CARCASS CHARACTERISTICS OF GOATS AND SHEEP IN NORTHEAST BRAZIL[1]

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ABSTRACT - Carcass characteristics of genotypes of goats and sheep were evaluated. The mature ewes belonged to three breeds: (1) Santa Inês, (2) Morada Nova and (3) Crioula. Yearling castrated or non-castrated male kids belonged (1) to four genotypic groups, local breeds (Moxotó, Marota, Canindé, Repartida); (2) to crosses and grades of Anglo-Nubian, (3) of Bhuj, and (4) SRD. In sheep, marked breed differences were observed in pre-slaughter weight and weights of wet skin, dressed head and pluck. In goats, marked breed differences were observed in pre-slaughter weight, weights of hot carcass and wet skin, lengths of carcass and hind leg, thorax depth and dressing percentages. Castrated kids had higher pre-slaughter and hot carcass weights, but lesser carcass and thorax depth.

Index terms: sheep breeds, goat breeds, castrated lambs, castrated kids, tropical semi-arid region.

CARACTERÍSTICAS DAS CARCAÇAS DOS CAPRINOS E OVINOS DO NORDESTE BRASILEIRO

RESUMO - Foram estudadas as características de carcaça dos caprinos e ovinos do Nordeste. Os ovinos eram das raças: (1) Santa Inês, (2) Morada Nova e (3) Crioula; e os caprinos, dos genótipos que incluem: (1) os quatro tipos nativos (Moxotó, Marota, Canindé e Repartida); (2) de sangue Anglo-Nubiano; (3) de sangue Bhuj; e (4) SRD. As diferenças entre raças foram muito marcadas em ovinos, principalmente em peso pré-abate, peso de pele fresca, peso de cabeça, e somatório do peso dos pulmões, traquéia, língua e esôfago. A largura da garupa dos animais vivos apresentou grande influência em todas as características de carcaça, com exceção dos rendimentos de carcaça. Em caprinos, foram observadas grandes diferenças, entre raças, no peso pré-abate, peso da carcaça quente, peso de pele fresca, comprimento da carcaça e das pernas posteriores, na profundidade do tórax e na percentagem de rendimento de carcaça quente e fria. Os cabritos castrados apresentaram peso pré-abate e peso de carcaça quente significativamente superiores, mas apresentaram menor comprimento de carcaça e menor profundidade do tórax.

Termos para indexação: raças de ovelhas, raças de cabras, cordeiros castrados, cabritos castrados, região tropical semi-árida.

INTRODUCTION

Ninety-two percent of the total goats in Brazil (7.43 million out of 8.07) are found in the Northeast, and there is an almost equal number of coarse wooled or hairy sheep (6.12 million) which represent 34 percent of the total sheep population of the country. These animals are primarily maintained for meat and are of various types and sizes. Majority of these animals are represented by nondescript mixed types, which for convenience are described as Crioula sheep and "Sem Raça Definida" (SRD) goats. The sheep breeders usually also maintain pure breeds like Morada Nova and Santa Inês; as these are relatively well differentiated, they can be readily identified and tend to breed pure. In the case of goats, the situation is a little different. The goat producers cross their animals with well defined breeds from time to time and various grades of Anglo-Nubian and Bhuj blood can be usually recognized in their flocks.

In the present work, a survey study was carried out to evaluate carcass characteristics of different genotypes of locally available goats and sheep in the field area to find out if the genotypes substantially contribute to the variability in the characteristics. In the case of goats, a comparison was also made between castrated and non-castrated males.

MATERIALS AND METHODS

Animals and sampling

A total of 39 ewes and 158 male kids were included in this study. The ewes belonged to three breeds: Santa Inês,

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Morada Nova and Crioula. The 39 ewes came from a larger sample and this reduced number was due to an attempt made to control their ages (determined by dentition) and physiological states (pregnant and non-pregnant). Even then, four to these were comparatively younger (around two years) and remaining older (three years or more). After slaugther, eight ewes were discovered in early stages of pregnancy. But these factors were ignored in the analysis as a preliminary inspection of data showed that these factors were not likely to be of any consequence.

In the case of goats, all were male kids of around one year of age and belonged to four recognizable genotypic groups: (1) the four recognized breed types (Moxotó, Marota, Canindé and Repartida) (Mason 1980, Shelton & Figueiredo 1981), (2) Anglo-Nubian crosses and grades, (3) Bhuj crosses and grades, and (4) SRD. These kids were either entire or castrated, a factor that was considered in the analysis.

