

PUBERTY IN BREEDS OF FEMALE HAIR SHEEP IN NORTHEAST BRAZIL¹

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ABSTRACT - This experiment was carried out with 112 ewe lambs, 32 of Morada Nova breed (MN), 63 Brazilian Somali (BS), and 17 Santa Inês (SI); grazing in native pasture at the Brazilian National Goat Research Center, CNPC, Sobral, CE, Northeast Brazil (3° 42' south latitude and 40° 21' west longitude). Lambs were weaned in groups averaging 112 days of age. Live body weights were recorded at birth and at four-week intervals until the first puberal estrus. Estrus was detected by using teaser rams. The date, time of day and live body weights were recorded to obtain the age and weight at first puberal estrus. Between 40 to 60 hours after estrus was detected, the ovaries of each ewe lamb were observed by laparotomy to determine the occurrence and rate of prepuberal (CA) and puberal (CL) ovulations. The overall mean age and weight at puberty were 306.3 ± 5.6 days and 20.7 ± 0.3 kg, respectively. The SI breed (24.0 ± 1.0 kg) was statistically ($P < 0,05$) heavier at puberty than the MN (21.2 ± 0.6 kg) and BS (19.7 ± 0.4 kg) breeds. No statistical differences were found ($P > 0,05$) among breeds for age at puberty. There was no statistical difference ($P > 0,05$) for weight or age at puberty due to type of birth. A significant ($P < 0,05$) influence of year on weight and age at puberty was found. No differences ($P > 0,05$) were found among breeds for incidence and rate of ovulation. All ewe lambs ovulated at puberal estrus with a mean ovulation rate of 1.31. During prepuberal period, 78.35% of the ewe lambs ovulated with an ovulation rate of 1.13.

Index terms: reproduction, ewe lambs, ovulation, native pasture.

PUBERDADE EM FÊMEAS DE RAÇAS OVINAS DESLANADAS NO NORDESTE DO BRASIL

RESUMO - Analisou-se o desempenho de 112 borregas Morada Nova (32), Somalis Brasileira (63) e Santa Inês (17), mantidas em pastagem nativa, no Centro Nacional de Pesquisa de Caprinos (CNPc), em Sobral, CE, Nordeste do Brasil (latitude 3° 42' Sul e longitude em 40° 21' Oeste). Desmamadas a idade média de 112 dias, foram pesadas ao nascer e a cada 28 dias, até à puberdade e observadas com vistas à detecção da ocorrência de estro, durante duas vezes ao dia, com auxílio de rufiões. Entre 40 e 60 horas após a borrega ser identificada em estro, era submetida à laparotomia, com o objetivo de se avaliar a função ovariana quanto à ocorrência e à taxa de ovulação nos períodos pré-puberal e puberal. A idade e o peso médio à puberdade foram de $306,3 \pm 5,6$ dias e de $20,7 \pm 0,3$ kg, respectivamente. A raça Santa Inês ($24,0 \pm 1,0$ kg) foi estatisticamente mais pesada ($P < 0,05$) do que a Morada Nova ($21,2 \pm 0,6$ kg) e a Somalis Brasileira ($19,7 \pm 0,4$ kg), porém as duas últimas não diferiram entre si. Não houve efeito de raça sobre a idade à puberdade, nem efeito do tipo de parto sobre peso ou idade ($P > 0,05$), porém observou-se efeito de ano ($P < 0,05$) sobre peso e idade à puberdade. Todas as borregas ovularam à puberdade, apresentando taxa de ovulação média de 1,31. Não houve diferença estatística ($P > 0,05$) entre raças. Durante o período pré-puberal, 78,35% das borregas ovularam com uma taxa de 1,13.

Termos para indexação: reprodução, borregas, ovulação, pastagem nativa.

INTRODUCTION

The variation in the onset of puberty in ewe lambs is influenced by both genetic and environmental factors. Identification of the specific

factor and its influence in relation to other factors is unclear (Foote et al. 1970, Dyrmondsson 1973, Land 1978).

