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Qualitative traits and their effects on litter size and birth weight in sheep in the Sudano-Sahelian zone of Cameroon

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Abstract

This study was carried out to determine the influence of maternal qualitative traits on litter size, and birth weight of lambs in small holder sheep in Soudano-sahelian zone of Cameroon. The results of the study indicate horned ewes are rare (5%). Coat pattern was predominantly dichromic (81%); the ewes were predominantly non-wattle (90.1%) and non-supernumerary teats (95.9%). The facial profile was convex (61.2%) while the ears were largely semi-pendulous (38.8%) and pendulous (52.1%). The mean litter size and birth weight were 1.27 and 2.58 kg respectively. Although litter size was not significantly ($P<0.01$; 0.05) affected by supernumerary teats, coat pattern and ears orientation. However, horns significantly ($P<0.01$) influenced litter size, with horned ewes having more twins (1.80±0.152) than hornless ewes (1.25±0.035). Wattles and facial profile also significantly ($P<0.05$) influenced litter size. Indeed, litter size is higher in females without wattles and having a straight facial profile. On the other hand, wattles, horns, coat pattern, facial profile and supernumerary teats had no significant ($P<0.01$; 0.05) influence on birth weight of lambs, while ears orientation did ($P<0.01$). Lambs from pendulous ears ewes were heavier (2.71±0.114 kg) than the ones from horizontal ears ewes (2.36± 0.187 kg) at birth. Although the birth weight is higher in males than female lambs and in single birth compared to twins. However, only litter size significantly ($P<0.01$) influenced the weight of lambs at birth. Parity significantly ($P<0.05$) influenced birth weight of lambs. The higher the parity, the heavier the lambs. These results show that some maternal qualitative traits influenced both prolificacy and body weight of lambs in sheep. These may play an important role in breeding programs aimed at improving body weight and prolificacy in sheep in Cameroon.
Keywords: Qualitative traits, Litter Size, Birth Weight, Sheep, Cameroon.
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1. Introduction

Livestock is a key component of the economy and livelihood of many people, with sheep being the most common (Roessler, 2019). The consumption of red meat has increased by 5–6% annually in developing countries. Globally, lamb meat consumption has been increasing, and countries like China, New Zealand, and Australia consume a lot of lamb meat (Suleman *et al*., 2020). Besides, Asia has the largest sheep population representing 43.6% of the world's sheep population. A large part of the increase in sheep populations is due to an increase in world meat and dairy consumption (Mazinani and Rude, 2020). For this reason, sheep are one of the most important livestock animals that affect the economy and industry through their high production and reproduction characteristics (Farrag, 2019; Al-Thuwaini, 2021). These characteristics of sheep that contribute to their economic value are necessary for the development of livestock breeding programs (Abd-Allah *et al*., 2019). Little size, birth weight, wattle, coat color and horn are some of the fundamental measures in studying and planing animal improvement or performance (Daure *et al*., 2013). However, improving performance of livestock, particularly sheep have been concentrated on the quantitative traits to the neglect of the qualitative traits (Osinowo *et al.,* 1988). Yet, qualitative traits of sheep are also characteristics about which systematic information is lacking in tropical breeds; in contrast to temperate breeds where interest on qualitative traits influence production has been substantial in view of their economic potentials (Odubote, 1994).

Willis, (1991) reported that characters and qualities are passed to offsprings genetically. Moreover, Hotst (1988) indicated that studies on qualitative traits and application of results in sheep may offer a cheaper and indirect method of improving production performance of our indigenous livestock which developing countries stand to gain from. For this reason, there is a need to study qualitative trait as an index of improvement.

The interest of the present study is to find out if it could be any relationship between qualitative trait, litter size and birth weight in sheep population in Cameroon. The findings could be used as a quick criterion to select potential prolific females of Cameroon sheep, thus enable stout breeding schemes.

2. Materials and Method

The study was carried out in the Sudano-Sahelian zone of Cameroon whose geoclimatic characteristics are as follows: 8°36" and 12°54" North latitude, and 12°30" and 15°42" East longitude. It approximately covers the northern and Far North regions, an area of 100,353 km2.

