INCIDENCE OF PREWEANING MORTALITY IN WEST AFRICAN DWARF GOATS AND THEIR RED SOKOTO HALFBREDS

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Received 15 April, 1994; Accepted 14 February, 1995

ABSTRACT

Preweaning mortality in West African dwarf (WAD) and West African dwarf X Red Sokoto (RS) halfbred goats was studied along side appropriate management systems aimed at improving survivability. The overall mortality rate at the end of the experiments was 25% (28.9% among WAD kids and 23% among WADXRS kids). Mortality rate was significantly affected by breed/genotype ($P < 0.01$), sex ($P < 0.01$), season of birth ($P < 0.01$), birth weights ($P < 0.01$) and birth type ($P < 0.05$). Kids with birth weights lower than the population mean had higher mortality rate than kids with birth weights higher than the population mean. The interaction effect between sex and birth type significantly influenced mortality rate ($P < 0.01$). Mortality was due mainly to infectious diseases such as peste de petite ruminante (PPR), Pneumonia, diarrhoea, and mycoplasmosis. Kids vaccinated against PPR and maintained under regular heat supply survived better than kids allowed access to either heat supply, vaccination against PPR or neither of the treatments.

Keywords: Mortality rate, PPR, Vaccination, goats.

INTRODUCTION

In Nigeria, goats are kept almost solely for meat. They are found mostly in the rural areas where they are traditionally kept under extensive management system (Osuagwu, 1985). According to ILCA (1981), mortality rate among goats in the humid zone of West Africa can be as high as 40%. Mortality is considered a major constraint to an efficient production system. It adds significantly to production cost and in some regions, it acts as a constraint to an

expansion in goat production (Bradford *et al* 1986). Heavy losses among goats occur immediately after birth and during the first thirty days of life, accounting for almost half of all losses before weaning (Mukharjee, *et al* 1991). Among West African dwarf goats, Upton (1985) reported a mean mortality rate of 33%, while ILCA (1982) reported average mortality rate of 37.5% in two of its research stations. However, a simple health intervention package introduced by Wilson *et al* (1987) increased survival rate from 67% to 86%.

This paper therefore, presents the findings of an investigation into preweaning mortality rate in WAD and WADXRS kids. It also attempted the design of appropriate management system that might increase survival rate among goats in the humid tropics.

MATERIALS AND METHODS:

Experiment 1:

This experiment conducted between 1988 and 1991 at the University of Ibadan Teaching and Research farm was designed to compare mortality rates and investigate the causes of preweaning mortality in West African dwarf (WAD) goats and their Red Sokoto (RS) halfbreds. The mating design was both direct and reciprocal and the mating ratio was 7-10 does to a buck. A total of Twenty-six does and seven bucks in four breeding cycles were used. At the end of the experiment, seventy-six kids (forty-five WAD and thirty-one WADXRS) from forty-eight kiddings were compared for productive potentials.

Experiment II:

This 150 day experiment was started in January 1991 and was designed with the aim

of reducing percentage mortality by attempting to control the major causes of mortality observed in experiment I. Twenty-eight kids (Twelve males and sixteen females) i.e. fourteen each of the genotypes studied, were divided equally between four treatments. Kids in group A were vaccinated against PPR as well as maintained under constant heat supply. Kids in group B, were vaccinated against PPR, while kids in group C were only maintained under constant heat supply and denied vaccination against PPR. Kids in group D received neither of these treatments. In each group, kids were observed closely for symptoms of diseases and mortality until 150 days of age.

Management of Kids:

All the kids used were allowed to run around and freely suckle their dams. However, fresh cow milk supplementation was made available to the kids until they were thirty days old. They were then fed concentrate containing 14% crude protein and 11.7MJ of energy once daily at the rate of 60g/head/day as supplement to dams milk and legumes between 30 days and 90 days of age when the concentrate supplementation was stopped. However, legumes and forages were made available to the kids until they were 150 days old.