Methodology

Details of methodology were presented in an earlier communication (Figueiredo et al. 1982). All animals were maintained under fasting conditions (with availability of drinking water) for up to 18 hours. The following measurements were taken:

Pre-slaughter weight

Animals were weighed immediately before their slaughter and this was termed the pre-slaughter weight. For slaughter, each animal was stunned by a blow on the head and bled by cutting the jugular vein. The animal was hanged in a head down position till the bleeding completely stopped. The carcass measurements were taken as follows.

Wet skin weight

After the bleeding had stopped and animal was dead, the carcass was skinned by skilled technicians and weight of skin represented the wet skin weight.

Dressed head weight

After removal of skin, the head was separated at atlas vertebra and legs at carpal and tarsal joints. The weight of skinned head without tongue was termed the dressed head weight.

Hot carcass weight and dressing percentage of hot carcass

The abdomen was opened and viscera including liver, kidneys, heart and lungs were removed and carcass was weighed. This was hot carcass weight. The proportion of hot carcass weight to the pre-slaughter weight was termed the dressing percentage of the hot carcass.

Chilled carcass weight and dressing percentage of chilled carcass

The carcass was kept in a deep freeze for 24 hours and weighed thereafter to obtain chilled carcass weight. The proportion of chilled carcass weight to the pre-slaughter weight gave the dressing percentage of the chilled carcass.

Pluck weight

The pluck weight included lungs, trachea, tongue and oesophagus.

Carcass length

Carcass length was the distance on carcass between pubic point and frontal border of the first rib.

Hind leg length

Was the distance between pubic joint and distal end of febula.

Thorax depth

Was the distance between dorsal position of the 6^{th} thoracic vertebra and the ventral position of the sternum.

Thigh circumference

Was the circumference of hind legs around thigh region where the reading was maximum.

In this study, several other body measurements on live animals were also taken to study their possible relation with dressing percentages. However, except rump width in sheep, none of these measurements appeared to be related to the dressing percentages and hence are not presented in this communication. Rump width was the distance between the two hook points.

Analysis of data

General Linear Model's procedure (Barr et al. 1976) of least-squares analysis was used for analysing data and for obtaining least-squares means.

RESULTS

The results on the analysis of data and the least-squares means of ewes are presented in Table 1. The pre-slaughter weight was significantly different between the three breed groups, Santa Inês being much heavier than the other two breeds, and Morada being slightly heavier to Crioula. But the magnitude of breed differences was much reduced in the hot carcass weights. Although Santa Inês was 73 percent more than Crioula in pre-slaughter weight, the hot carcass weight of the former was only 24 percent more. Similarly, Morada Nova was 12 percent more than Crioula in pre-slaughter weight, but its superiority was only 1.3 percent in hot carcass weight. This type of trend was reflected in the formal significance in the analysis of variance; the breed differences in pre-slaughter weight were significant at higher levels ($P < 0.005$) and of carcass weights at lower levels ($P = 0.05$ to 0.066) of probability. Inspite of large differences in the pre-slaughter weights, there was no significant difference in carcass length, hind leg length and thigh circumference. Thorax depth appeared to vary between breeds ($P < 0.05$) but had no relation to pre-slaughter weight as Morada Nova had significantly greater thorax depth than the much heavier Santa Inês and lighter Crioula; the latter two breeds did not differ significantly.

TABLE 1. Analysis of variance and least-squares means of carcass characteristics of sheep types in Northeast Brazil.

Source of variation	d.f.	Mean squares					
		Pre-slaughter weight (kg)	Hot carcass weight (kg)	Chilled carcass weight (kg)	Carcass lenght (cm)	Hind leg lenght (cm)	Thorax depth (cm)
Breeds	2	987.97****	5.21(*)	5.94*	5.14	2.14	14.52*
Regression	1 (Y_1)		67.30****	40.98****	13.40****	13.40****	20.86**
Error§	35	12.76	1.78	1.75	4.53	1.19	3.83
	36						
Least-squares means (one standard error)							
(1) Santa Inês		44.70^{c}	15.30^{b}	15.04^{b}	65.29^{a}	38.78^{a}	19.88^{ab}
		(1.26)	(0.976)	(0.968)	(1.56)	(0.80)	(1.43)
(2) Morada Nova		28.89^{b}	12.54^{a}	12.15^{a}	63.90^{a}	37.45^{a}	21.38^{b}
		(0.89)	(0.357)	(0.354)	(0.57)	(0.29)	(0.52)
(3) Crioula		25.81^{a}	12.38^{a}	11,72^{a}	62.75^{a}	36.84^{a}	19.51^{a}
		(0.92)	(0.469)	(0.466)	(0.75)	(0.39)	(0.69)

TABLE 1. Continuation.