Sheep flocks were used for this study which was carried out in forty-five herds from the small holder farms. The choice of farms was made using the snowball method according to the approach described by (Solomon *et al*., 2008) on voluntary farms with ewe that has given birth at least once. A total of 216 female ewes and 121 lambs were used for data collection. The maternal qualitative traits studied include; patches eyes (1= Present; 2=Absent), wattles (1= Present; 2=Absent), supernumerary teats (1= Present; 2=Absent), horns (1= Present; 2=Absent), coat pattern (1= Monochromic; 2=Dichromic; 3= Trichromic) and facial profile (1= Straight; 2=Convex; 3=Concave). Also, when the dam delivers the lamb, the birth weight of the born kids was taken few hours after birth and values recorded in kg. Weighing balance with a capacity of 50kg was used in taking the birth weight of the lambs. The number of kids born per doe, whether single, twins or triplets was recorded as type of birth.

Descriptive statistics were used to describe the distribution of qualitative traits. Analysis of variance was used to evaluate the effect of traits on litter size and lamb birth weight. The Duncan test and the T-test were used to separate the means, when the factors were significant. The analysis was done in stages using SPSS computer programme.

3. Results and Discussion

The study shows that animals with patches eyes were almost equal to those without patches (54.5%: 45.5% respectively). Patches eyes significantly ($P < 0.01$) affect litter size of dams. Non patches eyes ewes significantly have high litter size than those with patches eyes (Table 3a). Patches eyes ewes had no significant effect on lamb birth weight.

The percentage of Wattle ewes in this study was 9.9% (Table 1). This incidence of Wattle agrees with the findings of Sing *et al.* (1970) on temperate breed Malpura and Rambouillet X Malpura sheep and Daure *et al*. (2013) on Yankassa sheep that Wattle ewes were of low incidence.

Wattle had significant ($P < 0.05$) effect on litter size (fertility) of dams, but shows that the litter size is higher in females without pendants This does not agree with the report of Casu *et al.* (1970) on sheep that ewes with wattle tend to have higher prolificacy and higher milk yield than those without. Shongia *et al*. (1992) reported on Saanen does that Wattle does prove to have higher prolificacy than those without Wattle. However, the result of the present study tends is in concordance with the result of Singh *et al.* (1970) that reported lower prolificacy in Wattle Malpura and cross breed ewes. Reports in the literature (Osinowo *et al*., 1988) further suggest that wattle is involved in heat regulation, hence it may be an adaptive feature from the result of this study, it seems likely that the effect of wattle may be on body physiology (thermoregulation) other than fertility in Cameroon sheep.

Odubote (1994) reported that presence or absence of wattle do not exert any influence on births weight. This compares favorably with the result of this study. In this study Wattle does not significantly affect lamb birth weight (Table 3a). However, Daure *et al*. (2013) on Yankassa reported that wattle significantly affected lamb birth weight and body weight at 3 months. in that lambs born to non-wattle ewes though had lighter birth weight grow faster.

The percentage of ewes with supernumerary teats is 4.1% (Table 1). this disagrees with the report of Maijala and Kyle (1988), that observed the frequency of 20% of supernumerary teats (ST) in Finnsheep and Coopworth ewes. In this work, Presence or absence supernumerary teats not significantly ($P < 0.01$) affect litter of dams and lambs birth weight (Table 3a). this can be explained by the fact that these extra teats are in the majority of cases non-functional. The Animal Welfare Approved program in the United States (AWA, 2013) defines supernumerary teats as teats that are additional to the usual number of teats found on a cow (four), sheep (two), or goat (two). They can sometimes produce milk, but more often, they are not fully formed and can obstruct milking. With the same idea Palacios et Abecia (2014) observe in their work that ewes with four teats had the same milk yields as ewes with two teats. In sheep, teat number is a highly heritable characteristic (Rowson *et al*., 2012), and development of supernumerary teats is a complex polygenic trait (Peng *et al*., 2017).

Convex facial profile was dominant (61.2%) than straight facial profile (38.8%) in the herds studied (Table 1). Facial profile significantly ($P < 0.05$) influence litter size in ewes. Litter size is higher in ewes with straight facial profile than those with convex profile. Facial profile had no influence ($P < 0.01$) on lamb birth weight (Table 3a).

