The West African dwarf goat : body size, udder and teat circumference in relation to kid mortality

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OSUAGWUH (A. I. A.), INWANG (U. D.). La chèvre naine Djallonké : relations entre la taille du corps, la circonférence de la mamelle et du trayon et la mortalité des chevreaux. *Rev. Elev. Méd. vét. Pays trop.*, 1987, **40** (3) : 287-291.

Le poids vif et la circonférence de la mamelle et du trayon de 360 chèvres naines Djallonké ont été enregistrés une semaine après le part. Les données récoltées pour chaque paramètre ont été classées en quatre groupes - petit, moyen, grand, très grand. La carrière de reproduction de ces femelles, y compris la mortalité néonatale a été obtenue à partir de leurs fiches d'élevage. Sur un total de 1 738 chevreaux nés de ces femelles, 238 (13,7 p. 100) sont morts dans les 30 premiers jours après la naissance. Les relations établies à partir de ces données ont montré que le poids des animaux était significativement ($P < 0,001$) corrélé à la circonférence de la mamelle et du trayon. Le poids de l'animal et la circonférence de la mamelle ont influencé significativement ($P < 0,01$) le taux de survie des chevreaux. Les femelles de petit format et à la circonférence de mamelle petite ont eu plus de chevreaux morts que celles de tailles moyennes alors que les femelles à grandes et très grandes mamelles n'ont pas eu de chevreaux morts. Le poids le plus souhaitable s'avère supérieur ou égal à 24 kg, la circonférence de la mamelle la plus souhaitable supérieure ou égale à 16 cm. La circonférence du trayon influence aussi significativement ($P < 0,01$) le taux de survie des chevreaux. Les tailles enregistrées comme très grandes sont associées à la mortalité des chevreaux. La taille la plus souhaitable semble être inférieure ou égale à 4 cm. Dans l'élaboration de programmes d'élevage de chèvres naines Djallonké, prenant en compte, poids vif et circonférence de la mamelle et du trayon, la relation possible entre la production de lait et ces caractères devrait être évaluée. *Mots clés* : Caprin - Chèvre Djallonké - Chevreau - Dimension - Mortalité - Mamelle - Trayon - Nigeria.

INTRODUCTION

Traditionally, great importance has been attached to the environmental factors responsible for neonatal mortality in kids. Studies on the causes of kid mortality in Nigeria (2, 9) and elsewhere (3, 5, 7) have highlighted the significant role played by infectious and parasitic agents, nutrition, hygiene, housing and season of the year in causing neonatal mortality of kids. Other factors include birth weight, sex, type of birth (single or multiple) and parity. These studies have given rise to the formulation of some strategies aimed at minimizing the high rate of neonatal mortality in kids.

In Nigeria, it seems that the desired decrease in kids mortality is yet to be achieved (8). This study was therefore initiated with the aim of identifying some intrinsic factors related to the dams that may predispose their kids to early death, factors which *postmortem* investigation may not identify. Such factors include dam weight, udder and teat circumference. This information is considered important and helpful in planning a selective breeding programme and supplementary feeding strategy for the kids aimed at improving the overall productivity of the West African dwarf goat.

MATERIALS AND METHODS

Three hundred and sixty West African dwarf (WAD) does and 1,738 kids were used in this study. The animals were from the Teaching and Research Farm, University of Ibadan and Institute of Agricultural Research and Training, Moore Plantation, Ibadan, Nigeria. These areas are within the tropical humid zone of Southern Nigeria. Only does that have kidded (one week *postpartum*) were used for this study.

The animals were under semi-intensive system of management with giant star grass/legume (*Cynodon niemfuensis/Centrosema pubescens*) as the basal ration, which was provided *ad libitum* and standard farm concentrate for goats as supplement at the rate of 0.6 kg per goat per day. The ingredients and chemical composition of the feed are presented in table I. In order to eliminate as much as possible, some of the known factors (9) that influence kid mortality in WAD goats, this study was carried out with animals of not more than 5 kiddings and kids of not less than 1.2 kg birth weight. Routine deworming, with panacur(*), at a dose of 5 and 10 mg fenbendazole per kg body weight for gastrointestinal nematodes and tape worms respectively and dipping in Gamatox super fluid(**) at dilution of 1:500, were carried out to

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(*) Hoechest AG (Frankfurt main Germany/Allemagne).

