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Prolificacy and Pre-Weaning Mortality of West African Dwarf Sheep Raised Intensively in a Hot Humid Environment

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Authors' contributions

This work was carried out in collaboration between all authors. Author PCJ designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author FOA managed the literature searches, analyses of the study performed the spectroscopy analysis and author KI managed the experimental process and author EMA identified the species of plant. All authors read and approved the final manuscript.

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ABSTRACT

The production records of a flock of West African Dwarf sheep raised intensively in Michael Okpara University of Agriculture Livestock Farm, Umudike, Abia state in the rainforest belt of Nigeria were evaluated over a ten-year period (1998-2007). The flock was fed cut-and-carry forages consisting mainly browse plants, legumes and grasses in addition to receiving 16% CP concentrate supplement formulated from maize, wheat offal, soya cake etc. Parameters investigated were prolificacy, types of births and pre-weaning mortality as influenced by seasons. Results showed that there were 207 lamb harvests resulting from 157 lambing delineated into 122 single, 20 twin and 15 triplet births. Prolificacy was 135%. Season had significant (P<0.05) effect on lambing with rainy and dry season figures as 69.7 and 30.3%, respectively; single, twin and triplet births were

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however not affected (P>0.05). Mortality was fairly high generally (35.00%) within the flock with pre- and post weaning values at 30 and 7%, respectively. Season also had significant effect (P<0.05) on mortality (pre- and post weaning values were 73.3 and 26.7% and 71.4 and 28.6% for the rainy and dry seasons, respectively). Causes of mortality were linked to still birth (14.86%), hypothermia (9.46%), pneumonia (17.57%), starvation (27.03%), weakness (10.81%) and unknown causes (20.27%). The population of WAD sheep could be enhanced through management practices that would reduce avoidable mortalities.

Keywords: Prolificacy; pre-weaning mortality; West African dwarf sheep; intensive management; hot humid environment.

1. INTRODUCTION

The West African Dwarf (WAD) sheep is a trypanotolerant small ruminant meat breed distributed widely within the Rain forest and Derived Savanna zones of the humid Tropics. The ewes are characteristically good mothers with the ability of producing twins, triplets and even quadruplet births [1]. They are less fancied than their caprine counterparts for reasons bothering on religion and meat quality; but nevertheless, they contribute substantially to the annual domestic meat consumption. Production system for this breed is mostly extensive in the south eastern Nigeria and has been left in the hands of peasant/subsistent farmers and rural families who mostly rear 3-10 of these animals per household. The remarkably low attention given to the rearing and production of this breed has affected their population over the years.

The prolificacy of the adult ewe is high; breeding all through the year since they can be bred at any season; a view corroborated by [2]. They could produce their first lambs in 12-15 months of age. Average gestation length for the ewe has been reported to range between 143-162 days by [3]. It has also been possible with suckling to re-breed WAD ewes (44%) within 30 days postpartum [1]. [4] and [5] reported a lambing rate of 120% and 115% for WAD sheep. [6] reported a least square mean of 1.22 for litter size of WAD sheep. [7] and [8] reported a twining rate of 17% and 37.00% on West Africa Dwarf sheep.

Lamb mortality is high and growth rates are low under village conditions, nevertheless basic disease control and improved husbandry practices can reduce losses and allow a weight of 20-22 kg to be attained in 6-8 months compared with 2-3 years under traditional husbandry conditions [9].

There are not many intensive production establishments, private or governmental, aimed at multiplication of this breed in Nigeria; however, there are pockets of intensive flocks kept in some research and tertiary institution mainly for teaching and demonstration purposes. Any strategy that would drastically reduce mortality at pre- and post-weaning phases would be favourably disposed to increasing the population of this breed.

There is dearth of information on the prolificacy and lamb mortality of the WAD sheep in the Tropics. Skeletal data available are derived from a few intensive/semi intensive flocks kept in the southern part of the country; reports on traditional production systems are virtually non-existent. The present study investigates the effect of certain non-genetic factors on the prolificacy and lamb mortality of West African Dwarf sheep raised and managed intensively.

