EVALUATION OF GOAT BREEDS IN THE TROPICAL NORTH-EAST BRAZIL

II - AN ANALYSIS OF AGE AT DEATH OF KIDS[1]

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ABSTRACT - An analysis was made of the duration of survival of kids that eventually died within 360 days of their birth in the tropical North-East Brazil. These kids belonged to three breed groups: indigeneous (Moxotó, Marota, Canindé, Repartida), exotic (Bhuj, Anglo-Nubian) and SRD (Sem Raça Definida or nondescribed). The results showed that the size of kid at birth was most important and that there was significant difference between breed groups in the duration of survival. Type of birth alone had no effect and therefore if the weight of kid was as good as those of single born kids, the twins may survive equally well. Maximum mortality (37% of total) occurred within first five days of birth and tendend to increase again around 90 days. The results suggest that the single most important factor influencing survival may be the condition of the mother at the time of parturition, which may be improved either by supplementary feeding or by shifting the breeding season in such a way that the kids are born when the mothers are generally in good condition.

Index terms: mortality, Tropical semiarid region, breeds of goat, Moxotó, Marota, Canindé, Repartida, Bhuj, Anglo-Nubian.

AVALIAÇÃO DE RAÇAS DE CAPRINOS DO BRASIL
II. ANÁLISE DA IDADE A MORTE DOS CABRITOS

RESUMO - Foi analisado o tempo de sobrevivência dos cabritos que eventualmente morreram dentro do período de 360 dias de idade na fazenda do CNPC, em Sobral, CE. Os cabritos pertenciam a três grupos de raça: nativos (Moxotó, Marota, Canindé e Repartida), exóticos (Bhuj e Anglo-Nubiano) e SRD (Sem Raça Definida ou não descritos). Os resultados mostraram que o tamanho do cabrito ao nascer foi o fator mais importante no tempo de sobrevivência, o qual também foi diferente significativamente entre os grupos de raça. O tipo de nascimento apenas, não teve influência significativa na variável analisada; e por isso, se o peso do cabrito fosse tão bom quanto aquele dos cabritos nascidos de parto simples, os nascidos de partos gemelares poderiam sobreviver igualmente bem. A mortalidade maior ocorreu dentro dos primeiros cinco dias de idade (37% do total) e tendeu a aumentar novamente por volta dos 90 dias de idade. Os resultados sugerem que o fator mais importante influenciando tempo de sobrevivência pode ser a condição da matriz na época do parto, podendo essa condição ser melhorada, tanto fornecendo-se alimentação suplementar às matrizes, como ajustando-se a estação de nascimentos, de tal maneira que os nascimentos ocorram quando as matrizes estejam em boas condições.

Termos para indexação: mortalidade, região tropical semi-árida, raças de cabras, Moxotó, Marota, Canindé, Repartida, Bhuj, Anglo-Nubiana.

INTRODUCTION

In most tropical areas, high kid mortality is an important bottleneck in implementing a breeding programme. Several environmental factors may affect mortality and an analysis of these factors is a prerequisite for planning any improvement in survivability of kids. At this Centre, several breed types are being maintained for systematic studies in various aspects of goat production. In the initial years, there was heavy mortality (Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Caprinos 1979, 1980) and in this paper an analysis has been made to identify important factors with a view to effecting suitable modifications of environment to improve survivability.

MATERIALS AND METHODS

Location - The Centre is located in the semiarid Northeastern region of Brazil which is close to equator. The region is characterised by high temperature throughout the year with little rainfall, most of which occurs during January-June. The average maximum and minimum

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temperatures are 35° and 22°C respectively for whole year with small variation. The average annual rainfall is 758.8 mm.

Breeds - Seven breeds of goat are loosely characterised in this region. The main basis of classification of four of these breeds is the body colour types and there is a feeling that all or some of these are not genetically different and belong to one population (Mason 1980). Thus, Moxotó, Marota, Canindé and Repartida are considered as the local types of same breed (Shelton & Fitzhugh 1979, Mason 1979). However, Shelton & Figueiredo (1981) have tried to give the breed characteristics from which the following information is abstracted. Moxotó is the most common and is named after the Moxotó valley in Pernambuco state. All these animals are uniform in body colour, size and shape, which is due to the fact that these characteristics were the basis of their being included in the breed. Mature females weigh around 30 - 40 kg. The colour is light creamy white with black colour occurring as a line along the vertebral column and on feet and face. Most of these goats are horned. The ears are of medium size and erect and the kidding rate may be around 1.2 kids per doe kidding. Repartida is similar to Moxotó but has a typical colour pattern which consists of dark forequarters and points (face and legs) with a fawn or cream colour over the rest of the body. The reciprocal colour pattern with dark rearquarters is also included in this breed. Canindé is similar to the above two breeds in size, form and function and is named after the city of Canindé in Ceará state. Colour is black with yellow belly and a small amount of yellow or tan occasionally occurring on the face. The kidding rate has been reported to be 1.5 to 1.6 (Bellaver et al. 1980). Marota is all white but otherwise similar to other breeds and is also called Curaça.

