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Effects of Parity on Udder and Teat Traits among Three Breeds of Cattle Raised Extensively in Nigeria

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Abstract

Selection of dairy cows traditionally among farmers using phenotypic traits is a major problem in the northern part of Nigeria. This work studied udder and teat traits of cows based on three parities (parity 1, 2 and 3). The knowledge of the relationship between the physical characteristics of the udder and teats with milk yield as selection indices would improve performance in dairy cattle. A total of 270 cows comprising 90 each of Sokoto Gudali, White Fulani and Red Bororo were used in this study. Each breed was further divided into 3 groups of thirty cows according to parity (Parity 1, 2, and 3). Udder traits measured were udder width (UW), udder length (UL) and udder depth (UD) while teat traits were front teat length (FTL), hind teat length (HTL), distance between front and hind teat (DBFHT), distance within front teat (DWFT), distance within hind teat (DWHT). Data obtained were subjected to analysis of variance and significant means were separated using the Duncan Multiple Range Test. The results showed that in Sokoto Gudali, Parity 2 and 3 were similar and significantly ($p<0.05$) superior in FTL (6.570.43cm and 6.710.42cm) and DBFHT (9.500.50cm and 9.280.47cm) respectively whereas parity 1 was significantly ($p<0.05$) low in FTL (5.330.32cm) and DBFHT (8.300.49cm). Parity 1 was significantly ($p<0.05$) low in HTL (5.250.31cm) and UD (42.900.54cm) whereas parity 3 was significantly ($p<0.05$) superior in HTL (7.070.60cm) and UD (49.140.34cm). In White Fulani cows, Parity 3 was significantly ($p<0.05$) higher in DWFT (9.900.37cm), UW (29.100.43cm) and UL (28.300.44cm). Parity 1 and parity 2 were statistically similar and significantly ($p<0.05$) lower in DWFT, UW and UL as 7.400.40cm and 8.100.27cm, 26.000.59cm and 27.000.49cm and 26.000.59cm and 26.800.41cm respectively. In Red Bororo cows, Parity 2 and Parity 3 were statistically similar and significantly ($p<0.05$) higher in FTL and HTL as 6.200.29cm 5.60030cm and 6.130.52cm and 5.500.43cm respectively whereas Parity 1 was significantly ($p<0.05$) lower in FTL (4.500.31cm) and HTL (4.00021cm). Parity 3 was significantly ($p<0.05$) superior in UW 27.630.03cm whereas Parity 1 was significantly ($p<0.05$) low in UW 23.800.47cm. The study discovered that Parity had a significant effect on udder and teat traits in all three breeds studied.

Keywords: Parity, Breed, Udder and Teat, Traits

1.0 Introduction

It is well known that livestock contributes to the livelihoods of human communities all over the world. In Eastern Africa and the majority of the world's rangelands, indigenous cattle in particular are the foundation of pertinent and sustainable livestock production. It makes sense that they are better evolved to endure and tolerate harsh surroundings than their exotic counterparts. (Hoffmann, 2010; Mwai et al., 2015).

Their genetic potential has been partially blamed for their low productivity (Najari et al. 2002), but udder conformation may also be a barrier to increasing milk output. In fact, it's crucial to assess an animal's morphology and mammary gland functionality in order to characterize it and maximize milk production (Capote et al. 2006).

Multiple genes are involved in milk production (a polygenic characteristic), and some of these genes may serve as indicators of better milk quantity and quality. Quantitative trait markers (QTM) can also be discovered in lactating animals with its assistance (Sudhir and Agastian, 2013). The amount of peptide and steroid hormones, as well as communication between units of life and unit of life foundational communications inside the gland, regulate udder development and milk protein inheritable factor appearance (Li et al., 2008). Udder is the first place that local brokers or animal husbandry experts in developing countries use to assess an animal's capacity to produce milk (Modh et al., 2017). Therefore, understanding the relationship between the physical characteristics of the udder and teats and milk supply is increasingly crucial (Modh et al., 2017).

