Parity: A Selection Criteria for Pre-Weaning Morphometric Traits of West African Dwarfsheep

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ABSTRACT

One hundred and seventy six lambs produced by 84 ewes in their first to seventh parity were used to determine the effect of the number of births of ewe on the pre-weaning morpho metric traits of West African dwarf lambs. Body weight (BW), body length (BL), heart girth (HG) and height at wither (HW), were taken at birth, 4, 8 and 12 weeks after birth. Pre-weaning morpho metric traits of the lambs were significantly ($P<0.05$) affected by the parity of the ewe. The heaviest birth weight was recorded for lambs produced by fifth-parity ewes while the lambs from first parity had the least value. The highest value of BW, BL, and HW (4.74 ± 0.07kg, 37.00 ± 1.18cm, 41.32 ± 0.23cm) and (6.47 ± 0.09 kg, 40.40 ± 0.81cm, 46.11 ± 0.54 cm) were recorded from ewes in their fifth parity at weeks 4 and 8; respectively. Lambs produced by sixth parity ewes had the highest value of HG (39.00 ± 0.32cm, 42.01 ± 0.16 cm, and 42.80 ±0.86 cm) at birth, and 4 and 8 weeks after birth; respectively. However, the effect of parity on the growth performance tended to disappear at week 12. Sexual dimorphism was observed on all the morpho metric traits at week 12 in favour of male lambs. Growth performance of the lambs increases with parity though the effect was less significant at weaning.

Keywords: Parity, ewe, body measurements, lamb.

INTRODUCTION

The West African Dwarf (WAD) sheep, native to the humid and sub-humid zones, is the most predominant breed of sheep found in South Western part of Nigeria (Sowande and Sobola, 2008). They are raised by large numbers of rural households under extensive management system. They have quite a number of physiological properties that made acclimatization possible (Oni, 2003). The WAD sheep are hardy, small, short legged, early maturing and non-seasonal breeders and are less susceptible to trypanosomiasis transferred by tsetse fly prevalent in the sub humid zone. This breed of sheep is also superior to other Nigerian breeds in prolificacy but they are characterised by slow growth.

Growth usually defined as increase in size or body weight at a given age. Animal growth involves increase in size and changes in functional capabilities of the various tissues and organs of animals from conception through maturity (Adeleke et al, 2011). It is one of the important selection criteria for the improvement of meat animals such as sheep (Afolayan et. al., 2006). Many factors affect the growth performance of a young lamb. The quality and quantity of milk consumed is the primary factor influencing growth and these depend on litter size, nutrition of the ewe

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and general body score of the ewe.

Parity of ewe, defined as the number of times an ewe has successfully giving births, has been reported as a non genetic factor affecting the quality and quantity of milk produced by the ewe as well as the general body condition of the ewe (Sevi et al ., 2000, Oravcora et al ., 2006, Lee and Kim, 2006). The greatest part of the income in sheep production system is supplied through lamb production (Ekiz et al., 2005; Mokhtari et al., 2010). Efficiency of lamb production is controlled by reproduction, parity and milk production of the ewe, as well as growth rate and survival of the lamb (Bromley et al., 2001; Rao and Notter, 2000). Therefore it is imperative to study the effect of parity on pre-weaning growth of this breed of sheep so as to decide on the best parity to cull off the ewes from the reproducing flock.

MATERIALS AND METHODS

The experiment was carried out at the sheep unit of the Teaching and Research farm, University of Agriculture, Abeokuta, Nigeria. The area lies in the south-western part of Nigeria and has a prevailing tropical climate with a mean annual rainfall of about 1,037mm. The vegetation is an inter-phase between the tropical rainforest and the derived savannah (Ilori et al., 2010).

One hundred and seventy six lambs resulting from lambing by 84 ewes out of the animals kept by Small Ruminant Technical Committee of the University were used. The multiparous ewes ranged from those with second parity to ewes in their seventh parity. Twelve ewes were in each of the parity. Primiparous ewes were also 12 in number. The lambs were tagged within 24 hours of birth and weighed. The litter size ranges between one to three lambs . Semi-intensive management was practiced. The animals were allowed to graze within the paddock. Concentrate feed which was composed of maize (15%), wheat offal (45%), palm kernel cake (30%), oyster shell (3.5%), bone meal (5%), salt (1%), premix (0.5%) were supplied to the ewes. The diet contains 14% crude protein, 2,816.0 kcal/kg metabolisable energy. Clean water was also supplied ad libitum.

