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FEEDING TO INFLUENCE AGE OF PUBERTY IN TROPICAL HAIR SHEEP

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SUMMARY

Tropical hair sheep of the Morada Nova breed were utilized to study the effect of energy intake on age and weight at puberty. Twenty-four ewe-lambs, 140±1.2 days of age and weighing 12.5±.25 kg, were assigned to receive 50, 200, 350 or 500 g of maize grain per day (T1, 2, 3 and 4, respectively) along with 150 g of cottonseed cake and a ground maize stover/maize cob mixture ad libitum. Between the beginning of the experiment and first estrus, one lamb was removed from T3 and one from T4 due to rumen disorders. Also, one lamb from T1 was eliminated for reasons not related to experimental treatments. The remaining 21 lambs gained weight at rates of 42±6, 49±5, 60±8 and 74±9 $g.day^{-1}$ for T1, 2, 3 and 4, respectively. First estrus, detected by vasectomized teaser rams, was displayed at 283±13, 294±15, 310±16 and 266±16 days of age and 19.1±1.2, 20.6±1.2, 23.4±2.0 and 20.8±1.4 kg of weight for the four treatment groups. Treatment differences were not significant (P>.05) for age or weight at first estrus. Performance of Morada Nova ewe-lambs in this experiment indicates that postweaning feeding should provide for average daily gains within the range of 35 to 75 $g.day^{-1}$; that animals thus fed will display first estrus at 260-320 days of age (irrespective of weight) or at 18-22 kg weight (irrespective of age); and that a higher energy intake level will not accelerate age of first estrus.

KEY WORDS: Hair sheep, Semiarid tropics, Energy supplementation, Growth rate, Age at puberty.

Introduction

The economic return to a sheep production enterprise depends on many factors, including the genetic capacity of the animals themselves, the level of management and nutrition imposed relative to the genetic capacity, and the costs of major imputs such as feed. For replacement breeding females the age at which puberty (first estrus) is attained is an important determinant of the ewe's overall lifetime productivity and return above cost of rearing.

In Northeast Brazil ewe-lambs of tropical hair breeds born at the beginning of the rainy season normally will not reach an adequate weight for breeding by the end of the subsequent dry season, due to severe restrictions in feed availability from the native "caatinga" tree and shrub vegetation. Consequently lambs are either bred at a less than desirable weight or at a time well into the rainy season which results in parturition in the middle of the extended dry season. Either option causes severe reductions in flock productivity compared to the genetic potential of individual ewes.

At tropical latitudes photoperiod is not a factor in determining the reproductive cycle of sheep (Dyrmundsson, 1973). This makes the level of feeding and management all the more important an influence on onset of puberty (Allen and Lamming, 1961) by facilitating an adjustment of the breeding calendar to best take advantage of natural cycles in feed availability.

With these factors in mind the present experiment was designed to test the effect of four levels of post-weaning energy intake on the growth and subsequent age and weight at puberty (defined as first manifest estrus) of Morada Nova ewe-lambs raised in confinement during the prolonged dry season, in the semiarid tropics of Northeast Brazil.

Materials and Methods

The site of this experiment was the National Center for Goat Research (CNPC) of the Brazilian Enterprise for Agricultural Research (EMBRAPA) at Sobral, Ceará. Normal maximum and minimum monthly temperatures at the CNPC are 35 and 22°C, with little yearround variability. Mean precipitation is 759 mm per year, usually falling entirely within the period of January to May. The dry season is therefore of about seven months duration (Figueiredo and Pant, 1982).

Twenty-four Morada Nova ewe-lambs which had been weaned at about 112 days of age were assigned randomly to one of the four experimental diets shown in Table 1. In addition to these diets all animals were offered a mixture of ground maize stover (70%) and ground maize cobs (30%), ad libitum. Animals were penned in groups of three, and received water and a common salt-bone meal mixture ad libitum. Their age and weight at the onset of the experiment were 140±1.2 days and 12.5±.25 kg.

Animals were weighed every 28 days; growth rates for each animal were estimated by linear regression of weight as a function of age between the beginning of the experiment

Table 1. Composition of post-weaning supplemental diets fed to experimental Morada Nova ewe-lambs.

Item	Diet no. 1	2	3	4
	per animal, per day			
Cottonseed cake, g	150	150	150	150
Ground maize grain, g	50	200	350	500
Total concentrate offered, g	200	350	500	650
Digestible protein[a], g	33	43	53	63
Metabolizable energy[a], Mcal	0.7	1.2	1.7	2.3

[a]Estimated from published values (National Research Council, 1975).

and the first manifested estrus. One weight taken after first estrus, on the regular 28-day schedule, was included. The estimated weight at first estrus was calculated for each animal by use of these regression coefficients, except for two lambs whose calculated weights seemed too deviant from actual recorded weights around the same age. For these two animals actual weights taken on the day following first estrus were used.

Estrus was detected by exposing all lambs twice daily to vasectomized teaser rams. Lambs in estrus were bred to intact rams. Pregnancy was diagnosed by laparotomy at 35 days following last breeding.

One animal was removed from each of treatment groups 3 and 4 due to a rumen disorder which may have been related to high levels of starch intake. From treatment group 1, one

animal had to be removed due to a problem not related to the experiment. Weight gains and first estrus data for the remaining 21 lambs were analyzed in a completely randomized design (Steel and Torrie, 1980) with three degrees of freedom for treatments and 17 for residual effects. Feed intake data for pen groups were analyzed in the same design but with only four residual degrees of freedom. Duncan's multiple range test was used to compare means among dietary treatment groups.

