

*Full Length Research Paper*

# Relationship between litter size and parity of doe in smallholder goat herds in Kano and its environs, Nigeria

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The parity and litter size of 116 does from 22 randomly selected herds were surveyed to determine the relationship between herd size, parity and litter size of smallholder goat herds. The study revealed that the average parity and litter size of smallholder goat herds was 2.7 and 1.7, respectively with a herd size of 15.0 goats. Majority of the breeding does were within the herd size of 11 to 20 goats (53.4%) followed by  $\leq 10$  goats (30.2%) and least, 21 to 30 goats (16.4%). Most of the breeding does were within the 1st and 3rd parity (74.2%) and a good number within the 4th and 6th parity (25%), while extremely few of the breeding does go beyond parity 6 (0.8%). Although the farmers started culling the does after the 2nd parity, majority of the does are culled after the 4<sup>th</sup> parity. Relating the distribution of the breeding does with their parity and litter size showed that single bearing does could remain in the herds up to parity 5 but with the number decreasing with increase in parity. Twinning does existed up to parity 6 with majority of the twin bearing does observed at parity 2 declining thereafter up to parity 5 with the peak at parity 3. Does giving birth to quadruplets continue to remain in the herd; however this litter size was attained at much latter parity by the does. Herd size was not significantly correlated with parity and litter size ( $P > 0.05$ ;  $r = 0.01 - 0.09$ ). However, litter size was significantly and positively correlated with parity ( $P < 0.01$ ;  $r = 0.49$ ). The results presented seem to indicate that parity is an important factor in the evaluation of litter size in goats and multiple births could be achieved with good breeding plan and better management practices.

**Key words:** Goats, herd size, litter size, parity, smallholder herd.

## INTRODUCTION

Kidding frequency and litter size are important components of an efficient kid production system. Litter size or number of kids in the litter as defined by Alexandre et al. (1999) is a total number of born kids per kidding and per goat. The litter size at birth is an important trait for selection of goats to produce next generation and increase of meat and milk production. Litter size seemed to be the most useful selection criterion for genetic improvement of meat production. Although selection for litter size has been successful (Turner, 1978; Clarke, 1972), the rate of improvement

has not been large, partly because the trait is only observable in females of reproductive age that do conceive and maintain their pregnancy. Litter size in goat is influenced by numerous factors. Amoah and Gelaye (1990) established that litter size was under significant influence of goat age and parity, whereas Awemu et al. (1999) stated parity, year and season as factors of importance for goat litter size. Song et al. (2006) stated that reproductive efficiency of goats is determined by age of goats at first kidding, kidding interval, type of birth, litter size and mass of kids at birth and weaning. Knowing the relationship of parity and litter size will help in determining the parity level when a doe's prolific ability reaches its peak. This information is very important in culling and /or selection programme. The objective of this study therefore was to determine the relationship between parity and

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**Table 1.** Descriptive statistics for parity and litter size of does.

Characteristics	N	Mean $\pm$ (se)	CV (%)	Min	Max
Herd size	116	15.0 $\pm$ 0.60	43.4	4	29
Parity	116	2.7 $\pm$ 0.13	52.9	1	8
Litter size	116	1.7 $\pm$ 0.07	43.0	1	4

litter size of smallholder goat herd.

## MATERIALS AND METHODS

### Study location

The study was conducted in Kano and environs, located within the Sudan Savannah Zone of Nigeria. The area is situated between longitude 9°30' and 12°30' North, and latitude 9°30' and 8°42' East. The climate is characterized by dry and wet seasons. The dry season stretches from October to April, while the wet season ranged from May to September. The annual rainfall and temperature ranges between 787 and 969 mm and 21 to 39°C, respectively (IAR, 2005).

### Animal management

The animals were managed under the traditional smallholder system. They were released for grazing in the morning at 8.00am and kraaled at night. The goat houses were made using corn stalk for fencing and thatched roof for protection against heat and rainfall. The houses were open sided for adequate ventilation. There was no organized health care provision in terms of vaccination and deworming. However, veterinary officers were called to treat the animals when cases of ill-health occur. Supplementary feeding of the animals was done in the morning before turning them out for grazing and in the evening before they were kraaled. They were supplemented with groundnut hulms, beans pods, maize/ millets or sorghum offals. Mineral blocks and water were also provided. The kids were allowed to run with their dams throughout the study period, and weaning was by natural means.