The body weight and morpho metric traits were measured at birth, and at 4, 8 and 12 weeks after birth for each lamb. Pre-weaning body weight was taken with the use of a measuring scale in kilogram. Body length (BL) was measured from the base of the neck to the end of the public bone using a measuring tape in cm. Heart-girth (HG) was measured just behind the fore legs as the circumference of the body while the height at wither measured from the edge of the abdominal region to the ground at a standing position. Heart girth and height at wither were also taken with a measuring tape in cm.

Data Analysis

Data collected was analysed using the General Linear Model procedure of Stastical Analysis System – SAS (SAS, 2010). The model was fitted for the effect dam parity, lamb sex and parity by sex interaction on growth traits. Significant means were separated using Duncan's new multiple range test of SAS (2010)

The model used was as described below

$Y_{ijk} = \mu + P_i + S_j + (PS)_{ij} + e_{ijk}$

where

Y_{ijk} = single body measurement

μ = overall mean

P_i = effect of $_i$th dam parity (i=1 to 7)

S_j = effect of $_j$th lamb sex (j = 1 and 2)

PS_{ij} = Effect of dam parity by sex interaction

e_{ijk} = random residual error normally distributed with zero mean variance.

RESULTS AND DISCUSSION

The least square means for pre-weaning body weight as affected by parity are presented in Table 1. Ewes in their fifth parity produced lambs with the highest significant ($P < 0.05$) body weight at birth (3.39 ± 0.06 kg) while the least birth weight (2.09 ± 0.06 kg) recorded for lambs produced by primiparous ewes. The birth weights of lambs produced by ewes in their fourth and fifth parity were not statistically different. Birth weight of lambs reaches the peak for ewes in the fifth parity while a decrease in birth weight was recorded with subsequent parities. The increase in birth weight of lambs with parity of dam in this study might be due to the increase in average body weight of ewes as the parity advanced. Dickson et al (2004) had reported that a ewe average body weight increases with advance parity while, the work of Zambrano et al (1999) showed a positive relationship between a ewe body weight and its lamb birth weight. The features required for litter bearing develops with age and this may be responsible for the increases in the body measurements of the lambs at birth as parity advanced. The observation on the effect of parity on birth weight in this study agreed with the report of Gardner et al (2007) who showed that the average birth weight increased with parity in the experimental sheep studied at Nottingham. This also corroborated the findings of Dickson et al (2004).

At week 4, there was no significant difference in the body weight of lambs from first and second parity. Lambs from ewes in their third and seventh parity were also statistically the same in body weight while the highest value of body weight was recorded for lambs produced by ewes in their fifth parity. According to Thiruvenkadan et al.(2011), parity had highly significant effect on body weight of lambs. The author indicated that lambs born at 4th and above parities had higher body weight at different ages. Body weight of lambs also increased with the parity of the ewes from the first to the fifth parity at week 8. The body weight declined from the sixth parity. Bermejo et al (2010) reported that the average body weight of lambs increases up to the fourth parity and thereafter declined.

Table 1. Least square means (±SEM) of pre-weaning body weight (kg) as affected by parity

Parity No. of lambs	At birth N =178	Week 4 N =176	Week 8 N =176	Week 12 N =176
1	2.09 ± 0.06^{c}	3.32 ± 0.07^{d}	4.22 ± 0.07^{e}	7.44 ± 0.08^{c}
2	2.32 ± 0.11^{b}	3.43 ± 0.10^{d}	4.88 ± 0.11^{d}	7.47 ± 0.20^{b}
3	2.65 ± 0.09^{ab}	3.65 ± 0.10^{c}	4.94 ± 0.13^{c}	7.51 ± 0.11^{b}
4	3.33 ± 0.08^{a}	4.59 ± 0.08^{b}	6.25 ± 0.09^{b}	8.55 ± 0.10^{ab}
5	3.39 ± 0.06^{a}	4.74 ± 0.07^{a}	6.47 ± 0.09^{a}	9.20 ± 0.14^{a}
6	2.89 ± 0.08^{ab}	4.68 ± 0.10^{ab}	6.23 ± 0.12^{b}	8.98 ± 0.13^{a}
7	2.40 ± 0.09^{b}	3.98 ± 0.11^{c}	6.08 ± 0.15^{c}	8.68 ± 0.20^{ab}

SEM= standard error of means

^{a,b,c,d,e} Means within a column with different superscript are significantly different (P<0.05)

At week 12, the effect of parity of ewes on the body weight of their lambs tended to decrease. Although the highest value of body weight was recorded for lambs produced by ewes in the fifth parity, the body weight of the lambs from ewes in their fifth and sixth parity were statistically the same (Table1). This corroborated the findings of Macedo and Hummel (2006) that the number of births of a ewe did not influence lamb weaning weight.