Results and Discussion

Over the 20 weeks of the experiment, total dry matter intake (DMI) was 61±.9 g per kg metabolic weight (MW) per day. The mean for diet 3 was higher (64.5 g, $P<.05$) than for the other three diets (60.2, 59.1 and 59.4 g for diets 1, 2 and 4). These levels of intake were similar to those reported for Barbados Blackbelly (a tropical hair breed) X Dorset and/or Suffolk growing wether lambs consuming diets of wheat straw and up to 65% concentrates (Brown and Johnson, 1985) or coastal bermudagrass or fescue hay (Luginbuhl and Johnson, 1982). Growing lambs of a tropical breed in Indonesia, however, were reported to consume 79 g DM/kg MW when offered green forages and crop foliages (Haryanto et al., 1982). And in Brazil, Morada Nova wethers similar in weight to the ewe-lambs in the present study consumed about 90 g DM/kg MW per day when offered a diet with 50% maize crop residue (Oliveira et al., 1982).

The maize crop residue roughage portion of the diet, offered ad libitum, was consumed in decreasing amounts

(P<.05) as the level of concentrate offered increased (Table 2). The net effect was to shift the roughage/concentrate ratio from 62/38 for diet 1 to 38/62, 24/76 and 19/81 for diets 2, 3 and 4. For the latter three diets, refusals of concentrate measured 3, 8 and 30% of the amounts offered.

Total daily DMI per pen increased as the animals grew, for diets 1, 2 and 3. However, for the highest concentrate diet (no. 4) daily DMI was lower during the final weeks of the experiment than at the beginning. For all treatments, when DMI was corrected for body weight or MW it was lower in weeks 13-20 than in weeks 1-12 (Table 2). There was a reversal of treatment effects in these two sub-periods: during weeks 1-12, treatment groups 3 and 4 consumed more (P<.05) than groups 1 and 2; but during weeks 13-20, treatment group 4 consumed less (P<.05) than the other three groups.

Average daily gain responded (P<.05) to the increased energy concentration of the diets consumed (Table 3). The highest rates of gain, 60 and 74 g/day on diets 3 and 4, were still considerably lower than those reported by Oliveira et al. (1982) for Morada Nova wether lambs.

In spite of faster rates of gain for the animals which consumed more energy, average ages and weights at puberty were not significantly different for the four dietary groups (Table 3). Regardless of dietary treatment, all lambs except two (one each from treatment groups 1 and 4) had achieved at least 13 kg body weight before first display of estrus, and all lambs except a different two (again, one each from groups 1 and 4) were at least 260 days old by first estrus.

Table 2. Feed intake by experimental animals.

Item	Diet no. 1	2	3	4
	per animal, per day			
Concentrate offered, g	200	350	500	650
Concentrate refused, % of offered	0	3	8	30
Dry matter intake, g				
Concentrate	182	304	414	408
Roughage	298[a]	189[b]	133[c]	94[d]
Total	480[a]	493[a]	547[b]	502[a]
DM intake, % of body weight				
Wk 1-12	3.1[a]	3.1[a]	3.5[b]	3.4[b]
Wk 13-20	2.9[a]	2.7[a]	2.7[a]	2.2[b]
DM intake per $W^{.75}$				
Wk 1-12	62[a]	61[a]	70[b]	68[b]
Wk 13-20	58[a]	56[a]	57[a]	47[b]

[abcd]Means in the same row not followed by the same letter are different ($P<0.05$).

These results could be interpreted to define the minimum age and weight for puberty in sheep of this breed (when exposed daily to a ram). By the same token all but one of the lambs of the lower dietary energy treatments (groups 1 and 2) manifested first estrus before reaching 320 days of age and 22 kg weight, which could be interpreted as defining the upper limits for optimal ranges of age and weight for first

estrus. All but one lamb of these two groups gained at least 35 but not more than 62 $g.da^{-1}$.

Lambs receiving the higher dietary energy treatments (groups 3 and 4) generally did not display first estrus any earlier than those in groups 1 and 2. On the contrary, there was a tendency (non-significant) for first estrus to occur at an age older than 320 days (two lambs of group 3) or at body weights higher than 22 kg (five lambs or 50% of groups 3 and 4).

All lambs became pregnant after 1 or 2 services; only 5 of the 21 lambs required a second service, and this requirement was independent of dietary treatment (Table 3).

We conclude from these results that Morada Nova ewe-lambs, if fed to achieve post-weaning daily gains of at least 35 but not more than 60 g, and exposed to a ram, will reach puberty (first estrus) at 18-22 kg body weight or at 260-320 days of age. Increasing the energy concentration of the diet to the point where average daily gain exceeds 60 g is probably uneconomical as a feeding practice.

Table 3. Weight gains and age and weight at first estrus for experimental Morada Nova ewe-lambs.

Item	Diet no. 1	2	3	4	Overall mean ±SE
Starting age, da[a]	136	138	141	144	140±1.2
Starting weight, kg[a]	12.8	12.5	12.3	12.2	12.5±.25
Weight gains, g/da[b]	42[c]	49[cd]	60[cd]	74[d]	56±4.2
Age at 1st estrus, da[b]	283[c]	294[c]	310[c]	266[c]	288±7.8
Wt at 1st estrus, kg[b]	19.1[c]	20.6[c]	23.4[c]	20.8[c]	21.0±0.8
No of lambs pregnant[b], conceived at:					
1st service	4	5	4	3	
2nd service	1	1	1	2	

[a] n=6 for all treatments.

[b] n=5 for treatments 1, 3 and 4; n=6 for treatment 2.

[cd] Means in the same row not followed by the same letter are different ($P<0.05$).

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