Movement of kids was restricted within the ventilated pens for the first thirty days. Litters, made up of wood shavings, were changed weekly to prevent kids from ingesting faecal droppings. In addition, pens were disinfected with asuntol. All the kids were dewormed and dipped regularly to eliminate or reduce ecto - and endoparasitic infections.

Data Preparation and Analysis:

Basic information on breed/genotype, birth type and date, sex and dam kept on each kid, in addition to the date of death and possible causes of death after post-mortem examination of dead carcasses were part of the data obtained from the records of kids performance while the experiment lasted.

Mortality rate was determined by estimating the percentage of kids lost over 90 days and 150 days of age, while the causes of mortality were identified from post-mortem examination results of carcasses. The effects of season, birth weights, sex, birth type and breed/genotype on mortality rate were determined by least squares method (SAS 1990), after data transformation.

The model used was:

$$Y_{ijklmn} = U + G_i + S_j + B_k + D_l + T_m + GD_{il} + ST_{jm} + E_{ijklmn}$$

Y_{ijklmn} = The observation of the dependent variable on nth kid of the ith genotype group, of jth sex, of kth birth weight, of lth season of birth and mth birth type.

U = population constant of all records

G_i = effect of the ith genotype/breed of kid (i = WAD, WADXRS)

S_j = effect of the jth sex of kid (j = male, female)

B_k = effect of the kth birth weight (< 1.36 , > 1.36)

D_l = effect of the lth season of birth (1 = Dry, Rainy)

T_m = effect of the mth birth type (single, twin, triples)

GD_{il} = effect due to the interaction between genotype and season.

ST_{jm} = effect due to the interaction between sex and birth type.

E_{ijklmn} = random error which is normally and independently distributed with zero mean and variance (σ^2)

All effects except the error were considered fixed.

RESULTS

Mortality rate: Table 1 shows the preweaning mortality rate among pure and halfbred kids. The mortality rates at the end of the experiments were 28.9% for purebred, 23% for halfbreds and 25% overall. Within the first 30 days after birth, the overall mortality rates were 5.3% and 19% between 60 and 120 days of age. The mean squares from the analysis of variance presented in Table 2 revealed that, genotype, birth weight, sex, season and birth type significantly ($P < 0.01$) affected mortality rate between birth and weaning. More of the halfbreds survived than the purebreds (Table 1).

MORTALITY IN KID GOATS

TABLE 1: THE EFFECTS OF BIRTH WEIGHTS, GENOTYPE, SEX, SEASON AND BIRTH TYPE ON MORTALITY RATE.

VARIABLES	NO.OF KIDS AT BIRTH	NO.OF KIDS AT 90 DAYS	MORTALITY RATE AT 90 DAYS	NO.OF KIDS AT 150 DAYS	MORTALITY RATE AT 150 DAYS OF AGE.
Birth weight					
< 1.363	40	29	0.275 ^a	26	0.35 ^a
> 1.363	36	32	0.111 ^b	32	0.139 ^b
Breed: WAD	45	35	0.23 ^a	33	0.289 ^a
WAD X RS	31	26	0.17 ^b	25	0.23 ^b
Sex:					
Male WAD	22	19	0.44 ^a	18	0.18 ^a
WAD X RS	16	15	0.06 ^b	14	0.14 ^c
Female WAD	23	16	0.30 ^c	15	0.35 ^b
WAD X RS	15	11	0.27 ^c	11	0.33 ^b
Season					
Rainy WAD	14	12	0.14 ^a	11	0.30 ^a
WAD X RS	7	6	0.14 ^a	6	0.14 ^b
Dry WAD	31	23	0.26 ^b	22	0.30 ^a
WAD X RS	24	20	0.18 ^a	19	0.20 ^b
Birth Type					
Singles WAD	18	16	0.11 ^a	16	0.11 ^a
WAD X RS	15	15	0.00 ^b	14	0.17 ^b
Multiple WAD	27	19	0.31 ^c	18	0.37 ^c
WAD X RS	16	11	0.31 ^c	10	0.37 ^c
Overall	76	61	0.20	58	0.250

Columns with different superscripts are significantly different ($P < 0.01$).

