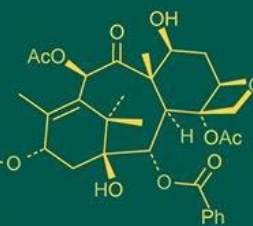
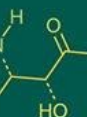
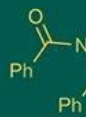


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A comparative udder biometry in singlet and twin kids bearing Surti goats

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Abstract

Udder biometry serves as a key indicator of mammary gland development and potential milk production in dairy goats. This study examines differences in udder morphological traits between singlet- and twin-bearing does, focusing on parameters such as udder length, width, depth, and circumference related measures during early lactation. Overall udder length (40.98 ± 1.65 vs. 33.74 ± 0.45 cm) and udder length on day of kidding (40.02 ± 1.42 vs. 31.97 ± 0.69 cm) was significantly ($p < 0.01$) higher in twin bearing as compared to singlet bearing group. Further research incorporating ultrasonographic assessments could refine these findings for practical application in goat husbandry.

Keywords: Udder biometry, mammary gland, singlet, twin kidding

1. Introduction

The mammary gland (udder) in goats is a specialized organ critical for milk synthesis and offspring nourishment. Udder morphology, including external biometry, influences milk yield, milking efficiency, and susceptibility to disorders such as mastitis (Peris *et al.*, 1999) [9]. Litter size at kidding affects mammary development due to variations in placental lactogen and other hormones that stimulate ductal and alveolar growth during gestation (Hayden *et al.*, 1980) [7].

Twin pregnancies impose greater physiological demands, potentially leading to enhanced udder expansion to support higher milk output required for multiple offspring (Lerias *et al.*, 2014) [8]. Previous investigations in breeds like Surti goats have indicated superior milk yields and certain udder measurements in twin-bearing does (Gamit *et al.*, 2019^a) [4]. Similarly, studies in Ethiopian pastoral goats have reported influences of birth type on udder circumference, width, and volume (Guyo & Tareke, 2025) [6].

2. Materials and Methods

The study was conducted at the Livestock Research Station, Navsari Agricultural University, Navsari. This unit is located at 20.95°N 72.93°E and at an elevation of 11.89 m above mean sea level. The climate of the area is tropical. The average maximum and minimum temperatures are 40°C (104°F) and 17°C (62.6°F) respectively. The average annual temperature is 27.1°C or 80.8°F . May month being the warmest has an average temperature of 31.1°C or 88.0°F . January has the lowest average temperature of 22.3°C or 72.1°F . The rainfall received is 1555mm or 61.2 inch per year.

The research was carried out on 16 Surti goats. The dams after parturition were grouped as singlet and twin kid bearing and each group had 8 does each. Shape of udder and udder biometry was recorded on the day of kidding (DOK), 30th and 60th day in goats. Udder length (UL), Udder width (UW) and Udder depth (UD) were recorded using measuring tape in cm. Data were compared between singlet (single kid) and twin-bearing does. The obtained data were first tabulated using descriptive statistics and analyzed by t-test and mean within the group was compared using Duncan multiple range test (DMRT).

3. Results and Discussion

3.1 Frequency of udder shape in dams

The frequency of shape of udder of singlet and twin kids bearing group have been presented in Table 1. Majority of the dam (75%) in singlet group had round udder while in twin group

it was 62.5%, 25% of dam in singlet group had bowl shaped udder while in twin group it was 37.5%. Shape of udder did not vary significantly with respect to singlet and twin kidding. Similar finding was also reported by Deshpande *et*

al. (2010) [2] while studying the morphometric characteristics of Surti goats, they reported 67.33% goats had round udder while 32.67% had bowl shaped udder.

Table 1: Percentage of udder shape in singlet and twin bearing dams

Parameters	Type of birth	Present	Absent	Chi-square	P-value
Round udder	Singlet bearing goats	6(75%)	2(25%)	0.290	0.589
	Twin bearing goats	5(62.5%)	3(37.5%)		
Bowl udder	Singlet bearing goats	2(25%)	6(75%)	0.290	0.589
	Twin bearing goats	3(37.5%)	5(62.5%)		

3.2 Frequency of teat shape in dams

The results of shape of teat of singlet and twin kids bearing dams have been presented in Table 2. The percentage of dam with conical teat in singlet and twin group was 62.5%

and 75% respectively while the percentage of cylindrical teat was 37.5% and 25% in singlet and twin bearing dams respectively. Shape of teat did not vary significantly with respect to singlet and twin kidding.