2. MATERIALS AND METHODS

2.1 Experimental Location and Climatic Condition

The experiment was conducted at the Sheep and Goat unit of the Teaching and Research farm of Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The study area is located at latitude 05° 28^{1} North and longitude 07°31^{1} East and lies 122 meters above sea level. Umudike lies within the tropical rainforest zone, characterized by average annual rainfall of 2177 mm in 148-155 rain days. Average ambient temperature was 25.5°C with minimum and maximum temperatures of 22°C and 29°C respectively. Relative humidity ranged between 76-87%.

2.2 Source of Data

The production records of a flock of West African Dwarf sheep raised at Michael Okpara University of Agriculture Teaching and Research Livestock

Farm were evaluated within a ten-year period. A total of 207 lamb harvests resulting from 157 lambing were recorded within the study period; these were broken into 122 single, 20 twin and 15 triplet births.

2.3 Animal Management

Each morning (0900 hrs), the animals were fed cut-and-carry forage comprising mainly *Panicum maximum*, *Andropogon gayanus*, *Stylosanthes gracilis*, *Calapogonium mucunoides, Alchornia chordifolia* and *Centrosema pubescens* in a cafeteria arrangement. In the evening (1600 hr), each animal received 0.5 kg of 12% concentrate mixture. Allowance for feed intake was based on 3% body weight. During dry season when forage quality is low, nutritional requirements were met through feeding of hay and silage.

Ewes were housed in groups of 6 in cement floored pens measuring 4 m x 4 m in size. Straw was used as bedding. Animals were dewormed quarterly while routine spraying against ectoparasites took place within the flock bimonthly or quarterly depending on the level of infestation. Vaccinations against endemic diseases (*Pestes des petite ruminants*, Pneumonia complex) were carried out annually. Breeding rams were allowed to run in rotation with ewes for period not exceeding three months in the year. At birth, each lamb had its umbilical cord cut and dipped in iodine solution to prevent entry of pathogens. Records of birth weight, date of birth, sex, type of birth and frequency of birth were taken. Thereafter, the lambs were tagged and allowed to run with their dams throughout the period of lactation. Mortalities encountered during parturition, during rearing and before weaning were also recorded.

2.4 Parameter Estimation

Prolificacy was calculated as the percentage of lambs dropped per breeding ewe

Per year:

$$\frac{\text{Total number of lambs born in a year}}{\text{Breeding ewe}} \times 100$$

Percentage of Twins and Triplets were calculated as

$$\frac{\text{Number of multiple births}}{\text{Total number of births}} \times 100$$

Pre-weaning Mortality was derived as

[(Total number of dead lambs before weaning / Total number of lambs born) X 100]

Sex ratio was determined as the ratio of male lambs to female lambs born in a flock each year:

(Total number of male lambs born in a flock in a given year / Total number of female lambs born in a flock in a given year)

2.5 Disease Diagnosis

Records of diseases/parasites causing death during the ten-year period were obtained. Evidence of disease was mainly by clinical examination and less often by post-mortem and laboratory investigation.

2.6 Data Analysis

Pre-weaning mortality was determined for both dry and rainy seasons. The effects of type of birth and birth weight on mortality was analysed using Completely Randomized Design (CRD). The influence of season of lambing and sex on pre-weaning mortality was analysed using a 2 x 2 factorial in a CRD while Mortality as influenced by etiologic agents was evaluated using percentages. Chi square was used to test for the significance of the observed sex ratio against the expected.