A large proportion of all goats in the region belong to SRD (Sem Raça Definida or without breed definition) type. These are of various colours and may have some Anglo-Nubian blood (Shelton & Figueiredo 1981).

Anglo-Nubian has been extensively imported and used for breeding in recent years. Bhuj was imported from India (Figueiredo et al. (1982).

Data - A total of 326 kids that died within one year (360 days) of their birth were included in this study. Of these, data on 318 kids was used for analysis as complete information on them was available. Records were made on the date of birth, birth weight, type of birth, sex of kid and date of death. In this study, three breed groups were considered. These were: 1. indigenous (Moxotó, Marota, Canindé, Repartida), 2. SRD, and 3. exotic (Bhuj, Anglo-Nubian). The basis of their grouping is partly due to Mason (1980). Each breed group was divided into two birth weight groups, light (up to 1.5 kg) and heavy (over 1.5 kg). According to type to birth again two classifications were made depending on whether the kid was born as a single or in multiple births. The season of birth may have a marked influence on mortality rate. However, we are trying to study the duration of survival of those kids that eventually died within 360 days. Hence, identity of season of birth was ignored. This was ne cessary because further partitioning of data would make numbers of observations exceedingly small in some groups, and as the births occurred in all breeds in the two recognised seasons, it was felt that ignoring season would not seriously bias the results.

An alternate analysis, by general linear models method of least squares, was also carried out. In this analysis, sex of kid was also taken into consideration, and the birth weight data, instead of being classified into two groups, was used as a continuous independent variate. The model used was as follows:

$$Y_{ijkl} = \mu + B_i + T_j + (BT)_{ij} + S_k + b(W_{ijkl} - \bar{W}) + E_{ijkl}$$

where:

Y_{ijkl} is the age at death of a kid of ith breed, jth sex born in kth type of birth,

μ is the overall population mean common to all observations,

B_i is the effect of ith breed (i= 1,2,3),

T_j is the effect jth type of birth (j= 1,2),

$(BT)_{ij}$ is the interaction between ith breed and jth type of birth (ij= 1,2,3,4,5,6),

S_k is the effect of kth sex (k= 1,2),

$b(W_{ijkl} - \bar{W})$ is the regression of age at death on birth weight of kids, and

E_{ijkl} is the random error assumed to be normally and independently distributed with zero mean and variance.

RESULTS

The data were arranged according to age at death over all other factors. These results are presented in Table 1. Of the total, maximum mortality occurred within five days of birth which was equal to the mortality in whole of the 90 - 360 days period. The trend of data showed that the

TABLE 1. Incidence of overall mortality according to age.

Age of kids at death (days)	Number of kids	Percentage of total mortality up to one year
0 - 5	118	36.6
6 - 15	21	5.5
16 - 30	15	4.6
31 - 60	21	6.5
61 - 90	42	13.0
91 - 180	61	18.9
181 - 360	45	13.9

$x^2 = 2668.2$ with 6 d.f. ($P < 0.005$)

mortality increased around 90 days. These proportions are based on the number of total deaths and not on the basis of kids that died out of total kids born. However, reports of this Centre (Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Caprinos 1979, 1980) give the following figures on mortality (%) for all kids born between February 1978 and August 1979; up to weaning (?); Moxotó, 15.19, Marota, 29.36, Repartida, 22.22; up to 360 days: Canindé, 59.38, Anglo-Nubian, 52.38, Bhuj, 68.75. There are no figures available for SRD. The mean age at death is presented in Table 2. It appears from the table that the kids which were smaller in size at the time of birth tended to die earlier. The data were statistically analysed and the results are presented in Table 3. There were three main effects in the analysis: Breeds, Types of birth and Birth weight groups. All these were considered as fixed effects and their effects with all possible interactions were calculated. The analysis showed that the kids born as singles or in multiple births appeared to have survived for similar duration before they died but there were significant differences between breeds and between birth weight groups. None of the two factors interaction was significant, but Breed x Type of birth x Birth weight group interaction was significant ($P < 0.05$).

The least square constants and analysis of variance are presented in Tables 4 and 5 respectively. The analysis confirmed the results obtained in the initial analysis and showed that there was a significant breed difference and the type of birth did not influence the age at which the kid died. A comparison of weighted means (Table 2) with least square means (Table 4) showed that in both cases, the kids of indigenous breeds survived longer than SRD and exotics. However, least square means also showed that SRD may have slightly longer survivability to those of exotic breeds. The least square analysis revealed a significant sex effect and female kids were found to survive longer. The sex was ignored as a potential source of variation in the first analysis and thus the sex variation was passed onto error. This would have the effect of reducing the F values of other effects in the model. But, the subsequent analysis (Table 5) has shown that the ultimate results were not affected in any way.

DISCUSSION

Very little has been reported on the breeds of goat in the tropical North-East Brazil. This paper attempts to give some information on these breeds with an analysis of data on kids that died within 360 days of their birth. Our results on birth-related traits of these breeds are appearing elsewhere (Figueiredo et al., 1982).

According to a 1975 census, in Nordeste (North-East) Brazil, there are 6.095 million goats

TABLE 2. Mean age (days) at death of kids.