The pattern of changes in metabolic hormones and metabolites after calving in dairy cows can be affected by parity. However, published results are uneven, especially in dairy research, where the majority of ruminant metabolic profile investigations have been carried out (Ruprechter et al., 2018). Individual cows' milk ability varies significantly depending on the breed (Oltenacu and Broom, 2010; Juozaitiene et al., 2016). It has been noted that parity and lactation stage affect milking effectiveness and, as a result, labor productivity (Miseikiene et al., 2014, Edward et al., 2014). For diverse breeds of animals, particularly cattle, structured data on udder and teat features are not accessible in Nigeria. Body measurements are phenotypic markers of the genetic makeup of an animal. Udder morphology traits are likely indicators of milk yield in dairy cattle; Bhuiyan et al., (2004) and Sam, (2012) explained that the size and shape of the udder are key conformation traits that could contribute to assessing a dairy animal’s suitability for commercial milk production and should be used in selection. Tilki et al. (2005), udder traits are significant for dairy cattle because milk yield is affected by the morphological properties of udder traits. It is more accurate to judge dairy cattle based on udder and teat characteristics. Therefore, the purpose of this study was to enlighten readers about the parity differences in udder and teat features across three breeds of cattle managed extensively in Nigeria.

2.0 Materials and Methods

2.1 Study Location

The study was conducted in Maiduguri, the capital of Nigeria's Borno State. Maiduguri is located between latitudes 110 32' and 110 4' North and longitudes 130 32' and 130 25' East and is within the semi-arid region. The mean annual rainfall is 200 – 250mm (Borno State Ministry of Land and Survey, 2016).

2.2 Animals and Management

A total of ninety (90) cows from the White Fulani, Red Bororo, and Sokoto Gudali made up the 270 cows total. Each breed of 90 cows was further separated into 3 groups (of 30 cows each) according to parities (Parities 1, 2 and 3). The animals were managed extensively and were permitted to graze throughout the day on natural grasslands in Northern Nigeria.

2.3 Measurement of traits

To reduce inter-person variation, all measurements were obtained before morning milking. The animals stood on level ground and the measurements were done with a graduated flexible tape. Below are the described procedures for the measurements as described by Patel et al. (2016).

- Udder Length: This was measured from the udder's rear attachment, which is close to the escutcheon, to its front attachment, which elegantly blends into the body.
- Udder width: This was calculated as the separation between the udder's two lateral lines of attachment to the abdominal wall, just below the flank. On one side of the cow, beneath the flank and close to the stifle joint, the measuring tape was left in place. On the opposite side, it was crossed over between the fore and near the teats.
- Udder depth: This was measured by dividing the distance from the barn floor to the base of the udder by the distance from the barn floor to the udder floor.
- Teat length: measured as the length of the teat from the point at where it hangs perpendicular to the quarter to the tip.
- Front teat length: This was measured as the distance of the front teat tip base of attachment to the udder
- Hind teat length: This was measured as the distance of the hind teat tip base of attachment to the udder
- Distance within the front teat: This was measured as the distance between the two front teats of the udder
- Distance within hind teat: This was measured as the distance between the two hind teats of the udder
- Distance between front and hind teat: This was measured as the distance between the front and hind teat of the udder

The animals were appropriately restrained in a standing position on a level ground floor before all measurements were collected early in the morning before morning milking for precision. A flexible tape in centimeters was used to measure all the udder traits.

2.4 Statistical Analysis

All the data generated from the study were analyzed by analysis of variance using a program (SAS, 2000). Significant means were separated by Duncan's Multiple Range Test. The below model was used for the study.

$Yij = \mu + Pj + eij$……Equation 2.1

Where:
Yijk=observed value of the ijth of the breeds
μ = is the overall mean
Pj = fixed effect of parity (jth=1, 2 and 3) and
eij=residual error associated with each animal record.