Souce of variation	d.f.	Mean squares						
		Thigh Circumference (cm)	Wet skin weight (kg)	Dressed head weight (kg)	Pluck weight (kg)	d.f.	Dressing % hot carcass	Dressing chilled carcass
Breeds	2	4.379	0.548****	0.07262****	0.0952****	1	1.007	0.654
Regression	(Y_1)	94.860****	2.902****	0.12821****	0.0429*	1 (Y_2)	364.235****	389.348****
Error§	35	2.100	0.082	0.00577	0.0104	28	12.067	12.362
	36							
Least-squares means (one standard error)								
(1) Santa Inês		32.70^{a}	2.932^{ab}	1.355^{b}	1.113^{b}		46.15^{b}	45.34^{b}
		(1.06)	(0.209)	(0.056)	(0.075)		(1.364)	(1.281)
(2) Morada Nova		33.81^{a}	2.628^{a}	1.251^{b}	0.843^{a}		40.94^{a}	39.62^{a}
		(0.39)	(0.077)	(0.020)	(0.027)		(1.542)	(1.550)
(3) Crioula		32.85^{a}	2.988^{b}	1.106^{a}	0.942^{b}		40.09^{a}	37.63^{a}
		(0.051)	(0101)	(0.026)	(0.036)		(0.718)	(0.788)

Note: (*) P = 0.0663; * P < 0.05; ** P < 0.025; **** P < 0.005.

Y_1 is the regression on pre-slaughter weight and

Y_2 is the regression on rump width measured on live animals.

§ degrees of freedom are 36 for pre-slaughter weight and 35 for other carcass characteristics. Degrees of freedom for dressing percentages are shown separately.

Least-squares means with any one same superscripted letter are not significantly different at 5% level of probability.

Within breeds, pre-slaughter weight significantly influenced hot and chilled carcass weights, carcass and hind leg lengths, thigh circumference and wet and dressed skin weights. Minor influence was observed on thorax depth and pluck weight.

Dressing percentages were analysed only for two breeds, Morada Nova and Crioula, as an attempt was made to correlate many measurements made on live animals with the dressing percentages and all these observations were not available for Santa Inês. However, mean dressing percentages for Santa Inês are presented in Table 1 and are significantly higher than the other two breeds; the latter two breeds did not differ significantly. Pre-slaughter weight within the two smaller breeds had no significant influence on dressing percentages of individual animals. However, a highly significant regression on rump width was obtained.

The results of analysis and least-squares means of carcass characteristics of goats are presented in Table 2. The pre-slaughter weight varied significantly between breeds and a comparison of means showed that the local breeds and SRD were significantly smaller than crosses and grades with exotic genes of Anglo-Nubian and Bhuj. This trend was also reflected in hot carcass weight but

TABLE 2. Analysis of variance and least-squares means of carcass characteristics of local types of goat in Northeast Brazil.

Source of variation	d.f.	Mean squares					
		Pre-slaughter weight (kg)	Hot carcass weight (kg)	Chilled carcass weight (kg)	Carcass length (cm)	Hind leg length (cm)	Thorax depth (cm)
Breeds	3	167.3***	1.922***	0.512	56.38***	28.53***	3.869***
Castrations	1	174.7***	2.097*	0.430	57.78***	0.59	8.445***
Breed x Castration	3	64.9*	18.468***	5.190***	13.47*	29.06***	14.303***
Regression on slaughter wt.	1	-	560.921***	322.663***	2299.63***	702.28***	169.495***
Error	§	17.0 (150)	0.378 (149)	0.333 (92)	3.82 (148)	2.88 (149)	0.624 (114)
Least-squares means (one standard error)							
Breeds							
(1) Recognised Local breeds		19.38^{b} (0.791)	7.539^{a} (0.118)	7.957^{a} (0.150)	51.15^{a} (0.375)	34.224^{a} (0.325)	14.96^{a} (0.239)
(2) Anglo-Nubian crosses		22.33^{c} (0.997)	7.942^{b} (0.154)	7.799^{a} (0.149)	54.43^{c} (0.492)	35.950^{b} (0.424)	16.04^{b} (0.199)
(3) Bhuj crosses		20.46^{c} (0.902)	8.073^{b} (0.135)	7.913^{a} (0.173)	54.47^{c} (0.431)	36.249^{b} (0.373)	15.96^{b} (0.174)
(4) SRD		16.89^{a} (0.529)	7.523^{a} (0.083)	7.591^{a} (0.103)	53.11^{b} (0.263)	34.224^{a} (0.229)	16.10^{b} (0.133)
Castrations							
(1) Non-castrated		18.45^{p} (0.668)	7.620^{p} (0.100)	7.728^{p} (0.106)	54.07^{q} (0.317)	35.241^{p} (0.275)	16.11^{q} (0.162)
(2) Castrated		21.09^{q} (0.481)	7.918^{q} (0.076)	7.902^{p} (0.103)	52.50^{p} (0.243)	35.083^{p} (0.209)	15.41^{p} (0.199)