The age and live body weight at which ewe lambs show the first puberal estrus are of considerable practical importance. Ewe lambs showing early sexual activity have increased lifetime performance and had higher reproductive efficiency in the adult ewe (Hulet et al. 1969, Dyrmondsson 1973).

An attempt has been made to study puberty in terms of age, live body weight, breed and ovarian

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activity at the onset of puberty (first behavioral estrus) of hair sheep in Northeast Brazil.

MATERIALS AND METHODS

This experiment was carried out at the Brazilian National Goat Research Center, Sobral, Ceará state, Northeast Brazil (3°42' south latitude and 40°21' west longitude). One hundred and twelve ewe lambs of three breed types were used in this study, 32 of Morada Nova (MN), 63 of Brazilian Somali (BS), and 17 of Santa Inês (SI). Lambs from the Brazilian Somali breed were born during March to April, 1978 to 1981, and from the Morada Nova and Santa Inês, during March to April 1980 and 1981. The lambs and their dams were grazed in native pasture, approximately, nine hours a day (7 a.m. to 4 p.m.). At night, they were placed in corrals where there was available water and a mixture, in equal parts, of bone meal and common salt, ad libitum. The lambs were weaned, weekly, in groups averaging 16 weeks (112 days) of age. Live body weights were recorded at birth and at four-week intervals to the first puberal estrus.

The lambs were exposed to teaser males, beginning at birth, because their dams were checked for first postpartum estrus. Following weaning, the ewe lambs were exposed continuously to vasectomized teaser rams, with their briskets painted. The ewe lambs were checked twice daily (6 - 7 a.m. and 4 - 5 p.m.) for the detection of the occurrence of estrus. The date, time of day, and live body weight of the ewe lambs were recorded to evaluate the age and body weight at first (puberal) estrus. Laparotomies were performed between 40 to 60 hours after estrus was detected, to determine the occurrence and rate of prepuberal and puberal ovulation, as indicated by the presence of corpora albicantia (CA) and corpora hemorrhagica (young corpora lutea - CL), respectively.

Data were classified according to breed and type of birth. Analysis of variance with information on age and body weight using General Linear Models (Barr et al. 1976) and simple correlations were performed.

RESULTS

Least-square means of birth and weaning weights, and the weight and age at puberty by breed and type of birth of ewe lambs, are shown in Table 1. The live body weights, both at birth and at weaning, were statistically significant among breeds ($P < 0,01$). Brazilian Somali (2.0 ± 0.04 , 13.2 ± 0.34 kg) were lighter than Santa Inês (2.6 ± 0.08 , 19.1 ± 0.65 kg); the Morada Nova breed (2.2 ± 0.08 , 16.4 ± 0.61 kg) was intermediate. Single born ewe lambs showed heavier live body weight ($P < 0,01$) at birth and at weaning (2.6 ± 0.06 , 18.4 ± 0.50 kg) than those from multiple births (2.0 ± 0.05 , 14.0 ± 0.40 kg).

The Santa Inês breed (24.0 ± 1.0 kg) was statistically ($P < 0,05$) heavier at puberty than Morada Nova (21.2 ± 0.6 kg) and Brazilian Somali (19.7 ± 0.4 kg) breeds. These latter two breeds did not differ statistically ($P > 0,05$). There was neither statistical difference ($P > 0,05$) for weight nor age at puberty due to type of birth. The advantage of single compared to twin born lambs in body weight at birth and at weaning, was lost as the animals approached puberty. Twin born ewe lambs did not differ in weight or age at puberty (22.1 ± 0.5 kg and 304.8 ± 10.2 days) from single born ewe lambs (22.1 ± 0.7 kg and 312.4 ± 15.2 days, $P > 0,05$). No statistically significant differences were found ($P > 0,05$) among breeds for age at puberty.

Table 2 shows a significant ($P < 0,05$) influence of year on weight and age at puberty in the Brazilian Somali breed.