Observations based on the deviation from the mean birth weight reveal that kids with birth weights lower than the population mean had higher mortality between birth and 150 days of age (35%) compared to kids with birth weights higher or equal to the population mean (14%). In fact, all kids weighing less than 0.8kg at birth died before weaning age. Mortality rate was greater among females. The overall percentage mortality was 15.8% among males and 34.2% among females. The first order interaction between sex and birth type was significant ($P < 0.01$). More females were involved in multiple births compared to males. Mortality rate was higher among WAD males compared with halfbred males. However, the 35% and 33% mortality rates observed among WAD females and halfbred females were virtually the same but higher

than the 18% and 13% observed among males, respectively. Partitioning of birth type by genotype showed no difference in mortality rates among multiple birth in kids from both genotypes. Among kids of single births, mortality rates were 11% for WAD and 7% for halfbreds.

The highest death rate was observed among kids born in the dry seasons but reared in the rainy seasons. Separation of the effect of seasons by genotypes revealed that more WAD kids died in both seasons. Post - mortem examination of carcasses of dead kids showed that diarrhoea, pneumonia, peste de petite ruminante (PPR) and mycoplasmosis were the major causes of deaths among kids. These conditions appeared mostly in the wet season (April-September) and in the dry cold months of December and January. PPR, a

TABLE 2 : MEAN SQUARES (M.S.) FROM THE ANALYSIS OF VARIANCE FOR MORTALITY AT 90 DAYS AND 150 DAYS OF AGE

SOURCES OF VARIATION	90 DAYS		150 DAYS	
	D.F.	M.S.	D.F.	M.S.
Breed	1	6.340**	1	7.3843**
Sex	1	6.0283**	1	7.3919**
Birth Type	2	5.462**	2	6.443*
Season	1	5.977**	1	7.339**
Birth weight	1	6.034**	1	6.3823**
Breed X Season	1	5.005	1	5.405
Sex X Birth Type	1	8.0054**	1	7.0015**
Error	52	1.2681	49	1.4400

*P < 0.01

**P < 0.001

TABLE 3: EFFECT OF HEAT SUPPLY AND TCRV VACCINATION ON PPR AND PREWEANING MORTALITY.

	A		B		C		D	
	RS	WAD	RS	WAD	RS	WAD	RS	WAD
Breed/genotype								
Average weight at birth	1.45	1.30	1.50	1.28	1.08	1.32	1.48	1.32
Initial number of kids	4	3	3	4	4	3	3	4
Final number of kids	4	3	2	3	3	3	2	2
Number died	0	0	1	1	1	0	1	2
Causes of death			Mycoplasmosis/ Pneumonia		PPR/ Pneumonia		PPR pneumonia/ diarrhoea	

GP A = Vaccinated against PPR and Maintained under heat supplied

GP B = Vaccinated against PPR

GP C = Maintained under heat supply

GP D = Received no treatment.

rinderpest-related viral disease, normally referred to as pneumoenteritis or "kata" was the most important cause of death observed, accounting for 52% of the total deaths recorded.

Two types of pneumonia were diagnosed, pleuropneumonia caused by *Mycoplasma mycoides*, or *Mycoplasma agalactia* and bacteria pneumonia caused either by *Streptococcus* sp; *Corynebacterium*, *Escherichia coli* or *Pseudomonas* sp; Pneumonia caused 23.6% of the total mortality observed. Diarrhoea, on the other hand accounted for 15% of the total mortality observed. Mortality due to diarrhoea occurred in the rainy seasons. The causes of the three cases of abortion recorded in this work were not easily ascertained. However, the does involved suffered mange infection.

Effects of PPR control and heat supply on mortality rate:

Table 3, shows the results of experiment II. All kids under group A, irrespective of breed/genotype survived up till 150 days of age, while two kids (one each of the genotypes involved) from group B, died before weaning. However, one of the kids in this group died of mycoplasmosis, a respiratory disease, while the other died of pneumonia. In group C, one of the seven kids died of PPR complicated with pneumonia, whereas, three kids from the control group died of PPR and pneumonia complicated with diarrhoea.