Note: § degrees of freedom of error are indicated within parentheses individually for carcass traits.
* $P < 0.025$; ** $P < 0.01$; *** $P < 0.005$.
Least-squares means with same superscripted any one letter are not significantly different at 5% level of probability.

TABLE 2. Continuation.

Source of variation	d.f.	Mean squares: Thigh circumference (cm)	Dressing % of hot carcass	Dressing % of chilled carcass	Wet skin weight (kg)	Dressed head weight (kg)	d.f.	Pluck weight (kg)
Breeds	3	1.075	205.927***	205.393***	0.763***	0.01085	2	0.0317
Castrations	1	0.977	0.464	19.301	0.166	0.00018	1	0.0164
Breed x Castration	3	5.608	157.475***	147.874	0.223**	0.015573*	2	0.0035
Regression on	1	949.828***	-	-	16.238***	1.38277***	1	0.5967
slaughter wt.	1	2.543	12.728	11.759	0.0535	0.00482	74	0.0124
Error	§	(114)	(150)	(93)	(149)	(93)		
Least-squares means (one standard erros)								
Breeds								
(1) Recognised		25.48^{a} (0.483)	39.53^{a} (0.752)	40.66^{b} (0.785)	1.526^{a} (0.044)	0.823^{a} (0.018)		
(2) Anglo-Nubian crosses		26.17^{a} (0.403)	42.09^{b} (0.849)	39.99^{b} (0.813)	1.802^{b} (0.058)	0.877^{b} (0.018)		0.466^{ab} (0.029)
(3) Bhuj crosses		25.79^{a} (0.351)	42.53^{b} (0.584)	40.32^{b} (1.196)	1.850^{b} (0.051)	0.847^{ab} (0.021)		0.512^{b} (0.034)
(4) S R D		25.75^{a} (0.268)	38.18^{a} (0.703)	36.94^{a} (0.729)	1.515^{a} (0.031)	0.823^{a} (0.013)		0.420^{a} (0.020)
Castrations								
(1) Non-castrated		25.68^{p} (0.327)	39.75^{p} (0.783)	38.76^{p} (0.826)	1.631^{p} (0.038)	0.841^{p} (0.013)		0.446^{p} (0.022)
(2) Castrated		25.92^{p} (0.669)	41.42^{p} (0.099)	40.19^{p} (0.968)	1.715^{p} (0.028)	0.841^{p} (0.012)		0.486^{p} (0.025)

Note: § degrees of freedom of error are indicated within parentheses individually for carcass traits.
* $P < 0.025$; ** $P < 0.01$; *** $P < 0.005$.
Least-squares means with same superscripted any one letter are not significantly different at 5% level of probability.

not in chilled carcass weight where all breeds appeared similar. Breed differences were also marked in carcass and hind leg lengths, thorax depth, wet skin and dressed head weights and dressing percentages. In all these characteristics, higher values were found with exotic breed crosses. Breed differences were not observed in thigh circumference and pluck weight.

Castrated kids exhibited significantly heavier pre-slaughter and hot carcass weights but lower carcass length and thorax depth. There was no effect of castration on other carcass characteristics on an overall basis, although significant breed x castration interactions indicated that castration may have had different effects in the various genotypes. This aspect was not further explored as the net magnitude of such effect for individual breeds was not expected to be of much significance.