### Data collection

The parity and litter size of 116 does from 22 randomly selected herds were surveyed. The study commenced with primary visits to identified herd and individual female goats. The herds were monitored (visited) regularly. Each herd was visited at the commencement of the study and does were identified with a neckband tag. The attributes measured were: Herd size, parity and litter size of doe at the time of survey. Birth type consisted of single, twins, triplets and quadruplets. Parity was based on the number of times the does had kidded (1, 2, 3, 4, 5 and 6). Litter size or numbers of kids were defined as the total number of born kids per kidding and per goat. All information obtained was used to examine the relationship between herd size, parity and litter size of smallholder goat herd.

### Data analysis

The data generated were analyzed using descriptive statistics, analysis of variance and correlation analysis. The following categorizations were made for herd size ( $\leq 10$ , 11-20, and 21-30);

breeding males (1,2,3, and 5); breeding females (2,3,4,5,6,7,8,9, and 10); and mating ratio (2,3,4,5,6,7,9, and 10) to be able to determine their effect on litter size. Correlation analysis was done using SAS, (2000).

## RESULTS

Table 1 shows the litter and parity of the does in goat herds in Kano and its environs. The average parity and litter size was 2.7 and 1.7, respectively within a mean herd size of 15.0 goats. The distribution of observed does according to herd, parity and litter size (Table 2) showed that majority of the breeding does were found within the herd size of 11 to 20 goats (53.4%) followed by  $\leq 10$  goats (30.2%) and least, 21 to 30 goats (16.4%). Most of the breeding does were within the 1st and 3rd parity (74.2%) and a good number within the 4th and 6th parity (25%), while extremely very few of the breeding does go beyond parity 6 (0.8%).

Relating parity and litter size distribution of the breeding does (Table 3) showed that in herds  $\leq 10$  goats breeding does begin to leave the herd after parity 3 with 20% going up to parity 4 and 5, and only 2.9% making it beyond parity 5 with the maximum observable parity of 8. For herd size 11 to 20 goats, does also start to leave the herd after parity 3, with about 14.5, 8.1 and 3.2% of them reaching parity 4, 5 and 6, respectively; and parity 6 was the maximum for this herd size. Observations on herd size 21 to 30 goats showed that breeding does declined after parity 2 and the maximum parity attainable was parity 3 with only 5.3% of the does.

On account of litter size, the maximum litter size attainable by does on herd size  $\leq 10$  goats was 3, consisting about 17.1% of the does; with majority of does having litter size of 1 (54.3%). Does under the 11 to 20 goat herd size had a maximum litter size of 4 attainable by only 1.6% of the does. Most of the does had either litter size 1 (41.9%) or 2 (40.3%); with 16.2% of them having litter size 3. Observations on the 21 to 30 goat herd size showed that majority of the does had litter size 2 (63.2) with about 5.3% of them attaining the maximum litter size of 3 for this category.

Relating the distribution of the breeding does with their parity and litter size (Table 4) showed that single bearing does could remain in the herds up to parity 5 but with the number decreasing with increase in parity. Twinning does existed up to parity 6 with majority of the twin bearing does observed at parity 2 declining thereafter up to parity

**Table 2.** Distribution of does according to herd size, parity and litter size.

Herd size	Attributes	
	Number observed	Frequency (%)
≤10 goats	35	30.2
11-20goats	62	53.4
21-30goats	19	16.4
Parity		
1	27	23.3
2	32	27.6
3	27	23.3
4	18	15.5
5	8	6.9
6	3	2.6
7	0	0.0
8	1	0.8
Litter size		
1	51	44.0
2	47	40.5
3	17	14.7
4	1	0.8

**Table 3.** Distribution of does according to parity and litter size in relation to herd size.

Attributes	10 goats	11-20 goats	21-30 goats
Parity	35	62	19
1	9(25.9)	15(24.2)	6(31.6)
2	9(25.9)	16(25.8)	12(63.1)
3	9(25.9)	15(24.2)	1(5.3)
4	5(14.3)	9(14.5)	0
5	2(5.7)	5(8.1)	0
6	0	2(3.2)	0
7	1(2.8)	0	0
8	1(2.9)		
Litter size	35	62	19
1	19(54.3)	26(41.9)	6(31.6)
2	10(28.6)	25(40.3)	12(63.2)
3	6(17.1)	10(16.2)	1(5.3)
4	0	1(1.6)	0

5 with the peak at parity 3. Does giving birth to quadruplets continue to remain in herd; however this litter size was attained at much latter parity by the does.

Table 5 shows the correlated relationship between herd size, parity and litter size of the doe. Herd size was not significantly correlated with parity and litter size ( $P>0.05$ ;  $r = 0.01 - 0.09$ ). However, litter size was significantly and positively correlated with parity ( $P<0.01$ ;  $r=0.49$ ).