3.0 Results and Discussion

3.1 Effect of Parity on Udder and Teat Traits of Sokoto Gudali

The parity differences in the udder and teat traits of Sokoto Gudali are presented in Table 3.1. The results showed significant ($p<0.05$) differences in front teat length (FTL), hind teat length (HTL), distance between front and hind teat (DBFHT), the distance within the front teat (DWFT), distance within hind teat (DWHT) and udder depth (UD) in three parities of Sokoto Gudali. Parity 2 and Parity 3 were similar and significantly ($p<0.05$) superior in FTL (6.75± 43 and 6.71± 42cm) and DBFHT (9.50±0.50 and 9.28±0.47cm) respectively whereas parity 1 was significantly ($p<0.05$) lower in FTL (5.33±0.32cm) and DBFHT (8.30±0.49cm). Parity 1 was significantly ($p<0.05$) lower in HTL (5.25±0.31cm) and UD (42.90±0.54cm) while parity 3 was significantly ($p<0.05$) superior in HTL (7.07±0.60cm) and UD (49.14±0.34) cm. Parity 2 was significantly ($p<0.05$) superior in DWFT (12.00±0.13cm) and DWHT (8.80±0.40cm) whereas parity 3 was significantly ($p<0.05$) low in DWFT (8.14±0.34cm). Parity 1 and Parity 3 were significantly ($p<0.05$) similar and low in DWHT at 7.35±0.29cm and 7.14±0.40cm respectively. The ranged value of FTL 5.33±0.32 – 6.71±0.42cm obtained in this study agreed with those who recorded 5.84 – 6.52cm (Petal et al., 2016).

The value for UD in this study ranged from 42.90 – 49.14cm and were lower than the 4.92cm – 5.94cm reported by Petal et al., (2016). Because higher parity was associated with increased milk yield and the maturation of biological organs for enhanced milk production, the differences in udder and teat characteristics between the parities in this study were caused by the physiological stages of the animals. In this study, FTL and DBFHT increased from parity 1 to parity 2 and then became static up to parity 3. This result was consistent with the findings of Modh et al. (2017), who suggested that there was increased drift in the length of udder features from the first to second parity at a rate of 24.3% and 9.7%, respectively. The length of the udder then became static up to the fourth parity then grew by 15.16% from the fourth parity (Petal et al., 2016). Udder depth in in this study increased with an increase in parity (from 1, 2 and 3). This might be explained by the rise in parity rates. This was in agreement with two reports that claimed multiparous cows had a much higher amount of udder than primiparous cows (Ghosh et al., 1998; Prasad et al., 2010).

Table 3.1: Effect of Parity on Udder Measurement of Sokoto Gudali Cattle

	Parities		
Traits (cm)	1	2	3
Front teat length	5.33±0.32[b]	6.75±0.43[a]	6.71±0.42[a]
Hind teat length	5.25±0.31[b]	6.60±0.41[a]	7.07±0.60[a]
Distance between front teat and hind teat	8.30±0.49	9.50±0.50	9.28±0.47
Distance within the front teat	9.50±0.96[ab]	12.00±0.13[a]	8.14±0.34[b]
Distance within the hind teat	7.35±0.29[b]	8.80±0.40[a]	7.14±0.40[b]
Udder width	34.30±0.87	31.30±0.60	35.28±0.86
Udder length	33.00±0.37	33.90±0.89	33.57±0.81
Udder depth	42.90±0.54[c]	44.90±0.48[a]	49.14±0.34[c]

abc means in the same row with different superscripts are significantly different (P<0.05). ± standard deviation

3.2 Effect of Parity on Udder and Teat Traits on White Fulani

The parity differences on udder and teat traits of White Fulani are presented in Table 3.2. The results showed significant (p<0.05) difference in DWFT, UW and UL in three parities of White Fulani cows. Parity 3 was significantly (p<0.05) higher in DWFT (9.90±0.37cm), UW (29.10±0.43cm) and UL (28.30±0.44cm). Parity 1 and parity 2 were statistically similar and significantly (p<0.05) lower in DWFT, UW and UL. The ranged value of UW 26.00±0.59 – 29.10±0.43cm obtained in this study was lower than 55.60±0.09 – 73.50±1.30cm for UW in Vrindavani cows (Singh *et al*., 2010). The results showed that parity 1 and 2 were statistically similar whereas parity 3 was significantly (p<0.05) superior in DWFT, UW and UL which increased from parity 1 and 2 to parity 3. The finding of this research concurred with the report of Zwertvaeghen *et al*. (2012) who reported that with parity, the udder and depth grew. Liberal udder hypertrophy in relation to the cow's age and parity can help to clarify this (Abdou *et al*., 2012). However, this finding is conflicting the report of Maria *et al*. (2001) who opined that teats morphology did not vary with parity in Egyptian Buffalo cows. The variations in the udder and teat differences could be due to species.