DISCUSSION

The sheep and goat are primarily maintained for meat in Northeast Brazil (Jordão & Caldas Filho 1952) and, therefore, information on their meat and carcass characteristics is desirable. In an earlier report, Figueiredo et al. (1982) presented some data on growth and carcass characteristics of three hairy sheep breeds of the region under

the experimental conditions of this Centre. In the present study, an attempt has been made to study the possible contribution that genotype may make to net-meat productivity as is obtained at the slaughter house with the surplus animals of the goat producers under the existing conditions in rural areas. Naturally, in such a study it would be unavoidable to run into difficulties of sampling. The bias may come because the animals were categorised into different genetic groups on the basis of visual examination and on the basis of information supplied by the goat producers. This is especially so in case of goats. This factor is likely to argument differences between genetic groups. The animals also varied in their age. Although in case of goats their age distribution was better controlled, in sheep it was not so. The results of this experiment should be viewed in the light of these limitations. On the other hand, these results show, in a more direct way the actual impact the different genotypes can make to meat productivity.

In the case of sheep, this study pertained to three pure breeds whose identification under field conditions was less likely to fall into error. A large difference between breeds was observed in the pre-slaughter weight which represents differences in their live weight (Galal et al. 1975). This difference was also reflected in the hot and chilled carcass weights, carcass length and pluck weight. The Santa Inês breed had significantly higher value for all these characteristics in comparison to the other two breeds. It confirms our previous observation (Figueiredo et al. 1982). Thus, genotype of the animal was found to make substantial contribution to improvement of carcass yield and characteristics (Fahse et al. 1973, Accardi et al. 1974, Galal et al. 1975, Atkins & Gilmour 1981).

Whithin breeds too, pre-slaughter weight influence almost all carcass characteristics except dressing percentages. Thus body weight alone may be an important indicator of carcass characteristics (Atkins & Gilmour 1981). The body weight and carcass weight are known to be closely related (Galal et al. 1975, El-Serafy et al. 1976) and together these two characteristics are known to determine most of the carcass characteristics (Choudhary et al. 1975, Basuthakur et al. 1980, Atkins & Gilmour 1981). However, difference in carcass weight of Santa Inês and other two breeds was not as large as in their body weights. This is an important observation as the net meat productivity of a genotype is apparently due to its effect on size which represents meat productivity per animal as well as on prolificacy which represents the number of progeny available for meat production per ewe-mother. Among the breeds studied here, Morada Nova is known to possess much rate of prolificacy (Figueiredo et al. 1979, Figueiredo 1980).

A comparisom of means of dressing percentages showed that it was distinctly higher for heavier Santa Inês than the other two breeds. Dressing percentage is known to increase with age of lambs (Ghanekar et al. 1972) and this effect appears to be due to increase in body size (Basuthakur et al. 1980, Reddy & Rao 1980, Singh et al. 1980). However, whithin breeds there was no significant association between dressing percentages and body weight. Basuthakur et al. (1980) have reported that the component of ingesta of lambs creates a large variation making correlations of empty carcass weight with live weight insigificant. Thus, unless body size differences are large and marked (as between very large and small breeds), dressing percentages may not follow the same trend as body weight. On the other hand, rump width was found to influence the dressing percentages. The rump width may be an indication of meatiness of sheep as also suggested by Zobrisky (1961) and Galal et al. (1965).

Williamson & Payne (1980) reported that the typical dressing of tropical breeds of sheep was 40 to 48. In this study, the values obtained are within this range, although Santa Inês is slightly higher and other breeds a little lower. At the same time, results of this experiment should not be considered strictly comparable as these animals represent partially culled stock. This view is further supported by our earlier observations (Figueiredo et al. 1982), where higher values have been obtained for the dressing percentage of Santa Inês and Morada Nova breeds maintained under experimental conditions of this Centre. Epstein (1954) reported that the tropical breeds of sheep yield poor dressing

percentages and he gave values of 35-40 percent. Osman & El-Shafie (1967) reported that dressing percentage varied between 36 and 52 percent in Sudan desert sheep. The hairy breeds of sheep in India located in similar agroclimatic zone as Northeast Brazil have also been reported to yield poor dressing percentage (Reddy & Rao 1980). However, in Iran much higher mean values (ca. 56 percent) have been reported for sheep maintained on range pastures (Demiruren et al. 1971) and in subtropical region of India also dressing percentage of 50 to 53 has been reported for Magra breed which is a carpet wool breed native to semi-arid and arid zones (Srivastava & Roy 1969).

