Evaluation of carcass traits and 12th rib analysis of hair sheep supplemented with phosphorus

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ABSTRACT

The aim of this study was to evaluate the performance of sheep supplemented with P using the analysis of 12th rib as an indicator. Twenty sheep weighing 13.88 ± 2.51 kg and kept on *Andropogon gayanus* pasture, divided in two treatments of 10 animals. In group P supplementation with 3g/phosphorus/animal/day was carried out and in group N no P supplementation was given. After 82 days the animals were slaughtered and carcass measurements taken. The 12th rib was removed for analysis. No significant differences in live weight, carcass kill out, or commercial cut weights were found between the two treatments, except for abdominal cavity organs which to be heavier in the non-supplemented group (p=0.0954). The 12th rib analysis showed that the supplemented group was heavier rib and bone weight (p<0.05) as well as muscle weight (p=0.0618) when compared with animals not supplemented with P in the feed. Other measurements such as fat cover and rib eye area were not significantly affected by the treatments, as well as crude protein, extract etereo, ash and P. It was shown that P supplementation improved performance in young sheep, including improved formation of bone and muscle tissue using the composition of the 12th rib as a reference, and liver and kidney too.

Key words: deficiency, grown and hair sheep.

INTRODUCTION

Small ruminants, especially sheep, are growing in importance for animal production in various regions worldwide. In Brazil, meat sheep production has grown considerably in recent years, based mainly on systems with native hair breeds at pasture (Veloso, 2002).

Phosphorus deficiency in tropical countries is more common in pasture fed herds, as most of the grasses established on soils in this regions are deficient in this element. In these zones of animal production, 50% of the soils are Latossoils with low levels of available phosphorus, although they have good physical properties. The available phosphorus deficiency is aggravated by elevated levels of iron and aluminium oxides and hydroxides which react with the low levels of phosphorus in the soil, thereby making it practically unavailable for the plants that are more nutritionally demanding and that have root systems that are unable to overcome the aluminium toxicity (Carvalho et al., 2003).

Phosphorus is a key mineral for animal growth, energy metabolism and is an essential component in buffer systems in the blood and other organic fluids. Therefore, the unsufficient ingestion of phosphorus by ruminants may cause a reduction in voluntary consumption of feed, slow growth and weak bones (Underwood & Suttle, 1999).

The carcass is an important factor for evaluation of the ability of an animal to transform food into edible product (meat). With increasing consumer demand for lamb, the standardization of product quality is necessary (Macedo et al., 2000).

Generally, sheep carcasses may represent between 40 and 50% of the animal liveweight, varying depending on animal related factors such as age, sex, birth weight, nutrition, management and others. Factors related to the carcass such as weight, length, finish and conformation also influence killout percentage (Pérez, 2002).

The most important component in valorization of the carcass or cut is muscle, the greater proportion of this, the higher commercial value can be achieved for the animal (Fernandes, 1994). Fat offers protection to frozen meat, reducing loss and influencing palatability (Deambrosis, 1972).

. Measurements that can be correlated with composition are very useful in avoiding costly total dissection of the carcass. The rib has been investigated as a cut that is useful in predicting the proportion of muscle, fat and bone in the (Silva & Pires, 2000). In this study carcass and 12th rib were analysed to evaluate the effect of P supplementation in young sheep.

MATERIAL AND METHODS

The experiment was carried out in teh sheep sector of the Água Limpa farm belong to Brasília University (UnB), situated at 15^{o} 47' latitude south and 47^{o} 56' longtitude west. The regional climate is calssified as AW by Köppen, with mean annual temperature of 21.1^{o}C, with 16.0^{o}C and 34.0^{o}C minimum and maximum respectively and precipitation is 1578.5 mm and mean relative humidity is 68%.

Twenty male sheep, Santa Inês breed, initial live weight of 13.8 ± 2.5 Kg, aged 3 months, were maintained in a single group on *Andropogon gaianus* grass pasture. No prior fertilization of pastures was carried out in the 12 months before the experiment. The lambs were randomly allocated to two dietary treatments (16.66 g de bicalcium phosphate animal/day and non supplement P).