However, Perez et al (2005) indicated that the lambs from the third to the seventh parity were heavier at weaning than those from young ewes in their first two parities. Benyi et al, (2006) reported that lambs born to first parity ewes were lighter than lambs of older ewes at weaning, lambs born to fourth parity ewes were heavier than those born to ewes of the other parities. The least square means of body length of lambs as affected by parity are presented in Table 2.

Table 2. Least square means (±SEM) of pre-weaning body length (cm) as affected by parity

Parity No. of lambs	At birth N =178	Week 4 N =176	Week 8 N =176	Week 12 N =176
1	21.25 ± 0.83^{e}	27.83 ± 1.60^{d}	33.67 ± 1.26^{e}	37.75 ± 0.95^{b}
2	22.79 ± 0.46^{d}	27.59 ± 0.99^{d}	32.50 ± 1.18^{f}	40.50 ± 1.23^{a}
3	23.00 ± 0.52^{d}	31.50 ± 0.72^{c}	37.17 ± 0.60^{c}	42.50 ± 0.96^{a}
4	26.33 ± 0.61^{c}	33.71 ± 0.25^{bc}	38.72 ± 0.29^{b}	41.86 ± 1.46^{a}
5	31.60 ± 0.93^{a}	36.20 ± 1.30^{b}	40.40 ± 0.81^{a}	42.03 ± 0.45^{a}
6	29.92 ± 0.42^{b}	37.00 ± 1.18^{a}	35.67 ± 0.56^{d}	43.00 ± 1.75^{a}
7	26.55 ± 0.61^{c}	36.00 ± 0.44^{b}	39.00 ± 0.41^{b}	43.01 ± 1.65^{a}

SEM= standard error of means

[a,b,c,d,e] Means within a column with different superscript are significantly different (P<0.05)

At birth, the least body length was recorded for lambs of ewes in their first parity (21.25 ± 0.83cm). This gradually increased for lambs from multiparous ewes. The longest body length was measured for lambs produced by ewes in their fifth parity. At week 4 and 8, the least body length was also recorded for lambs produced by ewes in their first parity while the highest value was measured for those in the sixth parity(37.0±1.18cm) at week 4 and fifth parity (40.40±0.81 cm) at week 8 . The body length of lambs from ewes in their seventh parity reduced though not as low as those of lambs from first and second parities. At week 12, the effect of parity of dam on pre-weaning body length of lambs tended to be less significant. Apart from lambs of primiparous ewes, all the lambs from multiparous ewes (second to seventh parities) are statistically the same in body length (Table2).

Ewes with advanced parities were not growing and higher percentage of the nutrient intake was used up in the production of milk for their lambs unlike young ewes in their early parities that are still growing and thus must provide for their own growth in addition to their lamb demand.

Heart girth also known as chest girth is an important morpho-metric traits in sheep. Heart girth is used to estimate live weight of animals especially for the determination of drug dosage when a measuring scale is not available as most drugs are administered based on the live weight of the animal. The least square means of heart girth as affected by parity are presented in Table 3. From birth to week 8, the lowest value of heart girth was measured for lambs produced by ewes in their first parity. However, unlike body weight and body length, the broadest girth was measured for lambs produced by ewes in their sixth parity. The effect of parity of the dam also tended to disappear on heart girth at 12 weeks as there was no significant difference in the heart girth of lambs, produced by multiparous ewes as shown in Table 3.The effect of parity on height at wither followed the same trend as body weight and body length from birth to week 8. Lambs from ewes in their first parity had the least value of height at wither. This increased for lambs produced by ewes with advanced parity till the fifth parity. The decline in the height at withers for lambs from ewes in their sixth parity was not significant as the value was statistically the same as those from fifth parity at week 8. At week12, the effect of parity of dam was not significant. The mean height at wither for lambs produced by primiparous and multiparous ewes were not statistically different as shown in Table 4. The quality and quantity of milk consumed by a lamb are the primary non-genetic factors influencing its growth. Oravcora et al (2006) reported that daily milk yield of ewe increases with increase in the number of successful parturition and lactations. Sevi et al (2000) found a significant effect of parity on milk total solids, fat, total protein and lactose. Ewes in their third parities had higher milk protein, casein and fat contents compared to parity 1 and 2.