## DISCUSSION

The litter size in this study ranged from 1 to 4 with the mean of 1.7, this is comparable to the litter size ranged of 1 to 4 with a mean of 1.847 earlier reported by Amoah et al. (1996) but higher than the litter size of 1 to 3 reported by Amoah and Gelaye (1990). The obtained average number of kids per goat in this study (1.7) was in

**Table 4.** Distribution of does in relation to parity and litter size.

Parity	Litter size				Total
	1	2	3	4	
1	21	4	2	0	27
2	17	14	1	0	32
3	8	13	6	0	27
4	4	11	3	0	18
5	1	3	4	0	8
6	0	2	0	1	3
8	0	0	0	1	1

**Table 5.** correlated relationship between herd size, parity and litter size of doe.

Characteristics	Parity	Litter size
Herd size	0.09	0.01
Parity	-	0.49**

\*\*= P<0.01.

accordance with literature estimates for goats of different breeds; 1.85 kids (Amoah et al., 1996); 2.06 kids (Sodiq et al., 2003); 2.09 kids (Moaen-ud-Din et al., (2008); 1.96 kids (Činkulov et al., 2009) and increase of this average can be expected, considering that, of the total number of kidding included in the research 51% were first and second kidding. Although herd size ranged from 4 to 29 with the mean of 15.0 goats but majority of the farmers herd size was between 11 to 20 goats.

Litter size in this study showed a tendency to increase from first parity to fifth parity and a reduction in the sixth parity. This is comparable to the earlier observation of many authors (references). Sodiq et al. (2003) reported that the reproduction rate of Kacang and Peranakan Etawah does tended to increase with advance in parity up to the 4th parity and slightly decrease thereafter. Das (1993) working on meat goats in Malya, Tanzania reported that prolificacy tends to increase from first parity and decrease in the sixth parity. Also Wilson and Light (1986) and Awemu et al. (1994) reported that litter size increased with parity with the largest litter at the fifth parity on goat and sheep in Central Mali and on Red Sakoto goat in Nigeria, respectively. These observations indicates that the parity level in which doe's prolific ability reaches its peak is between the 4th and 5th parity, thus culling of does from the herd can starts beyond the 5<sup>th</sup> parity. It may be economically unwise to culled does at the early parities (except for ill-health) when the full genetic potential of their reproductive rate has not yet been fully expressed. It has been reported that the prolificacy of does tended to increase with advanced parity (Das, 1993; Awemu et al., 994; Amoah et al., 1996; Akpa et al., 2000; Sodiq et al., 2003).

Although incidence of quadruplets was rare (0.8) in this breed it was however observed that the incidence

occurred mostly on does of advanced parity. The increase in litter size with advance parity may be associated with the physiological maturity of the doe. Amoah et al. (1996) reported that lower prolificacy of primiporous does may be associated with an under developed state of the reproductive features required for successive litter bearing compared with those of multiparous does that have reached physiological maturity. It was observed that does giving birth to quadruplets continue to remain in the herd for a long time, this suggest that the smallholder farmers in the study area are conscious of retaining does that had high potential for multiple births in order to increase their herd size.

The most frequent litter size was singles (44.0%), with the next highest frequency being twins (40.5%), together accounting for 84.5% of births. This is in line with Akpa et al. (2000) but in contrast to the findings of Amoah et al. (1996) who reported that the most frequent litter size was twins (48.1%), with the next highest frequency being singles (34.6%), together accounting for 82.8% of births.

Multiple births were common in this study; 44% single, 40.5% twins, 14.7% triplets and 0.8% quadruplets (n=116). This is comparable with what was obtained at Shika, Zaria traditional system; 32.6% single, 58.8% twin, 7.2% triplet, 1.8% quadruplet (n=123). Also 56.1% single, 40.9% twin, 2.8% triplet, 0.1% quadruplet (n=1668) in Niger traditional system (FAO, 2009).

Although the farmers started culling the does after the 2nd parity, majority of the does were culled after the 4th parity. This is probably due to the fact that after the 4th parity the performance of the doe decreased, hence it may not be economical to keep these does beyond the 4th parity. The positive relationship of parity and litter size implies that prolificacy of this goat increased with parity. This is consistent with the report of some researchers.

Amoah and Gelaye (1990), Das (1993), Wilson and Light (1986), Awemu et al. (1994, 1999), Mtenga et al. (1994) and Husain et al. (1996). Therefore, to improve the prolificacy rate of this does, selection of does to be parents of next generation should be made on does of advanced parity when their genetic potential must have been fully expressed. This is evidence by the result of this study in which quadruplets were observed only on does of much latter parities.

## Conclusion

The goats used in this study are quite prolific and are significant producers of multiple births. The results presented seem to indicate that parity is an important factor in genetic evaluation of litter size in goats and reasonable size in litter could be achieved with good breeding plan and improved management programme.

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