In this study, the ears orientation was distributed as follows: 9.1%; 38.8% and 52.1% respectively for horizontal, semi-pendants and pendants ears (Table 1). Ears orientation had not significant ($P < 0.05$) influence on litter size of dams but significantly ($P < 0.05$) affect lamb birth weight. Lambs from females with pendants ears are heavier than those from females with horizontal ears (Table 3b).

The percentage of horned ewes in the herds studied was 5% (Table 1). This result agrees with the findings of Daure *et al*. (2013) on Yankassa sheep that horned ewes were of low incidence. Litter size is significantly ($P < 0.05$) high in horned ewes than those without horns. On the other hand, the presence or absence of horns had no effect on the birth weight of the lambs (Table 3b).

The current study recorded higher single births (72%) than twin births (27%) (Table 2). There was 2 occurrences of triplet and 1 quadruplet. This is in agreement with the report of Olawale (1989) who reported lower percentage of multiple birth in Oudah and Yankasa sheep and higher percentage of single births for the same breeds. During this study it was observed that prolificacy increases with parity hence the ability of the older ewes producing twins. Litter size tends to increase from second and subsequent lambing but declined insignificantly and inconsistently at sixth parity. This compares favorably with the results obtained by Balogun *et al.* (1993) in which they reported insignificant decline at the sixth parity. It also agrees with the report of Daure *et al*. (2013) on Yankassa sheep which indicate the decline of Litter size at fourth parity. The litter size can be increased until five years of age or the fourth parity, and then it gradually decreases afterward (Ahmed and Maher, 2009). On the other hand, an increase in litter size with increasing parity and larger litter size at the fifth parity are reported in other studies (Tec Canché *et al*., 2016; Assan, 2020), in which peak prolificacy is generally achieved between the ages of 4 and 8 years old.

Parity significantly ($P<0.05$) influenced lamb distribution according to litter size (Table 3b). This is in consonance with the report of Bonsman (1939) and Belic and Ognojovic (1955) indicating that the first lambing ewes produced significantly single and lighter lambs than subsequent lambing. It also agrees with the report of Ainsworth and Shrestha (1987) which indicated a progressive increase in overall fertility and fecundity as the type of birth of lambs' increases from single to triplet. As parity increases in the present study the number of twin lambs born increases while single decrease. In other words, fertility increases with parity which is in line with the report of Adu *et al.* (1985) that fertility increases from first to sixth lambing and then decreases with age. But results of this study show prolificacy in older ewes than in yearlings and hogget. This may be due largely to differences in reproductive physiological maturity that may affect ovulation rate.

Parity significantly ($P< 0.05$) influenced lamb birth weight (Table 3b). Primiparous ewes tend to produce significantly ($P<0.05$) lighter lambs at birth than multiparous ewes. This has been supported by literature cited by Osinwo *et al*. (1992) on Yankasa Sheep. Birth weight significantly ($P<0.05$) increased from first to fourth parity, and begins to decrease at fifth parity. Also, the result obtained in this study is in line with the report of Balogun *et al.* (1993) and Daure *et al*. (2013) which indicated a decline in birth weight at the sixth and fourth parity.

Table1. Distribution of qualitative traits in ewes

Qualitatives traits	Modalities	Effectifs	Frequencies (%)
Patches eyes	Present	66	54.5
	Absent	55	45.5
Wattles	Present	12	9.9
	Absent	109	90.1
Supernumerary teats	Present	5	4.1
	Absent	116	95.9
Facial profile	Straight	47	38.8
	Convex	74	61.2
Horns	Absent	104	86.0
	Mottes	11	9.1
	Present	6	5.0
Ears orientation	Horizontal	11	9.1
	Semi-pendants	47	38.8
	Pendants	63	52.1
Coat pattern	Monochromic	13	10.7
	Dichromic	98	81.0
	Trichromic	10	8.3
Total		**121**	**100**

Table 2. Distribution of lambs according to sex of lamb by type of birth

Modalities	Dam (Frequencies %)	Male	Female
Single birth	88 (72.73%)	42	46
Twin	33 (27.27%)	19	28
All male	5 (4.13%)	5	0
All female	14 (11.57%)	0	14
Co-Twin	14 (11.57%)	14	14

Table 3a. Effect of patches eyes, facial profile, supernumerary teats and wattles of dam on litter size and lamb birth weight