Lee and Kim, (2006) reported, that milk yield increased with parity, however parities higher than 5 is associated with loss in body condition, parturition difficulties and risk of retained placenta.

The increase in body weight and body measurements of lambs from multiparous ewes at 4 and 8 weeks might be due to the nutrients available to them through milk consumption.

The effect of parity tended to be non significant at weaning (12 weeks). This is in agreement with the Bermejo et al. (2010) who reported that there was no significant difference in the weaning weight of lambs produced by primiparous and multiparous ewes. The non- significance of parity on lamb body measurements at weaning in this study might be due to the availability of concentrate feed for the animals. The lambs are less dependent on milk and were able to consume part of the concentrate feed supplied to their dams at this age.

The effect of sex was not significant on the measurements at birth (Table 5). Nevertheless, sexual dimorphism was observed with the body weight of the male lambs was significantly higher than female lambs at weeks 4, 8 and 12.. Sexual dimorphism was observed for body length at week 8 and 12 while significant difference was not observed in the height of the male and female lambs until week 12 when the mean height at wither for the male lambs was about 2.11cm better than those of the female lambs. Sexual dimorphism observed in this study in favour of male lambs corroborated the report of Bermejo et al. (2010) that ram lambs had higher birth weight than ewe lambs of Canarian hair sheep. According to Thurvenkadan et al. (2011), the difference between male and female lambs increased from 0.18 kg at birth to 2.84 kg at 12 months of age. Moreover, Tariq et al. (2010) and El Fadili, (2011) also reported sexual dimorphism on pre-weaning growth in favour of male lambs.

The superiority of male lambs in weaning weight and body measurement in the study could be attributed to the influence of male sex hormone which promotes the aggressive feeding behaviour of male lambs. According to Gardner et al. (2007) the presence of a Y-chromosome has specific effects on the body weight and linear body measurements.

In the same vein, the superiority of male lambs over the female counterparts in terms of growth are reported by Ravimurugan et al. (2007), Sivakumar et al. (2006) and Gbagboche et al.(2005)

The effect of the interaction between dam parity and sex was not significant on any of the parameters measured.

Table 3 . Least square means (±SEM) of pre-weaning heart girth (cm) as affected by parity

Parity No. of lambs	At birth N =178	Week 4 N =176	Week 8 N =176	Week 12 N =176
1	27.67 ± 0.44[d]	35.67 ± 0.33[e]	39.00 ± 0.39[d]	40.33 ± 1.12[b]
2	29.93 ± 0.56[c]	38.72 ± 0.71[c]	42.29 ± 0.47[c]	44.43 ± 1.37[a]
3	29.40 ± 0.51[c]	37.40 ± 0.81[c]	41.20 ± 0.37[c]	43.00 ± 0.55[a]
4	30.42 ± 0.52[c]	39.08 ± 0.76[c]	42.50 ± 1.06[c]	44.67 ± 1.95[a]
5	36.33 ± 1.15[b]	39.83 ± 0.91[b]	41.50 ± 0.92[b]	42.17 ± 0.45[a]
6	39.00 ± 0.32[a]	42.00 ± 0.16[a]	42.80 ± 0.86[a]	42.40 ± 0.53[a]
7	35.33 ± 1.25[b]	39.08 ± 1.02[b]	42.50 ± 1.21[b]	43.07 ± 1.25[a]

SEM= standard error of means

[a,b,c,d,e] Means within a column with different superscript are significantly different (P<0.05)

Table 4 . Least square means (±SEM) of pre-weaning height at wither (cm) as affected by parity

Parity No. of lambs	At birth N =178	Week 4 N =176	Week 8 N =176	Week 12 N =176
1	33.57 ± 0.11[a]	36.88 ± 0.24[de]	40.68 ± 0.35[e]	43.88 ± 0.26[b]
2	34.92 ± 0.22[e]	37.72 ± 0.29[c]	41.84 ± 0.10[d]	45.66 ± 0.37[a]
3	35.42 ± 0.15[d]	41.32 ± 0.23[a]	44.37 ± 0.15[c]	45.57 ± 0.13[a]
4	36.12 ± 0.03[bc]	37.55 ± 0.22[cd]	44.72 ± 0.12[bc]	45.53 ± 0.11[a]
5	36.60 ± 0.15[a]	39.70 ± 0.80[b]	46.11 ± 0.54[a]	46.78 ± 0.09[a]
6	35.85 ± 0.20[c]	39.50 ± 0.32[b]	46.20 ± 0.09[a]	46.06 ± 0.11[a]
7	36.38 ± 0.18[b]	37.54 ± 0.27[d]	45.00 ± 0.31[b]	45.87 ± 0.13[a]