(**) Contains gama BHC 20 p. 100 W/V (Cooper McDougall, 25, Robertson Ltd., Berkhamsted, Herts, England.)

TABLE I Ingredients and chemical composition of the standard farm ration supplement as fed to the animals during the studies.

Ingredients (g/100 g DM)		
Maize	63.50	
Palm Kernel Cake	15.50	
Brewers' Grain	20.00	
*Mineral/Vitamin Mix	0.50	
Salt	0.50	
Chemical Composition Nutrient	Concentrate (in percent)	Grass (in percent)
Dry Matter (DM)	93.00	93.00
Crude Protein (CP)	15.29	11.00
Crude Fiber (CF)	16.13	50.54
Organic Matter (OM)	88.16	85.47
Ash	4.84	7.53
Gross Energy (KJ/g)	19.10	19.58

* g/kg : Manganese 16.0 ; Zinc 12.0 ; Iron 6.0 ; Copper 4.0 ; Cobalt 0.30 ; Iodine 1.20 ; Magnesium 200.0 ; Vitamin A 0.50 and Vitamin D 0.25 I.U.

minimize both endo and ecto parasitic infection. The animals were also vaccinated with tissue culture rinderpest vaccine (TCRPV) against *peste des petits ruminants* (PPR).

Each animal was weighed and the weight recorded. In measuring the different parameters of the udder and teat, the animal was restrained in the standing position and each half of the udder was measured from the mid point where the two halves meet on the ventral aspect of the animal to the posterior aspect with the two hind legs abducted. Similarly, the circumference of the teats was determined. All the dimensional measurements were taken by the aid of a piece of thread which was later placed on a ruler graduated in centimeters. Information about each individual goat's reproductive history was obtained from the breeding records. The study lasted for 12 months.

CGAnalysis of dataRO : from the data collected, the mean dam weight, circumference of the udder and teat were calculated. All parameters considered here were classified into four groupsCG ROaccording to their sizes - small, medium, large and extra-large - designated A, B, C and D respectively. Each class was related to kid mortality. Only kids that died within the first 30 days ITpostpartumRO were considered in this study.

On the hypothesis that kids survival rate is independent of the three variables - dam weight, udder and teat circumference, the chi-square (X^2) test of independence as described by LITTLE and HILLS (4) was done. Simple correlation coefficients between these three variables were also performed.

RESULTS

Out of the 1,738 kids involved in this study, 238 (13.7 p. 100) were recorded as dying. The mean values of the dam weight, udder and teat circumference are presented in table II. The relationship between the kids mortality rate with each class of the parameters is shown in table III. The results of the chi-square statistical analysis on the effects of the dam weight, udder and teat circumference on the survival of the kids are presented in table IV. In all cases the effects were highly significant ($P < 0.001$). The dam weight, udder and teat circumference were positively and significantly ($P < 0.01$) related to one another. The results of the analysis are shown in table V.

TABLE II Mean value of the body size, udder and teat circumference of the West African dwarf goats.

Dam weight (kg)		Circumference (cm)	
		Udder	Teat
Mean	18.96	14.74	3.59
S.D.	3.67	1.91	0.79
Range	13.4-31.2	10.55-18.70	2.25-8.90

TABLE III Effects of dam size, udder and teat circumference on the mortality rate of the West African dwarf kids.

Parameter & range	No.of does	Total No. of kids	Total mortality	Percentage of mortality
Dam weight (kg)				
A) 13-18	190	700	160	22.9
B) 19-24	140	660	50	7.6
C) 25-30	20	225	0	0
D) > 30	10	153	28	22.4
Udder circumference (cm)				
A) 10-13	70	230	170	73.9
B) 14-16	240	1 010	40	4.0
C) 17-19	50	498	0	0
D) > 19	0	0	0	0
Teat circumference (cm)				
A) 2.0-3.7	207	774	156	20.2
B) 3.8-5.4	108	639	0	0
C) 5.5-7.0	27	253	0	0
D) > 7.0	18	72	54	75.0

A = small ; B = medium ; C = large ; D = extra-large.