The wet skin weight recorded here is much lower to the values reported by Bellaver et al. (1980) for Santa Inês sheep. This difference is more likely to be due to the methods of statistical calculations. The data presented in this work represents means corrected for various factors in the analysis. The significant breed differences in wet skin weight did not reflect the breed differences in the body weights, but within breeds the heavier animals yielded heavier wet skins. However, the breed variation in pluck weight appeared to be due to larger size of Santa Inês which produced heaviest pluck. Similar breed differences in pluck weight have been reported by Galal et al. (1975), and El-Serafy et al. (1976) have reported that pluck weight increases with age of sheep from 1.5 to 3 years which obviously is due to growth in body size of animals. All this shows that the pluck weights is more a function of body weight of animals than anything else.

In case of goats, four breeds groups were studied. Two of these groups represented easily identifiable breeds namely the four recognised types (Shelton & Figueiredo 1981) and SRD, although SRD in itself is a nondescript group of goats with varying body colours. However, Anglo-Nubian and Bhuj crosses as identified in this experiment must have represented higher levels of their grade to make them recognizable. In all these breed groups, we also had two types of yearling males, castrated or entire. The analysis showed that marked breed group differences existed in pre-slaughter weight, hot carcass weight, carcass length, hind leg length, thorax depth, wet skin weight and dressing percentages. Bhuj and Anglo-Nubian are much larger breeds than the local types and their crossbreeding is expected to result into increase in body size at different stages of growth. Thus, their heavier body size appears to have influenced all the characteristics except chilled carcass weight. These results are somewhat similar to those reported by Pant (1980), although in semi-arid subtropical region crossing between larger and smaller native breeds did not result into a larger sized progeny (Misra et al. 1981). The weight of chilled carcass, dressed head and pluck and the thigh circumference did not vary between breeds and dressing percentage calculated on the chilled carcass weight showed a different trend than that observed with the dressing percentage calculated on the weight of hot carcass. Chilling of goat carcass, therefore, in itself was a major source of variation which disturbed the order in which the hot carcass weight varied between breeds.

On the whole, castrated kids had significantly higher pre-slaughter and hot carcass weights. This is in confirmation to the report of Kumar et al. (1980a) who found that castration at one month of age gave the best results. They (Kumar et al. 1980b) also studied the effect of partial castration on the morphology of skeletal muscle and found that the number of muscle fibres per unit area was significantly higher in goats castrated at one month of age than in controls. Louca et al. (1977) have shown that if kids are castrated at an early age their postpubertal growth may be greater to that of entire kids. They stated that in entire male kids intense sexual activity retarded postmaturity growth. In sheep, some workers have reported an adverse effect of castration on growth (Darwish et al. 1973, Ahmed et al. 1975) while others have found no effect (Younis et al. 1972, Chawla & Nath 1980), and this may at least in part be due to a difference in age at which the castration was performed (Joubert 1959). Cresswell et al. (1964), Korotkov (1966) and Price (1975) have reported beneficial effects of castration in lambs and Younis et al. (1972) found that castration at birth caused a significant increase in dressing percentage of lambs at six months of age.

The dressing percentage obtained here was around 40 which is lower to values reported by Srivastava et al. (1968), Khan & Sahni (1979),

Pant (1980) and Misra et al. (1982). This only shows that the animals used in this experiment were, perhaps, inferior ones culled by the goat producers. Srivastava et al. (1968) found that dressing percentage was nearly 50 in small meaty type goats of Barbari breed whereas in larger Jamnapari it was around 45. The latter breed is similar to Bhuj and is also known to have contributed to formation of Anglo-Nubian. The dressing percentage of Bhuj and Anglo-Nubian crosses in this experiment is relatively closer to the value of Jamnapari. The kids used in this experiment were around one year in age and increased age is known to improve dressing percentage of goats (Srivastava & Roy 1969, Pant 1980). For Sardinian goat, Brandano & Piras (1978) have reported a very high dressing percentage of 79.

REFERENCES

ACCARDI, F.; LETO, G.; GIACCONE, P. & ALICATA, M.L. La produzione dell'agnellone di otto mesi. **Riv. Zootec. Vet.**, 3:249-61, 1974.

AHMED, N.; TIWARI, S.B. & SAHNI, K.L. Effect of castration on live weight, growth and meat production in crossbred lambs. **Indian J. Anim. Sci.**, 45:454-8, 1975.