Table 2: Percentage of teat shape in singlet and twin kid bearing dams

Parameters	Type of birth	Present	Absent	Chi-square	P-value
Conical teat	Singlet bearing goats	5(62.5)	3(37.5%)	0.290	0.589
	Twin bearing goats	6(75%)	2(25%)		
Cylindrical teat	Singlet bearing goats	3(37.5%)	5(62.5)	0.290	0.589
	Twin bearing goats	2(25%)	6(75%)		

While studying the morphometric characteristics of Surti goats Deshpande *et al.* (2010) [2] observed 52.66% goats to have conical teat while 47.34% had cylindrical teats.

3.3 Biometry of udder length in dams

The results of Udder length after kidding have been presented in Table 3. The mean values of udder length in Singlet bearing group were 31.97±0.69, 33.45±0.53 and 35.80±0.45 while in twin bearing goat was 40.02±1.42, 42.67±1.26 and 40.26±4.77 on day of kidding, 30 day and 60 day after parturition respectively.

Table 3: Biometry of udder length in singlet & twin bearing dams

Day of observations	Singlet bearing goats	Twin bearing goats	P- value
Day of kidding	31.97±0.69	40.02±1.42	0.0001**
30 th day	33.45 ^a ±0.53	42.67±1.26	9.730
60 th day	35.80 ^b ±0.45	40.26±4.77	0.369
Overall	33.74±0.45	40.98±1.65	
F value	11.430**	0.245	

** Indicates significance at $P < 0.01$ across rows respectively and means bearing different superscript within column differ significantly (** $P < 0.01$).

The overall mean value of udder length was significantly ($p < 0.01$) higher in twin bearing group as compared to singlet bearing group of animals. The mean values of Udder length were significantly higher ($P < 0.01$) in twin bearing goats on 0 day of parturition as compared to singlet. In twin bearing goats mean of udder length was higher on 30th day and slightly decreases on 60th day of observation while in singlet bearing goats mean of udder length were showed increasing trend on 30th day as well as 60th days of observation. F-value of singlet bearing goat were highly significant ($p < 0.01$). While comparing within group Udder length was similar on day of kidding and 30th day. In singlet bearing goats moreover udder length was significantly ($p < 0.01$) higher on 60th day as compared to udder length of day of kidding and 30th day. In twin bearing group udder length not-varied significantly from day of kidding, 30th

and 60th day of observation. Gamit (2016) [3] reported that udder length (40.00±40.53 vs. 35.57±41.32) in twin bearing doe was significantly higher ($p < 0.05$) as compared to singlet bearing goats on 45 days of kidding.

3.4 Biometry of udder width

The results of Udder width after kidding have been presented in Table 4. The mean values of udder width in Singlet bearing group were 10.76±0.24, 10.92±0.53 and 11.07 ±0.19 on 0, 30 and 60 day after parturition respectively. The mean values of udder width in Twin group were 10.89±0.17, 11.00±0.16 and 11.09±0.14 on day of kidding, 30th and 60th day after parturition respectively.

Table 4: Biometry of udder width in in singlet & twin bearing dams

Day of observations	Singlet bearing goats	Twin bearing goats	P- value
Day of kidding	10.76±0.24	10.89±0.17	0.678
30 th day	10.92±0.53	11±0.16	0.804
60 th day	11.07±0.190	11.09±0.14	0.930
Overall	10.92±0.13	10.99±0.09	
F value	0.434	0.383	

The overall mean values of udder width were higher in twin bearing as compared to singlet bearing goat through did not differ significantly. Mean values of udder width were higher in twin as compared to singlet group on day of kidding, 30th and 60th days of kidding. Through the value not varied significantly on test day. F-value was not significant of both groups. Similar finding was reported by Gamit (2016) [3] that udder width in doe was higher in twin bearing goats as compared to singlet bearing dam. Though the difference was not significant.