TABLE 1. Least-square means (\pm SE) of ewe lambs body weight (kg) from birth to puberty and age (days) at puberty*.

Variables	n	Weights			Age at puberty
		Birth	Weaning	Puberty	
Overall mean	112	21.2 ± 0.03	14.5 ± 0.26	20.7 ± 0.30	306.30 ± 5.60
Breed					
Morada Nova	32	2.2 ± 0.08 b	16.4 ± 0.16 a	21.7 ± 0.60 a	296.8 ± 14.20 a
Brazilian Somali	63	2.0 ± 0.04 a	13.2 ± 0.34 a	19.7 ± 0.40 a	306.8 ± 8.80 a
Santa Inês	17	2.6 ± 0.08 c	19.1 ± 0.65 c	24.0 ± 1.00 b	322.2 ± 22.00 a
Type of birth					
Single	50	2.6 ± 0.06 b	18.4 ± 0.50 b	21.1 ± 0.70 a	312.4 ± 15.20 a
Multiple	62	2.0 ± 0.05 a	14.0 ± 0.40 a	22.1 ± 0.50 a	304.8 ± 10.20 a

* $P < 0.05$ for means with different superscripted letters by columns within main effects.

TABLE 2. Least-square means (\pm SE) of weight and age at puberty in Brazilian Somali ewe lambs, in different years.

Year	n	Weight (kg)	Age (days)
1978	15	19.3 \pm 0.70 b	284.5 \pm 11.10 a
1979	9	16.0 \pm 0.90 a	344.2 \pm 14.30 b
1980	15	16.7 \pm 0.70 a	392.8 \pm 11.10 c
1981	24	20.4 \pm 0.50 b	289.6 \pm 8.80 a
Total	63	18.7 \pm 0.30	320.8 \pm 5.40

P < 0.05 for means with different superscripted letters by columns.

A strong tendency existed for heavier lambs to reach puberty at a younger age than lighter lambs when data from all breeds were pooled (Table 3). This is shown by the significant negative correlation ($P < 0.05$) between live body weights at weaning and at puberty, ($r = -0.485$) and with age. ($r = -0.290$). Also, positive significant correlation coefficients existed between live body weight at puberty, and at birth, ($r = 0.595$) and at weaning ($r = 0.719$) (Table 3).

Table 4 summarizes the ovarian activity, the occurrence and rate of ovulation, at puberty and during the prepuberal period. Significant differences did not occur among breeds ($P > 0.05$), in terms of occurrence or rate of ovulation, when breeds were combined. All ewe lambs ovulated at puberal estrus with a mean ovulation rate of 1.31. During the prepuberal period 78.35 percent of the ewe lambs ovulated with an ovulation rate of 1.13. In terms of the ovarian activity there was higher incidence of ovulation at the right ovary than at the left in the

TABLE 3. Simple correlations among weight and age variables (= 112).

Variables	Weaning weight [†]	Weight at puberal estrus	Age at puberal estrus
Birth weight	0.612**	0.595**	-0.135 NS
Weaning weight	—	0.719**	-0.485**
Weight at puberal estrus	—	—	-0.290**

[†] 112 days.

** P < 0.01.

NS = Non significant, P > 0.05.

prepuberal stages, but this difference tended to disappear at puberty.

DISCUSSION

The overall mean age at puberty, of 306.3 days is higher than those reported for St. Croix (Foote 1983), Peliguet (Gonzalez-Reyna et al. 1983) and Djallonke sheep (Berger 1983).

Ewes show estrus throughout the year in Northeast Brazil (Simplício et al. 1980), indicating that age at puberty is not affected by photoperiod. Land (1978) has reported that the genetic effect on puberty is obscured to a varying extent by external factors. Foster & Ryan (1979) have shown that fast growing lambs were not, necessarily, those exhibiting early puberal estrus. Some early born lambs with retarded body growth did not attain puberty until a relatively older age. Single lambs which, as a rule, have faster growth rates, experience their first estrus earlier than twins (Dyrmondsson & Lees 1972). Although in this study, lambs born as singles were heavier at birth and weaning, than lambs born as twins, they were the same weight and age at puberty, indicating a compensatory growth rate of the twins following weaning.