SEM= standard error of means

[a,b,c,d,e] Means within a column with different superscript are significantly different (P<0.05)

Table 5. Least square means (±SEM) of pre weaning growth traits as affected by sex

Growth traits	Sex	At Birth	Week 4	Week 8	Week 12
Body Weight (g)	M	2.61 ± 0.08^a	3.98 ± 0.13^a	5.46 ± 0.17^a	7.21 ± 0.21^a
	F	2.52 ± 0.10^a	3.65 ± 0.11^b	5.08 ± 0.14^b	6.79 ± 0.17^b
Body Length (cm)	M	24.15 ± 0.83^a	33.26 ± 0.80^a	38.13 ± 0.48^a	41.96 ± 0.62^a
	F	23.89 ± 1.02^a	32.58 ± 1.04^a	36.58 ± 0.74^b	39.37 ± 0.59^b
Heart Girth (cm)	M	31.24 ± 0.74^a	39.00 ± 0.62^a	41.50 ± 0.61^a	45.30 ± 0.74^a
	F	29.98 ± 0.88^a	38.85 ± 0.74^a	40.85 ± 0.12^a	43.52 ± 0.48^b
Height at Wither (cm)	M	28.04 ± 0.12^a	30.50 ± 0.31^a	34.57 ± 0.25^a	38.21 ± 0.10^a
	F	27.95 ± 0.81^a	30.38 ± 0.53^a	34.68 ± 0.21^a	36.10 ± 0.24^b

[a,b] Means in a column (within a growth trait) with different superscript are significantly different ($P<0.05$)

CONCLUSION

Pre-weaning body weight and other body measurement of lambs increased with parity up till the fifth parity and then declines with subsequent parities. Although lamb pre-weaning body measurements reduced at 6th and 7th parity, it was not as low as the performance of lambs produced by ewes in their first two parities. The effect of parity on body measurement tended to disappear at weaning. Ewes with advanced parities can therefore be kept in the flocks as long as there are no lambing difficulties and retention of placenta which are usually associated with parturition of lambs by very old ewes. However, there is sexual dimorphism of body weight and morph metric traits in favour of male lambs.

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أعداد الولادات: معايير الانتخاب للصفات الشكلية قبل الفطام في سلالة خراف الدورف الغرب افريقي

أديلدون فادار [1] واوموتايو اكيوي [2] واتوسين اديدجي [3]

ملخــص

تم دراسة 176 خاروفاً مولوداً من 84 نعجة خلال الولادة الاولى – السابعة من أجل تحديد أعداد الولادات عند النعاج وعلاقتها بالصفات الشكلية للخراف في مرحلة قبل الفطام. تم تسجيل الوزن(BW) وطول الجسم(BL) و heart girth (HG) وHeight at wither (HW) عند عمر 4 و8 و12 اسبوعاً. حيث أظهرت الصفات الشكلية اختلافاً معنويا (P‹ 0.05) متأثرة بأعداد الولادات (Parity). وقد وجدت القيم العظمى للاوزان(BW) عند الولادة في الخراف من الولادات الخامسة والقيم الدنيا في الخراف في الولادات الأولى كما وكانت القيم العليا للاوزان (BW) وطول الجسم(BL) و HW على النحو التالي: (4.74±0.07kg,37.00±1.18cm and 41.32±0.23cm) و(6.47±0.09kg, 40.40±0.81cm, 46.11±0.54cm) عند الخراف من الولادات الخامسة في الأسبوع الرابع والثامن على الترتيب. أما الخراف من الولادات السادسة كانت تحضى بالقيم العضمى في HG ,39.00±0.32cm) 42.01±0.16cm, 42.80±0.86cm (عند الولادة وفي الأسبوع الرابع والثامن على الترتيب. في حين بدأ أثر أعداد الولادات على النمو يتلاشى في عمر 12 شهراً. ولوحظ تواجد ثنائية الشكلية الجنسية (Sexual Dimorphism) على عمر 12 اسبوعاً لصالح الخراف الذكور. وتبين أن كفاءة النمو عند الخراف تزداد بزيادة الولادات وكانت هذة الزيادة أقل معنوياً عند عمر الفطام.

الكلمات الدالة: أعداد الولادات، المعايير الشكلية، الخراف.

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