3.5 Biometry of udder depth

The results of Udder depth after kidding have been presented in Table 5. The mean values of udder depth in Singlet bearing group were 33.15±0.33, 33.46±0.31 and 33.39±0.29cm on day of kidding, 30th and 60th day after

parturition respectively. The mean values of udder depth in Twin group were 33.20 ± 0.25 , 33.26 ± 0.26 and 33.43 ± 0.23 on day of kidding and 60 day of parturition respectively. On 30th day udder width was higher in singlet bearing as compared to twin bearing goat though the difference was not significant. The overall mean values of udder depth in dam did not differ significantly between singlet and twin group. The overall udder depth in singlet bearing goat was lower as compared to twin bearing goat. F-value was not significant in both groups.

Table 5: Biometry of udder depth in singlet & twin bearing dams

Day of observations	Singlet bearing goats	Twin bearing goats	P-value
Day of kidding	33.15 ± 0.33	33.20 ± 0.25	0.896
30 th day	33.46 ± 0.31	33.26 ± 0.26	0.643
60 th day	33.39 ± 0.29	33.43 ± 0.23	0.925
Overall	33.17 ± 0.17	33.30 ± 0.14	
F value	0.266	0.203	

3.6 Biometry of udder circumference

The results of Udder circumference after kidding have been presented in Table 6. The mean values of udder circumference in Singlet bearing group were 35.13 ± 0.33 , 35.32 ± 0.32 and 35.32 ± 0.32 cm on day of kidding, 30th day, and 60th day after parturition respectively. The mean values of udder circumference in twin group were 39.83 ± 0.43 , 40.63 ± 0.23 and 40.63 ± 0.23 on day of kidding, 30th day and 60th day after parturition respectively.

Table 6: Biometry of udder circumference in singlet & twin bearing dams

Day of observations	Singlet bearing goats	Twin bearing goats	P-value
Day of kidding	35.13 ± 0.339	39.83 ± 0.43	6.650
30 th day	35.32 ± 0.37	40.63 ± 0.23	1.070
60 th day	35.32 ± 0.37	40.63 ± 0.23	2.881
Overall	35.26 ± 0.20	40.36 ± 0.19	
F value	0.97	2.092	

The mean values of udder circumference in dam did not differ significantly between singlet and twin group, mean values of udder circumference were higher in twin as compared to singlet group on day of kidding, 30th day and 60th day of kidding. The overall udder circumference in singlet bearing dam was lower as compared to twin bearing dam though it was not significantly different.

Twin-bearing does generally display larger udder dimensions than singlet-bearing ones. In Surti goats, udder length was significantly higher in twin-bearing does at 45 days postpartum, suggesting accelerated mammary parenchyma development (Gamit *et al.*, 2019^b)^[5]. Udder circumference, width, and height showed non-significant differences but trended higher in twins.

In Ethiopian lowland goats, birth type significantly affected udder width (UW), circumference (UC), distance from ground (UDG), and volume (UV), with twins often exhibiting variations that correlated with daily milk yield (Guyo & Tareke, 2025)^[6]. For instance, twin-bearing does had UC values around 31.2 ± 0.5 cm and UV of 941.5 ± 2.4 cm³ in some cohorts, though specific singlet-twin contrasts varied by lactation stage and parity.

Teat traits (length, circumference) were less consistently influenced by litter size, with non-significant effects in many cases (Guyo & Tareke, 2025)^[6]. However, overall

udder volume and width positively correlated with milk production, underscoring biometry's predictive value.

Multiple fetuses increase placental mass and hormone secretion (e.g., placental lactogen), promoting greater mammary epithelial proliferation (Hayden *et al.*, 1980)^[7]. This results in larger alveolar networks capable of higher milk synthesis, explaining observed biometric advantages in twin-bearing does. In contrast, singlet pregnancies may limit such stimulation, leading to relatively smaller udders.

Higher udder measurements in twin-bearing goats align with elevated milk yields, particularly in early lactation (Gamit *et al.*, 2019^b)^[5]. Udder length and volume emerge as potential non-invasive markers for selecting high-producing does. Limitations include breed-specific variations and environmental influences (e.g., nutrition, parity).

4. Conclusion

Udder biometry reveals notable differences between singlet and twin-bearing goats, with twins often showing enhanced dimensions, especially length linked to lactational demands. These traits offer practical tools for predicting productivity and guiding selective breeding in goat dairy systems. Promoting twin kidding through genetics could indirectly support superior udder development and milk output.

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