At the end of each day the groups were separated in closed stables when they received a basic diet of 200 g/day of cassava flour and 10 g/day of urea and 9.57 g/day of mineral mixture (0.009 KI; 0.0008 $CoSO_4$; 0.03 $CuSO_4$; 1.61 MgO; 3.0 NaCl; 0.32 $ZnSO_4$; 0.148 $MnSO_4$; 0.457 $FeSO_4$; 4.0 S g/day). For one group 16.66 g/animal/day of Bicalcium phosphate was added, offering 3.0 g phosphorus/animal/day (Group P), and the other remained with phosphurus supplementation (group N).

Pasture samples were collected on days 6, 42 and 69 of the experiment, and bromotalogical analysis carried out on the feed on offer using AOAC (1995) recommendations (Table 1).

Animals were weighed on days 1, 8, 29, 43, 57 and 82 of the experiment. Parasites were counted (eggs per gram of faeces – EGF) weekly using modified Mc Master technique (Whitlock, 1948). Aniamls were dosed as necessary using febendazole (Panacur oral®).

After 82 days on experiment, lambs were weighed (Slaughter Live-weight – SLW) and slaughtered after a 24 hour fast. Soon after bleeding, skin was removed and weighed. Víscera were removed and thoracic cavity organs weighed (TCO – lung, heart and trachea) as well as abdominal cavity organs (ACO – liver and kidneys). Hot carcass weight was then taken (HCW). Carcass traits were evaluated using the system proposed by Osório (1998). Fat was measured subjectively on an increasing scale (1 to 5). Carcass length (distance between base of the tail and base of the neck) was takjen wioth a metric tape.

Hemi-carcasses were obtained by a longtitudinal cut on the vertebral column and the left half weighed (LHCW). A fraction of the rib cage was taken by transverse cuts at the 12^{th} and 13^{th} ribs to obtain the 12^{th} rib weight and composition (muscle, bone and fat – adapted from Hankins & Howe, 1946). The component rib tissues were minced together for liofilization. Afterwards, all the material was again chopped for chemical analysis using AOAC (1995).

Eye muscle área was determined using a standard transparent checked base ($1cm^2$/cell), by drawing around the longissimus muscle exposed by the tranverse cut of the 12^{th} intercostal space.

The halfcarcass was divided into six regions of commercial cuts: leg, shoulder, back, rib, belly and neck (adapted from Santos, 1999), and each individually weighed.

True killout of hot carcass was calculated (TKO) using the formula suggested by Osório et al. (1998).

TKO=(HCW/SLW)x100

The experiment was analysed as fully random design with two treatments (levels of P in the diet) with ten repetitions and five measures repeated in time for live weight. The program STATISTICAL ANALISIS SYSTEM (SAS, 1996) was used for data analysis.

RESULTS

Bromatological analyses of the feed used in the experiment are presented in Table 1.

No significant differences were observed in liveweights of the animals on the different treatments throught the experimental period. (Figure1).

No significant differences were observed between the animals on the two treatments for carcass component weights (Table 2), except for liver and kidney weights which to be heavier in the supplemented group (p=0.0954).

The weights of the 12th rib bone were higher for animals supplemented with P, as were muscle (p=0.0618) whereas the other measures were not significantly different (P>0.10; Table 3).

DISCUSSION

Winks (1990) observed that the effects of P deficiency were more severe in grazing ruminnats where pastures had a P level less than 0.15%. In the present work, P levels of the pasture were approximately 0.25%, classifying the deficiency as marginal for the group of sheep that didn´t receive P supplementation. It may be that the 82 day period used here was not sufficient to reduce weight gain to a signifiucant level in this group.

Working with Nelore calves with a liveweight of 215 kg, Nicodemo et al. (2000) verified a reduction in ingestion and consequently in weight gain from 71 days with animals receiving 5g de P/animal/day. Some studies show that liveweight alone is not adequate in the early diagnosis of P deficiency (Vitti et al., 1988; Villarroel et al. 1991).