3. RESULTS AND DISCUSSION

3.1 Sex Ratio and Prolificacy Profile of West African Dwarf Sheep

The prolificacy and sex ratio of WAD sheep are shown in Table 1. More females representing 56.52% or 117 lambs were born to the flock within the period of study. The male lambs representing 43.48% of total births or 90 lambs, differed significantly ($P<0.05$) from the females. Prolificacy can be said to the number of progenies born per parturition. [10] obtained 50:50 sex ratios in a similar experiment working with Tswana lambs. [11] observed that a significant positive correlation existed between the flock age and birth sex ratio; that as the flock aged, the birth sex ratio changed from female biased to male biased, remain for quite a while before changing to female biased again. Also, the prolificacy value of 135% obtained for WAD sheep in this study is comparable with 130.6%

obtained for a flock of Djallonke sheep in Ghana [12]. It would appear that most African sheep breeds have distinct prolificacy values. For instance, 138% has been reported for African long tailed sheep in Rwanda [13], 104% for Sahel sheep in Mali [14], 107% for Uda sheep in Chad [15] and 106% for Yankasa sheep in Nigeria [16]. Similarly, different values have also been reported for WAD sheep in the humid (145.6%) by [17] and sub-humid (133%) by [18] regions of Nigeria and even within the Sub-Saharan nations of Senegal (112%) by [19], Congo (104.7%) by [20] and Togo (148.7%) by [21] in Africa. The high prolificacy of WAD sheep could be related to genetics, management systems, parity, age of the ewe and nutrition.

3.2 Effect of Type of Birth and Birth Weight on Pre-Weaning Mortality of WAD Sheep

The influence of type of birth and birth weight on pre-weaning mortality of WAD sheep are shown in Table 2. The average birth weight differed ($P<0.05$) and was highest for single lambs (1.53 kg) than for either twin (1.30 kg) or triplet (1.09 kg) lambs. Lower birth weight among the triplets contributed for pre-weaning lamb mortality. The average birth weight of lambs in this study (1.30 kg) is low compared to 1.66 kg obtained [22] for WAD sheep. The highest birth weight of the single births could be as a result of higher energy balance in the single-birthed offspring.

The effect of type of birth on pre-weaning mortality of WAD sheep differed ($P<0.05$) significantly and was highest for triplet births (29) than for either twin (25) or single births (20) lambs. This finding is in agreement with the findings of [23]. The high mortality in triplets and twins may be explained by the facts that they have lower energy balance than single-birthed offspring. Besides, it also takes the ewe dam a longer time to lick and dry 2 or 3 lambs. Furthermore, the milk requirement of twins or triplets is higher than that of single lambs and starvation is more likely among them leading to starvation and death. Despite the stated possible causes of higher pre weaning mortalities among triplets and twins, they are still preferred for economic purposes, increment of lock size and in augmenting the animal protein malnutrition among the humid Tropics. Similarly, the effect of type of birth on mortality rate differed ($P<0.05$) with the highest percentage occurring in triplet births (39.1%) than for either twin (33.7%) or single births (27.2%). This finding is comparable with [24] who observed a higher mortality rate in multiple births (35%) than in single births (20%). Mortality rate in lambs' increases with litter size (birth type), a relationship that is associated with a decline in birth weight as litter increase. The lower birth weights observed among the multiple births can however be minimized by increasing the nutritional plain of the ewes toward the third trimester of their pregnancy and proper management systems.

3.3 Effect of Season of Lambing and Sex on Pre-Weaning Mortality of WAD Sheep

The effects of season of lambing and sex on pre-weaning mortality of WAD sheep are shown in Table 3. The mortality was higher during the rainy season than dry season. Similarly it was

Table 1. Sex ratio and prolificacy profile of West African dwarf sheep

Birth type	No. of births	Total no. of lambs	Percentage of total birth	Number of males	Number of females	Sex ratio	Prolifica (%)	SEM
Single	122	122	77.8					0.00
Twin	20	40	12.7					0.00
Triplet	15	45	9.5	90^{b}	117^{a}	1:1.3	135	11.64
Total	157	207						0.00

^{a,b} Means with different superscript differ significantly ($P<0.05$)