Table 3.2: Effect of parities on udder and teat traits of White Fulani cows

	Parities		
Traits (cm)	1	2	3
Front teat length	5.60±0.33	5.30±0.21	5.80±0.33
Hind teat length	4.55±0.25	4.40±0.14	4.60±0.27
Distance between front teat and hind teat	7.30±0.39	7.00±0.26	7.80±0.42
Distance within the front teat	7.40±0.40[b]	8.10±0.27[b]	9.90±0.37[a]
Distance within the hind teat	6.80±0.32	7.05±0.21	7.40±0.22
Udder width	26.00±0.59[b]	27.00±0.49[b]	29.10±0.43[a]
Udder length	26.00±0.59[b]	26.80±0.41[b]	28.30±0.44[a]
Udder depth	39.00±0.29	39.10±0.69	40.00±0.67

[abc] *"Means in the same row with different superscripts are significantly different* (P<0.05), *cm=centimeter,* ± standard deviation

3.3 Effect of Parity on Udder and Teat Traits of Red Bororo

The parity differences on udder and teat traits of Red Bororo are presented in Table 3.3. The results showed significant ($p<0.05$) differences in FTL, HTL, DBFHT, DWFT, UW and UD in three parities of Red Bororo cows. Parity 2 and parity 3 were statistically similar and significantly ($p<0.05$) higher in FTL and HTL as 6.20 ± 0.29cm and 5.60 ± 0.30cm and 6.13 ± 0.52cm and 5.50 ± 0.43cm respectively whereas parity 1 was significantly ($p<0.05$) lower in FTL 4.50 ± 0.31cm and HTL 4.00 ± 021cm. Parity 2 was significantly ($p<0.05$) superior in DBFHT whereas parity 1 was significantly ($p<0.05$) lower in DBFHT (6.60 ± 0.37cm). Parity 1 was significantly ($p<0.05$) superior in DWFT 8.85 ± 0.36cm and UD 43.70 ± 0.24cm whereas Parity 2 and 3 were similar and significantly ($p<0.05$) lower in DWFT (7.75 ± 0.36cm and 7.50 ± 0.37cm) and UD (38.80 ± 0.89cm and 40.00 ± 0.13cm respectively. Parity 3 was significantly ($p<0.05$) superior in UW (27.63 ± 0.03cm) whereas parity 1 was significantly ($p<0.05$) low in UW (23.80 ± 0.47cm). The ranged values for FTL and HTL in this study were 4.50±0.31- 6.20±0.29cm and 4.00±0.21 - 5.60±0.30cm respectively and was similar with 5.84 – 6.52cm for FTL but higher than 4.92 – 5.94cm for HTL in crossbred cows (Petal *et al*., 2016). The results in this study agreed with the reports of Kuczaj (2003) and Singh *et al*. (2010) who stated that front teat length increased with the advancement in parity. In this study UD and DWFT tend to decrease with increased parity. FTL and HTL increased from parity 1 to parity 2 and become static in parity 3. This agreed with the report of Modh *et al*. (2017) who opined that from first to second parity, the udder's length and rate of drift increased before becoming static. The variations in parities could be a factor for determining milk yield. This agreed with (Dauda, 2021) which observed the higher the udder characteristics the better the animal in terms of milk yield.

Table 3.3: Effect of Parity on Udder and Teat Traits of Red Bororo Cattle

	Parities		
Traits (cm)	1	2	3
Front teat length	4.50 ± 0.31^{b}	6.20 ± 0.29^{a}	6.13 ± 0.52^{a}
Hind teat length	4.00 ± 0.21^{b}	5.60 ± 0.30^{a}	5.50 ± 0.43^{a}
Distance Between front teat and hind teat	6.60 ± 0.37^{b}	8.20 ± 0.20^{a}	7.00 ± 0.42^{b}
Distance within the front teat	8.85 ± 0.36^{a}	7.75 ± 0.13^{b}	7.50 ± 0.37^{b}
Distance within the hind teat	8.05±0.36	7.80±0.20	7.63±0.32
Udder width	23.80 ± 0.47^{b}	26.60 ± 0.87^{ab}	27.63 ± 0.03^{a}
Udder length	27.75±0.14	26.90±0.91	27.13±0.52
Udder depth	43.70 ± 0.24^{a}	38.80 ± 0.89^{b}	40.00 ± 0.13^{b}

abc means in the same row with different superscripts are significantly different ($P<0.05$), ± standard deviation

4.0 Conclusion

Parity had a significant effect on the udder and teat measurement of the three breed of cattle. In Sokoto Gudali FTL, HTL increased with increased in parity. With White Fulani, DWFTL, DWHTL, UW and UL increased with increased parity. With Red Bororo, FTL, HTL, DWFHT, UD also increased with increase in parity. The increase in parity which led to increase in udder and teat traits is an indication that could be a marker for dairy selection. Variations in udder and teat traits within breed will help dairy farmers to know when the udder is static and well developed.