Breed group	Size class	Type at birth	Age at death	Weighted mean over type of birth	Weighted mean for breed
Indigenous	Small	Single	75	94	105
		Multiple	96		
	Large	Single	150	136	
		Multiple	112		
S.R.D.	Small	Single	49	45	64
		Multiple	44		
	Large	Single	18	87	
		Multiple	92		
Exotic	Small	Single	64	63	85
		Multiple	59		
	Large	Single	119	102	
		Multiple	89		

TABLE 3. Analysis of variance of days at death of kids.

Source of variation	d.f.	MS
Breeds	2	48581 **
Birth weight groups	1	86637.60 ***
Types of birth	1	113.80 NS
Breeds x groups	2	14989.40 NS
Breeds x types	2	13979.60 NS
Groups x types	1	341.10 NS
Breeds x groups x types	2	21910.10 **
Error	306	6674.50

Note: NS = Not significant (P > 0.05)
* = Significant (P < 0.05)
** = Significant (P < 0.01)
*** = Significant (P < 0,005)

TABLE 4. Least square constants of age at death of kids of different breeds in North-East Brazil.

Item		Constants
Overall mean (μ)		65.645
Breeds		
(1) SRD		- 6.577
(2) Indigenous		+26.180
(3) Exotic		-19.603
Types of birth		
(1) Single		- 8.095
(2) Multiple		+ 8.095
Breeds x Types of birth		
(1) SRD	Single	-23.750
(2) SRD	Multiple	+10.590
(3) Indigenous	Single	+19.140
(4) Indigenous	Multiple	+33.221
(5) Exotic	Single	-19.675
(6) Exotic	Multiple	-19.532
Sexes		
(1) Males		-13.784
(2) Females		+13.784

and 5.290 million sheep as against 6.601 million goats and 17.283 million sheep in the whole of the country. Thus, most of the goat population is in the Nordeste region. At this Centre, goats are being maintained on natural pastures which are in poor condition in dry months. In this study,

TABLE 5. Least square analysis of variance of age at death of kids of different breeds.

Sources of variation	D.F.	MS
Breeds	2	48268.923 **
Types of birth	1	2895.780 NS
Breeds x Types of birth	2	12690.289 NS
Sexes	1	35394.473 *
Regression of age at death on birth weight	1	193706.102 **
Total of effects assumed in the model	7	50559.253 **
Error	311	6351.065

Note: NS = Not significant (P > 0.05)
* = Significant (0.01 < P < 0.025)
** = Highly significant (P < 0.005)

maximum deaths were observed within five days of birth. In many tropical goat breeding centres similar results have been observed (Minett 1950, Devendra & Burns 1970, Gill & Dev 1972, Ali et al. 1975, Mittal 1976, Indian Veterinary Research Institute 1979).

However, in Assam Local breed, maximum pre-weaning mortality occurred after one month of age (Sarmah et al. 1981). The most prolonged survival was observed among the indigenous type and least in the SRD. There appeared a clear positive relation between the birth weight and age at death. This is in conformity with the results of Mittal (1975) and Sarmah et al. (1981), who have observed higher mortality among smaller kids. These observations show that, as the maximum mortality occurred immediately after birth and as the size of the kid at birth had marked effect on the relative period to which a kid could survive, survivability could be improved if the condition of mother is good at the time of parturition. This could be done either by giving supplementary feeding during last weeks of pregnancy or by adjusting the breeding in such a way that the kidding takes place in favourable season when plenty of grazing is available and does are generally in good condition.

The results of this study also show that the type of birth has no influence on the age at which

the kid died. But, the birth weight within breeds and types of birth shows a marked relation with the age at death. This supports the observations of Purser & Young (1961) and Labban et al. (1969) in sheep. Obviously, if mother-doe is in good condition, twins may survive as good as single born kids. Higher incidence of mortality among twins at this Centre has been reported elsewhere (Guzman et al. 1980) and this excess mortality among twins may be entirely due to their smaller size.

The study revealed a marked breed difference in age at death. If the breeds have been maintained under identical environment for over several generations, such differences may be claimed as genetic in origin. Further confirmation of these results is necessary, but breed differences in survivability are common, especially if some breeds come from different agro-climatic regions. The survival of lambs produced by an identical breed of ewes can differ on account of the breed of sire (Shelton 1964, Smith 1977), and there may be real differences among sire groups (Knight et al. 1979). The results on the duration of survival appear to closely follow the pattern of survivability reported in kids and lambs. All combinations of any two main effects did not interact, but within breeds and size classes, the differences in type of birth were undirectional resulting into a significant three factor interaction. However, this can be ignored as the type of birth as a main effect did not contribute significantly to total variation and as the interaction was significant at five percent of probability. A significant sex difference in duration of survival was also observed and it was found that females survived better and longer. In case of percent survivability also, females are known to surpass males (Rageb et al. 1954, Lax & Turner 1965, Sarmah et al. 1981) in sheep and goat, although Labban et al. (1969) and Mittal (1975) did not find a significant sex effect in mortality.

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