Table 2. Effect of type of birth and birth weight on pre-weaning mortality of WAD sheep

	Single	Twin	Triplet	Total	SEM
Average birth weight of lambs (kg)	1.53^{a}	1.30^{b}	1.09^{c}	1.30	1.02
Lambs dead before weaning	20^{c}	25^{b}	29^{a}	74	2.49
Mortality rates (%)	27.2^{c}	33.7^{b}	39.1^{a}	35.7	6.21

^{a,b,c} Means on same row with different superscript differ significantly ($P<0.05$)

observed that more females died than their male counterparts before weaning. The rainy season mortality represented 67.5% of which were 27.0% males and 40.5% females. The dry season mortality totaled 32.5% of which were 13.5% males and 19.0% females, of the total 74 pre weaning mortalities recorded within the period of study. The high mortality rate could be due to the fact that feed availability, diseases, parasites and extreme droughts all fluctuate within and across the seasons. The mortality rate was higher during the rainy season (67.5%) which is in agreement with the findings [25] for lambs. Mortality during rainy season is not uncommon with the inclement weather during the rains. The rains, cool temperatures, wet environment, winds and higher incidence of parasite all play a role in exposing the young lambs to hypothermia and pneumonia. Mortality during the dry season was lower (32.5%) in the present study. According to [26] mortality during hot season may be due to the two critical needs of shed or shelter and proximity to water to the ewe which may be lacking. The mortality observed during dry season could be explained by the effect of the dry and dust laden harmattan winds which predisposes the lambs to respiratory disease and pneumonia.

Table 3. Effect of season on lambing, sex and pre-weaning mortality of WAD sheep

	Male	Female	Total
Rainy season	20 (27.0%)	30 (40.5%)	50
Dry season	10 (13.5%)	14 (19.0%)	24
Total	30	44	74

3.4 Causes of Pre-Weaning Mortality

The causes of pre-weaning mortality of WAD Sheep are shown in Table 4. The mortality rate was higher because of still birth/dystocia, hypothermia, pneumonia, weakness, unknown causes and starvation to lambs during a practically unattended lambing. Post-mortem findings revealed the total lamb losses to be ascribed to starvation (27.03%), unknown causes (20.27%), pneumonia (17.57%), still birth/dystocia (14.86%), weakness (10.81%) and hypothermia (9.46%). Starvation is the most widespread cause of mortality, accounting for the highest proportion of all deaths in the present study which corroborate with [27] who concluded that starvation is the common cause of lamb mortality. However, unless lamb receives colostrum within two or three hours of birth, the body reserves becomes critically depleted. The result is however in contrast to the findings of [24] who attributed pneumonia as the major cause of lamb mortality.

Table 4. Causes of pre-weaning mortality

Cause of mortality	Total number of dead lambs	% Mortality
Starvation	20	27.0
Unknown causes	15	20.3
Pneumonia	13	17.6
Still birth/Dystocia	11	14.8
Weakness	8	10.8
Hypothermia	7	9.5

4. CONCLUSION

The results indicated that season, sex and type of birth in this study were shown to influence prolificacy and pre-weaning mortality of lambs. Management due to litter size and season due to feed fluctuations in quality and quantity are important factors need to be considered in the improvement plan of sheep. Intensive management, particularly dams carrying twins and triplets, is crucial to improve reproduction and reduce mortality rate of lambs. Special care should be given to lambs during the early stage of life particularly lambs with low birth weight either born singly or as twins or triplets. The nutritional and health status of ewes especially during late gestation and at lambing should be given close and special attention. Farmers should be made to understand the need for lambs to have adequate colostrum immediately after they are lambed (24 - 36 hours critical). To improve ewe productivity and enhance household income from sheep, intensive management and health improvement measures have to be implemented.

ETHICAL APPROVAL

This paper followed all the guidelines for the care and use of laboratory animal model of the Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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