TABLE IV Effect of different parameters on the survival rates of West African dwarf kids.

Parameters	df	Chi-square values	Probability
Dam Weight	3	111.2	$P < 0.001$
Udder Circumference	3	948.0	$P < 0.001$
Teat Circumference	3	569.5	$P < 0.001$

TABLE V Simple correlation coefficient between dam weight and udder and teat circumference and between udder circumference and teat circumference.

Variable	DW	UC	TC
UC	0.5554**	—	—
TC	0.7393**	0.5560**	—
TL	0.6682**	0.5983**	0.6597**

DW = Dam Weight.
UC = Udder Circumference.
TC = Teat Circumference.
** = $P < 0.01$.

DISCUSSION

Previous studies on the causes of neonatal mortality in WAD kids (9), had indicated the significant role of starvation and undernutrition in causing the death of these kids. The present study highlights the intrinsic role of the physical characteristics of the does in the mortality of their kids, even under an improved system of management. The marked relationship between kid mortality and the dam weight, udder and teat circumference seems to be an important predisposing cause of death. Although it may be difficult to say that these factors were responsible for the death of the kids, but more often than not, it is the initial factor in the chronological sequence that is more important, for as it were, such a factor acts as a catalyst to subsequent factors. For example, studies have shown that starving or underfed kids are highly susceptible to cold and disease (11). Not only that, cold predisposes kids to such killing diseases like pneumonia and *peste des petits ruminants* (PPR) (9). Also the high rate of mortality among kids within the first 30 days of life in tropical countries have been associated with the cold periods of the year (5, 9). Similar initial predisposing factors in the WAD goats are being highlighted in the present report.

WAD goats with small body weight (13-18 kg) and udder circumference (10-13 cm) were associated with the highest rate of kids mortality of 22.9 and 73.9 p. 100 respectively. Those with medium sizes, had 7.6 and 4 p. 100 mortality rate associated with the dam weight and udder circumference rspectively ; while those under large and extra-large udder sizes were not associated with mortality. This may indicate that animals with small body weight and udder size did not produce enough milk to meet the nutritional needs of their kids, hence the high rate of death of the kids probably due to starvation and undernutrition. This situation was more serious in cases of multiple births than single. And it was from this group of multiple births that 85 p. 100 of the deaths occurred.

The positive significant ($P < 0.01$) correlation ($r = 0.56$) between dam weight and udder circumference shows that most of the animals with small body weight had also small udder circumference. Attempts have been made to classify the West African dwarf goat into different sizes (6). This classification shows that the small bodied adult WAD goats are in a class of their own and were not growing animals. However, the size of the animals not withstanding, they still have high rate of multiple births characteristic of this breed of goat (1, 10). It seems, therefore, that supplementary cow milk feeding of these kids is necessary in order to reduce the high rate of kids mortality and maximize the prolificacy of the WAD goats.

On the other hand, dams with large and extra-large body and udder sizes, recorded no kid mortality during the study period. The survival of their kids may be due to the fact that the does, by virtue of their large sized udder, produced adequate quantity of colostrum and milk to satisfy both the immunological and nutritional requirements of their kids.

The fact that there was no perfect correlation in the statistical analysis between the various parameters considered in this study, showed that some of the parameters were out of proportion. For example, some animals had extra-large weight but small udder size or small body weight but with large udder. In the former, mortalities were recorded but none in the later. This situation may explain why there were some mortalities associated with the animals having extra-large weight as shown in table III.

Teat circumference was another factor that contributed significantly to the high rate of mortality recorded in this study. Even though the small sized teats were associated with 20.2 p. 100 mortality of the kids, this was not considered a reflection of the true situation. Rather it was more associated with the small sized udder of the animals than the small sized teat, for the two variables were significantly ($P < 0.01$) correlated ($r = 0.556$). No mortality was associated with the medium and large sized teat circumference. However,

teats with extra-large circumference were associated with very high rate (75 p. 100) of kids mortality. In most cases, this class of teats had supranumerary teats which were smaller and more cylindrical than normal teats (Fig. 1). As a result of the great size of these teats, the kids preferred suckling the supranumerary teats which could not deliver enough milk to satisfy their nutritional requirements, thereby predisposing them to death due to starvation and undernutrition. Like the kids born of the animals with small sized body and udder, artificial rearing may be the only way of reducing the high rate of mortality here. Or, perhaps, it may be genetically wise to exclude these groups of animals from breeding programmes.

