=2,p<0,01