Carcass killout values were approximately 40%, below those found by Alves et al. (2003) which were 45 to 50%. These authors worked with heavier animals (14.5 – 16.5 kg carcass weight). Comparison of carcass traits should consider breed, sex, age, weight and nutrition of the animals to avoid inadequate conclusions. Sousa (2003), working with Santa Inês sheep of a similar weight and age to those here, but different feeding system (confined with corn and sunflower silage), found a better quality carcass. The higher energy diet used by this author resulted in higher carcass fat (fat cover, fat and ether extract of 12th rib), but little differences between the other traits and those observed in the present work.

Studying the effect of four different forage types (hay of water-grass, hay of bagasse of pineapple 2, forage palm - 3 and corn silage - 4) on the quality of meat in Santa Inês sheep, Madruga et al. (2002 apud Madruga (2003)), found different lipid levels at higher concentrations for treatments 1, 2 and 4, also due to higher energy levels in the diet. In the meat, levels of humidity, protein, phosphorus, calcium and colesterol were significantly greater for sheep fed with forage palm compared to the other treatments.

Fat in the carcass has beneficial effects in terms of flavour as well as dehydration which occurs during the cooling process, making the meat dark and dry, undesirable to the customer (Sainz, 1996). Fat in adult sheep is not desirable for sale purposes, because of its texture and consistency, as it has a high degree of saturated fatty acids which adhere to the palate when not served hot (Osório & Osório, 2003).

Animals that received the P supplementation had a higher degree of deveolopment of the 12th rib, reflected by the higher quantity of muscle and bone tissue, the former being edible and more valued in the carcass and economic terms. The heavier liver and kidneys, although not carcass components *per se*, have an aggregated economic interest for sale value serving also as food stuff, reducing the price of products and quality of life for lower income families in a developing country such as Brazil (Osório et al. 1996).

It is therefore important to pay extra attention to mineral supplementation to animals, and P in particular, especially when animals are fed at pasture and there is an inherent deficiency of this element.

Nutrition is a key point in the standardization of lamb carcasses for market purposes, for valorization of the product and to attract consumers. The carcasses should have a high percentage of muscle, uniform subcutaneous fat deposits and fat levels adequate for the buying market, all these traits influenced by the degree of maturity of the genotype. Conformation and finishing score of carcasses are criteria which define quality as those that are well conformed and finished tend to attract higher prices at sale, especially in countries with tradition in lamb and mutton production (Silva Sobrinho, 2001).

CONCLUSION

Phosphorus supplementation can improve performance and carcass traits in young sheep reared at pasture in the savannah region of Brazil, improving bone tissue and muscle deposition, using 12th rib analysis as reference, as well as, kidneys and liver weights.

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Table 1: Bromatological composition of feed offered to sheep.

Chemical composition (g/kg MS)	Forage	Concentrate	
		P	N
Dry Matter	322.6	888.5	880.1
Crude Protein	61.7	238.0	232
Ether Extract	28.0	14.8	11.1
FDN [a]	733.6	143.5	142.7
FDA [b]	380.8	31.5	32.6
Ash	63.4	84.1	28.6
Phosphorus	2.1	16.4	0.9