ATKINS, K.D. & GILMOUR, A.R. The comparative productivity of five ewe breeds. 4. Growth and carcass characteristics of purebred and crossbred lambs. **Aust. J. Exp. Agric. Anim. Husb.**, 21:172-8, 1981.

BARR, A.J.; GOODNIGHT, J.H.; SALL, J.P. & HELWIG, J.T. **A User's Guide to SAS 76.** Raleigh, North Carolina, USA. SAS Institute, 1976.

BASUTHAKUR, A.K.; NIVSARKAR, A.E. & SINGH, R.N. Studies on some pre-and post-slaughter parameters in Malpura lambs. **Indian Vet. J.**, 57:473-8, 1980.

BELLAVER, C.; OLIVEIRA, E.R. & PORTELLA, J.S. Avaliação de carcaças em ovelhas de raça Santa Inês. In: EMPRESA BRASILEIRA DE PESQUISA AGROPECUÁRIA. Departamento de Informação e Documentação, Brasília, DF. **Pesquisa em ovinos no Brasil 1975-1979.** Brasília, 1980. p.40.

BRANDANO, P. & PIRAS, B. La Capra Sarda. II. Caratteri riproduttivi e produttivi. **Studi Sassar. Sez. III.**, 26: 226-91, 1978.

CHAWLA, D.S. & NATH, I. Note on weight of different carcass cuts and organs of Beetal and its exotic crosses. **Indian J. Anim. Sci.**, 50:1021-4, 1980.

CHOUDHARY, S.S.; CHOPRA, S.C. & BALAINE, D.S. Factors affecting carcass yield and cuts in Indian sheep. **Indian J. Anim. Sci.**, 45:461-5, 1975.

CRESSWELL, E.; ASH, R.W.; BOYNE, A.W. & GILL, J. C. Some effects of partial castration compared with full castration on lamb's growth and on the development of male characteristics. **Vet. Rec.**, 76:645-50, 1964.

DARWISH, M.Y.H.; EL-SAMMAN, S. & ABOU-HUSSEIN, E.R.M. Meat production from Rahmani lambs. **Egypt. J. Anim. Prod.**, 13:35-48, 1973.

DEMIRUREN, A.S.; BEHESHTI, R.D.; SALIMI, H.; SALEH, B.A. & DJAFERI, A. **Comparison of the reproductive and productive capacities of sheep of Kellakul, Kizil, Bakhtiari and Baluchi breeds in Iran.** Tehran, Animal Husbandry Research Institute, 1971. (Technical Rep. nº 1).

EL-SERAFY, A.M.; EL-ASHRY, M.A. & SWIDEN, F. Comparison between carcass traits of two age groups of fat tailed sheep. **Egypt. J. Anim. Prod.**, 16:65-8, 1976.

EPSTEIN, H. The tailed sheep of Arabia. **Z. Tierz. Zuch. Biol.**, 63:381-96, 1954.

FAHSE, R.; ITEM, C. & VUILLEMIN, D. Die Verbesserung der Schlachtqualitat einer Landrasse mit Hilfe von Gebrauchskreuzungen am Beispiel des Walliser Schwarznasenschafes. **Schweiz. Landw. Mh.**, 51: 413-21, 1973.

FIGUEIREDO, E.A.P. Morada Nova sheep in Brazil. In: **Prolific tropical sheep.** Rome, FAO, 1980. p.53-8. (FAO. Animal Production and Health Paper, 17).

FIGUEIREDO, E.A.P.; OLIVEIRA, E.R. & BELLAVER, C. **Performance dos ovinos deslanados no Brasil.** Sobral, EMBRAPA-CNPC, 1979. 32p. (Circular Técnica, 1).

FIGUEIREDO, E.A.P.; SIMPLICIO, A.A.; RIERA, G.S. & PANT, K.P. Prelimary studies on the carcass characteristics of native breeds of woolless sheep in hot tropical semiarid Northeast Brazil. **Pesq. agropec. bras.**, Brasília, 17(6):951-60, 1982.

GALAL, E.S.E.; CARTWRIGHT, T.C. & SHELTON, M. Relationship among weights and linear measurements in sheep and heritability estimates of some of these measurements. **J. Anim. Sci.**, 24:388-91, 1965.