DISCUSSION

The 5.3% mortality rate observed in the first thirty days after birth is much lower than the results of Suliman *et al* (1990) and

Mukharjee *et al* (1991), who reported high mortality immediately after birth and during the first thirty days of life. The higher survival rate observed here could be associated with management system practised. Sacker and Trail (1966) and Datta *et al* (1963) reported higher survival rate for kids housed within the first 21 days and three months, respectively after birth. The high mortality rate (19%) observed between 60 and 120 days in this study agreed with the findings of Mukharjee *et al* (1991), who reported two distinct periods of high mortality rates in goats (0-30 days and 90-120 days). Prenatal growth as influenced by direct parental and individual maternal effect is considered a key point in mortality rate. Kandasamy and Gupta (1983) associated lower mortality rates among crossbreds to heterotic advantage, while Mukharjee *et al* (1991) associated it with the introduction of favourable genes as well as differences in genetic pathways. Observation on the deviations from mean birth weights revealed that kids with birth weights lower than the population mean experienced higher mortality than kids with birth weights higher or equal to the population mean. Devendra (1974) reported a hundred percent mortality rate for kids with birth weights lower than 0.5kg and 12.5% for kids with birth weights higher than 1.5kg. Osuagwuh and Akpokodje (1981) and Sacker and Trail (1966) also reported similar results.

The death of more females in this study corroborated the results of Osuagwuh and Akpokodje (1981) but contradicted the findings of Sulieman *et al* (1990), who observed higher mortality among males. The differences in mortality rate between kids of multiple birth continuously weighed less at birth than those born single. Sulieman *et al* (1990) and Osuagwuh (1985) reported that mortality increased with multiple births in small ruminants because of the low birth weights and shorter parturition intervals. Kids reared in the rainy season recorded higher mortality than kids reared in the dry seasons. Similar observation was

made by Osuagwuh (1985) who reported that more than 80% of deaths in goats occurred during the rainy season, even though deaths occurred all year round.

The high survival rates among kids reared in the dry season may also be a reflection of the nutritional status of their dams at the time of conception and during the pregnancy period resulting in heavier birth weights. Jeffery *et al* (1971) reported that birth weights and subsequent preweaning performance are distinctly associated with the weight of the dam 90 days before parturition. On the average, a kg increase or decrease in the dam weight results in corresponding increase or decrease of about 0.025kg in birth weight of the offspring.

PPR, accounting for over 50% of total mortality recorded agreed with the reports of Bonniwell (1978) and Opong (1987), who concluded that PPR is enzootic in humid West Africa and is the most important single cause of mortality in sheep and goats. Pneumonia, on the other hand, is common in humid West Africa during the wet and cold months of the year. It is one of the potentially-acute diseases accounting for about one-third of all goat mortality in humid West Africa (Opong, 1987). Diarrhoea, although singularly accounted for 15% of total mortality observed, was common as a symptom of PPR infection. Mortality due to diarrhoea occurred mostly in the rainy seasons.

Attempts to reduce mortality rate by simple health intervention package resulted in significant increase in survival rate in this study. Similar results were reported by Wilson, *et al* (1987). Sumberg and Mack (1985) also reported increased survival rates of kids to weaning with vaccination against PPR and monthly dipping of goats. Acquired immunity against PPR is, in kids, only effective for about three months, while immunity acquired from a survived infection lasts for about three years in adults. Immunity acquired from vaccination against PPR using TCRV lasts for 12 months.

Therefore, Sumberg and Mack (1985) suggested a yearly vaccination for maximum effectiveness.

In conclusion, halfbred kids with better performance appeared to be highly adapted to resisting environmental stress. Therefore, crossing WAD with Red Sokoto goats could reduce mortality rate and increase general productivity. Regular vaccination against PPR and rival pneumonia and regular heat supply in addition to constant dipping and deworming to reduce, if not eliminate ecto- and endoparasite infection will also ensure high survival rate among kids. Manipulating the period of birth in such a way that kids are born in late rainy seasons and reared in dry seasons where management cost appears to be a burden would ensure higher survival rate among kids following the results obtained in this study.

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