CONCLUSION

Essentially, the West African dwarf goats are meat rather than milk animals. However, the failure, by normal kids at birth to achieve a regular and adequate milk supply from the dam due to the body size, udder and teat circumference of the dam, calls for different approaches aimed at minimizing neonatal mortality in WAD goats. Since the results of the present study have indicated the significant ($P < 0.001$) role the dam weight, udder and teat circumference play in the survival of the kids, it is suggested that selective breeding based on the body size, udder and teat circumferences be considered as one of the major approaches of preventing early losses in this breed of goat. Studies on the relationship between these traits and milk yields are being conducted.

Fig. 1 : Large udder and extra-large teat, showing supranumerary teat, of the West African dwarf doe.

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The dam weight, udder and teat circumferences of 360 West African dwarf does were taken within one week *postpartum*. The data collected for each parameter was classified into four groups - small, medium, large and extra-large. The reproductive history of these animals including neonatal mortality was obtained from their breeding records. A total of 1,738 kids from these dams were involved with 238 (13.7 p. 100) of them recorded dead within the first 30 days of life. Correlations performed on these data showed that the body weight of the animals was significantly ($P < 0.001$) correlated with both udder and teat circumference. The udder circumference was significantly ($P < 0.001$) correlated with teat circumference. The body weight and udder circumference of the animal significantly ($P < 0.01$) influenced the survival rate of the kids. Animals with small body weight and udder circumference recorded more dead kids than those with medium sizes but none from the large and extra-large udders. The most desirable body weight and udder circumference are $\geq$ 24 kg and $\geq$ 16 cm respectively. Teat circumference also significantly ($P < 0.01$)

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Se anotaron el peso vivo y la circunferencia de la ubre y del pezón de 360 cabras nanas Djalonke una semana después del parto. Se clasificaron en cuatro grupos - pequeño, medio, grande, muy grande - los datos de cada parámetro. Asi, las fichas de cria de dichas hembras permitieron tener una visión de conjunto de su reproducción y de la mortalidad neonatal. De 1 738 cabritos nacidos de estas hembras, 238 (13,7 p. 100) murieron los 30 primeros días después del nacimiento. Las relaciones hechas a partir de estos datos mostraron que se correlacionaba significativamente ($P < 0,001$) el peso del animal con la circunferencia de la ubre y del pezón. El peso del animal y la circunferencia de la ubre influenciaron significativamente ($P < 0,01$) la tasa de supervivencia de los cabritos. Las cabras de pequeño tamaño y con ubre de pequeña circunferencia tuvieron más de cabritos muertos que las de tamaño medio mientras que las hembras con grandes y muy grandes ubres no tuvieron cabritos muertos. Son respectivamente $\geq$ 24 kg y $\geq$ 16 cm el peso y la circunferencia más

influenced the survival rate of the kids. Those in the extra-large range were associated with kids mortality. The most desirable size seems to be < 4 cm. In formulating breeding programmes for the West African dwarf goats based on body weight, udder and teat circumference, possible relationships between milk yield and these traits should be evaluated. *Key words* : West African dwarf goat - Kid - Body size - Udder - Teat - Mortality - Nigeria.

deseables. La circunferencia del pezón influye también significativamente (P < 0,01) sobre la proporción de supervivencia de los cabritos. Las dimensiones muy grandes están ligadas con la mortalidad de los cabritos. Es s 4 cm la dimensión más deseable. En los programas de cria de las cabras nanas Djalonke tomando en cuenta peso vivo y circunferencia de la ubre y del pezón, se necesitaria evaluar la relación posible entre la producción de leche y dichas caracteristicas. *Palabras claves* : Ganado cabrió - Cabra Djalonke - Cabrito - Mortalidad - Ubre - Pezón - Nigeria.

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