GALAL, E.S.E.; GHANEM, Y.S.; FARID, M.A.; FAHMY, M.H. & SEOUDY, A.E.M. Carcass traits and feed lot performance of Barki, Merino and Awassi breeds of sheep and some of their crosses. **Egypt. J. Anim. Prod.**, 15:33-46, 1975.

GHANEKAR, V.M.; SOMAN, B.V. & BHATAWADEKAR, S.D. A note on some vital and meat characteristics in Bannur sheep. **Indian J. Anim. Sci.**, 42:584-6, 1972.

JORDÃO, L.P. & CALDAS FILHO, C.F. Aspectos da criação de caprinos no Estado de São Paulo. **B. Soc. Paul. Med. Vet.**, 20, 1952. Número especial.

JOUBERT, D.M. Effect of age at which lambs are castrated on carcass weight and quality. **Anim. Prod.**, 1:163-5, 1959.

KHAN, B.U. & SAHNI, K.L. A study of some carcass characteristics in Jamnapari kids. **Indian Vet. Med. J.**, 3:77-80, 1979.

KOROTKOV, V.I. Is it more advantageous to fatten wethers or ram lambs? **Ovtsevodstvo, 12**:27-9, 1966.

KUMAR, R.; KUMAR, A. & SINGH, H. Note on the effect of castration on meat production in goats. **Indian J. Anim. Sci., 50**:1160-2, 1980a.

KUMAR, R.; KUMAR, A.; PRAKASH, P. & SINGH, H. Morphological changes in skeletal muscle of goats following partial castration. **Acta Vet. Beogr., 30**: 115-20, 1980b.

LOUCA, A.; ECONOMIDES, S. & HANCOCK, J. Effect of castration on growth rate, feed conversion efficiency and carcass quality in Damascus goat. **Anim. Prod., 24**:387-91, 1977.

MASON, I.L. Sheep and goat production in the drought polygon of Northeast Brazil. **World Anim. Rev., 34**: 23-8, 1980.

MISRA, R.K.; SINGH, D.; GAUR, D.; SHARMA, M.M.; PARTHSARTHY, M.; PRASAD, V.S.S. & RAWAT, P.S. **Annual Report 1980.** Avikanagar, India, Central Sheep & Wool Research Institute, 1981.

MISRA, R.K.; GAUR, D.; SINGH, D. & ACHARYA, R. M. Purebred performance of Sirohi goats under range management in semi-arid region of Indian. In: INTERNATIONAL CONFERENCE GOAT PRODUCTION AND DISEASE, 3, Tucson, USA, 1982. **Proc** ... p.348.

OSMAN, A.H. & EL-SHAFIE, S.A. Carcass characteristics of Sudan desert sheep. **Sudan J. Vet. Sci., 8**:115-9, 1967.

PANT, K.P. **Annual Report 1979.** Khanapara, India, Assam Agricultural University, 1980.

PRICE, M.A. The effects of added dietary lipid on the body composition of rams and wethers. **J. Agric. Sci., 84**:201-8, 1975.

REDDY, P.M. & RAO, P.L.N. Evaluation of certain carcass characters of Nellore and Mandya sheep. **Livest. Adv., 5**:27-33, 1980.

SHELTON, M. & FIGUEIREDO, E.A.P. Types of sheep and goats in Northeast Brazil. **Int. Goat Sheep Res., 1**:258-68, 1981.

SINGH, G.; SINGH, V.K. & MISHRA, R.K. Carcass characteristics of Coimbatore rams, their interrelationship and prediction on live weight and physical dimensions. **Indian Vet. J., 57**:919-25, 1980.

SRIVASTAVA, V.K. & ROY, A. The influence of season of birth and age on the carcass quality of Magra lambs. **Indian J. Anim. Sci., 39**:294-306, 1969.

SRIVASTAVA, V.K.; RAIZADA, B.C. & KULKARNI, V.A. Carcass quality of Barbari and Jamnapari type goats. **Indian Vet. J., 45**:219-25, 1968.

WILLIAMSON, G. & PAYNE, W.J.A. **An introduction to animal husbandry in the tropics.** 3. ed. London, Longmans, 1980.

YOUNIS, A.A.; KOTBY, S. & KAMAR, G.A.R. Effect of castration on live body weight and certain carcass traits of Ossimi and Rahmani lambs. **Egypt. J. Anim. Prod., 12**:91-7, 1972.

ZOBRISKY, S.E. Live animal and carcass indices of lamb composition. **J. Anim. Sci., 20**:922-3, 1961.