Qualitatives traits	Modalities	N	Litter Size $\bar{X}$ ±SD	Pvalue	Birth Weight $\bar{X}$ ±SD	Pvalue
Patches eyes	Present	66	1.20±0.049	**	2.55±0.069	ns
	Absent	55	1.36±0.065		2.65±0.087	
Supernumerary teats	Present	12	1.20±0.20	ns	2.60±0.245	ns
	Absent	109	1.27±0.042		2.59±0.056	
Wattles	Present	5	1.17±0.112	*	2.75±0.218	ns
	Absent	116	1.28±0.043		2.58±0.056	
Facial profile	Straight	47	1.34±0.70	*	2.45±0.073	ns
	Convex	74	1.22±0.049		2.69±0.074	
Total		**121**	**1.27±0.044**		**2.58±0.058**	

ns, non-significant ($P < 0.05$; $P < 0.01$); * significant at 0.05 level; ** significant at 0.01 level

Table 3b. Effect of coat pattern, ears orientations, horns and parity of dam on litter size and lamb birth weight

Factors	Modalities	N	Litter Size ($\bar{X}$ ±SD)	Birth Weight ($\bar{X}$ ±SD)
Coat pattern	Monochromic	13	1.20±0.139a	2.54±0.159a
	Dichromic	98	1.28±0.095a	2.58±0.108a
	Trichromic	10	1.31±0.174a	2.80±0.198a
Ears orientation	Horizontal	11	1.25±0.164a	2.36±0.187a
	Semi-pendants	47	1.27±0.116a	2.49±0.132ab
	Pendants	63	1.30±0.100a	2.71±0.114b
Horns	Present	6	1.50±0.202b	2.50±0.229a
	Mottes	11	1.09±0.153a	2.36±0.175a
	Absent	104	1.27±0.082ab	2.63±0.093a
Parity	1	12	1.21±0.129a	2.00±0.170a
	2	38	1.22±0.121a	2.32±0.137ab
	3	18	1.22±0.142a	2.78±0.161cd
	4	9	1.33±0.149ab	3.11±0.212d
	5	21	1.67±0.187b	2.95±0.147cd
	6	9	1.28±0.153a	2.78±0.203cd
	7	14	1.23±0.178a	2.64±0.174bc
Total		**121**	**1.27±0.044**	**2.58±0.058**

a, b, c and d; Means under the same factor and parameter with different superscripts are significantly different.

Adu and Ngere (1979), Buvanendran *et al.* (1981), Osinowo *et al.,* (1990; 1993), Gbangboche *et al.* (2005) and Daure *et al*. (2013), litter size consistently (P<0.01) affected birth weight. This implies that; lambs born single are heavier than twin lambs hence they grow faster thereby conferring heavy body weight on them. These observations are in disagreement with our results (Table 4) which showed that litter size does not significantly (P<0.01; (P<0.05) influence birth weight of lambs. This could be explained firstly by the differences in genetic types present within our population and secondly, by differences in breeding techniques and on the other hand,
Sex of lamb did not significantly (P<0.01) affect birth weight (Table 4). This result is in agreement with report of Daure *et al*. (2013) on Yankassa sheep which indicate that sex of lamb did not significantly (P<0.05) affect birth weight. However, this disagrees with the report of Hassan (1987) and Osinowo *et al*. (1990; 1993) that ram lambs constantly weighed heavier than female lambs at birth. It is highly suggestive that management and environmental factors are responsible for the reverse.

Table 4. Effect of type of birth and sex of lamb on birth weight of lambs

Factors	N	Birth weight $\bar{X}$ ±SD	Pvalue
Type of birth			
Single	88	2.69±0.064	ns
Twins	33	2.37±0.096	
Sex of lambs			
Male	66	2.67±0.069	ns
Female	88	2.45±0.066	

ns, non-significant (P < 0.05 ; P < 0.01); ** significant at 0.01 level

4. Conclusion

This study indicates that, some maternal qualitative traits influence litter size and birth weight of lambs in small holder sheep in Soudano-sahelian zone of Cameroon. Also, parity, litter size and litter composition affected lamb body weight. These maternal qualitative traits should be exploited as a way of enhancing performance and planning animal improvement or performance. More farmers flock should be studied for these traits in various seasons of the year.

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