Measurements of year variation in age and weight at puberty were available only for the Brazilian Somali breed. These results clearly indicate an influence of year on body weight and age at puberty, as shown in Table 2. In the years with good rainfall and forage production, like 1978 (19.3 \pm 0.7 kg and 284.5 \pm 11.1 days) and 1981 (20.4 \pm 0.5 kg and 289.6 \pm 8.8 days), ewe lambs showed significantly heavier body weights and younger ages at puberty than in the years of 1979 (16.0 \pm 0.9 kg and 344.2 \pm 14.3 days) and 1980 (16.7 \pm 0.7 kg and 392.8 \pm 11.1 days) when climatic factors and feed conditions were less favorable. A significant negative correlation existed between live body weight and age at puberty for all years within the Brazilian Somali sheep and for all data when breeds were combined.

The ovulation and lambing rates in ewe lambs are generally low compared to adults. They are under considerable genetic variation (Quirke 1979). In this study, there was no significant difference between breeds in ovulation rates at puberty. However, the Morada Nova tended to have a higher ovulation rate than the Brazilian Somali or Santa Inês breeds. Consistently, in all breeds, the rate ovulation during

TABLE 4. Incidence and rate of ovulation prepuberal and at puberty¹, and ovarian activity at puberty in hair ewe lambs.

	Breeds			Total
	Morada Nova	Brazilian Somali	Santa Inés	
Incidence of ovulation (%)				
Prepuberal	84.38 (27/32) a	77.08 (37/48) a	70.59 (12/17) a	78.35 (76/97)
At puberty	100.00 (32/32)	100.00 (48/48)	100.00 (17/17)	100.00 (97/97)
Ovulation rate²				
At prepuberal ovulation (C.A.) ⁴	1.11 (30/27) ³	1.14 (42/37)	1.17 (14/12)	1.13(86/76)
At puberal ovulation (C.L.) ¹	1.34 (43/32)	1.31 (63/48)	1.24 (21/17)	1.31 (127/97)
Ovarian activity at prepuberal ovulation (%)				
Left ovary	53.33 (16/30)	28.57 (12/42)	28.57 (4/14)	37.21 (32/86) a
Right ovary	46.67 (14/30)	71.43 (30/42)	71.43 (10/14)	62.79 (54/86) b
Ovarian activity at puberal ovulation (%)				
Left ovary	44.19 (19/43)	49.21 (31/63)	66.67 (14/21)	50.39 (64/127)a
Right ovary	55.81 (24/43)	50.79 (32/63)	33.33 (7/21)	49.61 (63/127)a

¹ P > 0,05 for means with same superscripted letters among rows and columns.

² Prepuberal ovulation was identified by the presence of CA at the time of laparotomy (40 - 60 hours after beginning of estrus); puberal ovulation was confirmed by the ovulation associated with first estrus and was identified as CL at laparotomy.

³ Information within parentheses are number of observations.

⁴ C.A. Corpora albicantia; C.L. Corpora lutea.

the prepuberal period was lower (1.13) than at puberty (1.31). This is in agreement with the generally recognized fact that the ovulation rate increases with the age of the animals (Quirke 1979, 1979).

It should be recognized that the occurrence of ovulation and the ovulation rate at the prepuberal ovulation were based on the identification of corpora albicantia, which might not always have been identifiable, and, therefore, represents conservative values.

The occurrence of estrus without ovulation (Edey et al. 1977) and ovulation without estrus (Foote et al. 1970, Quirke 1979), is common in puberal ewe lambs. In this study, 78.35 percent of the ewe lambs ovulated without estrus during the prepuberal period. Puberal estrus was accompanied by ovulation in all ewe lambs in the experiment.

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