[a]FDN: Fibre Detergent Neutral
[b]FDA: Fibre Detergent Acid

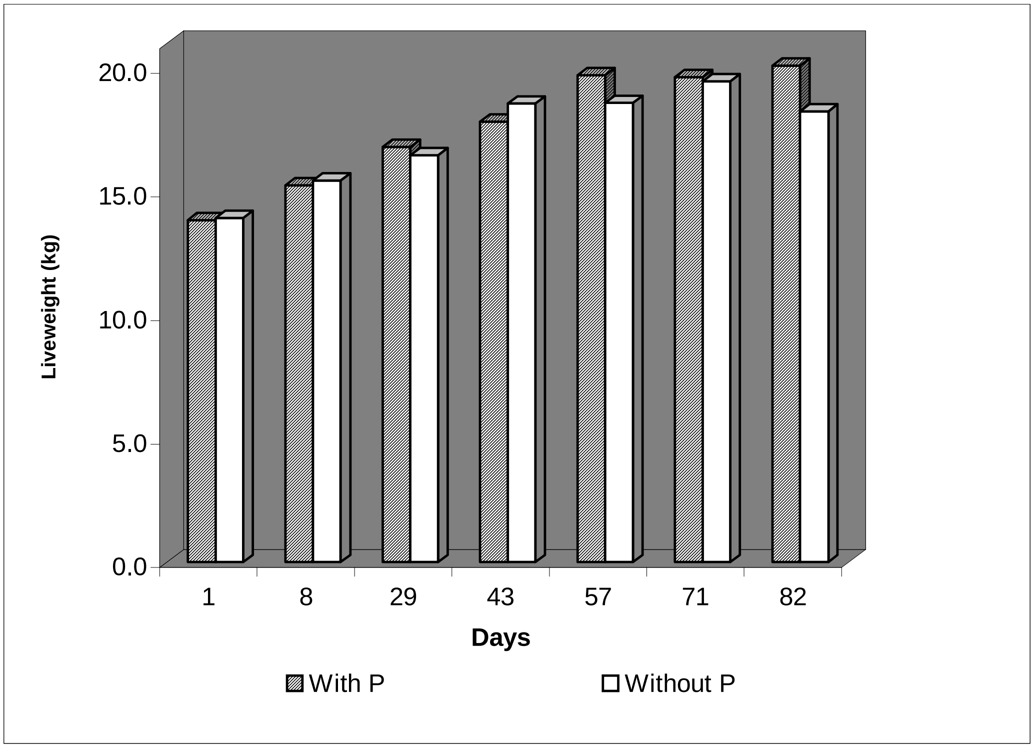

Figure 1: Liveweight variation in sheep on two different P treatments.

Table 2: Slaughter and carcass weights and weights and proportions of commerical cuts of half carcasses and components in sheep on two P treatments.

Treatments	P	N	Standard Error
Liveweight at slaughter (Kg)	18.71	18.24	1.52
Carcass weight (Kg)	8.08	7.51	0.52
Half carcass weight (Kg)	4.09	3.90	0.27
Kill out (%)	38.4	41.2	2.1
Skin (Kg)	1.17	1.19	0.07
%	17.1	15.4	2.1
Carcass Length (cm)	60.2	62.4	1.34
Fat cover (1to 5)	2.3	2.2	0.1
Leg (Kg)	1.33	1.21	0.08
%	31.4	31.2	1.1
Shoulder (Kg)	0.89	0.81	0.06
%	20.2	20.9	1.0
Back (Kg)	0.44	0.50	0.06
%	11.0	12.7	1.1
Rib (Kg)	0.44	0.41	0.03
%	11.2	10.5	0.6
Belly (kg)	0.68	0.64	0.06
%	14.9	16.3	1.4
Neck (Kg)	0.39	0.34	0.02
%	9.2	8.9	0.5
Lung, trachea and heart (kg)	0.46	0.42	0.03
%	6.0	5.8	0.4
Liver and kidneys (kg)	0.57[b]	0.49[a]	0.03
%	7.1	6.7	0.3
Scrotum weight (kg)	0.21	0.20	0.04
%	2.3	2.7	0.4
Scrotal circumference (cm)	19.5	19.0	1.65

[a and b] Means followed by different letters on the same line are significantly different ($p<0.10$)

Table 3: Weight and composition of 12th rib and rib eye muscle área for sheep on two P treatments

Tretaments	P	N	Standard Error
Rib Weight (g)	55.72 [b]	43.37 [a]	3.77
Muscle weight (g)	35.94[b]	29.23[a]	2.43
%	65.0	67.4	2.3
Bone weight (g)	12.57 [b]	8.53[a]	1.30
%	22.3	19.5	1.3
Fat weight (g)	5.16	4.17	0.67
%	9.2	9.9	1.2
Eye Muscle Area (cm^2)	8.1	8.3	0.6
Dry matter	32.9	33.6	0.88
Crude Protein (%DM*)	61.9	59.2	2.46
Ether Extract (%DM*)	17.2	19.3	1.60
Ash (%DM*)	15.2	14.2	0.65
Phosphurus (%DM*)	2.7	2.5	0.12

[a and b] Means followed by different letters on the same line are significantly different ($p<0.10$); DM = Dry Matter