References

Abdou, H., Marichatou, H., Beckers, J. F., Dufrasne, I. and Hornick, J.L. (2012). Physiology of reproduction and chemical composition of colostrum of domestic mammals. *Annal of Médicine and Véterinary*, 156:87–98.

Bhuiyan, M. M., Islam, M. R., Ali, M. L., Hossain, M. K., Kadir, M.A., Lucky, N.S. and Das, B. R. (2004) Importance of Mammary System Conformation Traits in Selecting Dairy Cows on Milk Yield in Bangladesh J*ournal of Biological Sciences* , *4*:100–102

Borno State Ministry of Land and Survey, (BMLS) (2016). Annual Report 15-58

Capote J., Arguello A., Castro N., Lopez J. L. and Caja G. (2006). Short communication: Correlations between udder morphology, milk yield and milking ability with different milking frequencies in dairy goats. *Journal Dairy Sci*ence, 89**:**2076-2079.

Dauda, A. (2021). Expression of Diacyl glycerol acyl transferase 1 (DGAT1) and alpha casein s1 (CSN1S1) genes in three breeds of cattle under extensive system in Nigeria. Ph.D Dissertation submitted to the University of Calabar Pp 270

Edward, J. P., Lopez-Villalobos, N. and Jago, J. (2014). Milk flow profiles with an intermediate bimodality score are more efficient for milk harvesting. Proceedings of the 5th Australasian Dairy Science Symposium. pp. 350–52. 19–21 November. Hamilton, New Zealand

Ghosh, B. & Prasad, J. (1998). Milk yield and composition as influenced by udder measurements, in Jersey × Red Sindhi crosses. *Indian Journal of Animal Production and Management*, 14(1):23-25.

Hoffmann, I. (2010). Livestock biodiversity. *Revue scientique et technique*, 29(1): 73-78

Juozaitiene, V., Anskiene, L., Japertiene, R., Juozaitis, A., Stankevicius, R., Cernauskiene, J., Zymantiene, J. and Zilaitis, V. (2016). Dependence of dairy cows milkability traits on genotype. *VeterinariaIr Zootechnika*, 73(95): 32–36.

Kuczaj, M. (2003). Analysis of changes in udder size of high-yielding cows in subsequent lactations with regards to mastitis. *Electronic Journal of Polish Agricultural Universities Animal Husbandry*, 6(1):1-8.

Li, R., Li, Y., Kristiansen, K. and Wang, J. (2008) SOAP: short oligonucleotide alignment program. *Bioinformatics*, 24: 713–714.

Marai, I. F. M., Farghaly, H. M., Nasr, A. A., Abou-Fandoud, E. I. and Mohamed, I. A. S. (2001). Buffalo cow productive, reproductive and udder traits and stay ability under sub-tropical environmental conditions of Egypt. *Journal of Agriculture and Tropical and Subtropical*, 102:1–14.

Miseikiene, R., Ivaskiene, M., Tusas, S., Kerziene, S. and Gerulis. G. (2014). Evaluation of cows milking process in herringbone and rotary milking parlours.*Veterinary Medicine and Zootechnics*, 65(87): 44–46.

Modh, R. H., Islam, M. M., Patel, Y. G., Modi, R. J and Wadhwani, K. N. (2017). Effect of Parity on Udder and Teat Biometry and its Association with Milk Yield in Gir Cows. *International Journal of Science, Environment and Technology*, 6(3): 2068 – 2073.

Mwai, O., Hanotte, O., Kwo, Y. J. and Cho, S. (2015). African Indigenous cattle: Unique genetic resources in a rapidly changing world. *Asian-Australian Journal of Animal Science*, 28(7): 911-921

Najari S., Ben hamouda M. and Khaldi G. (2002). Expression of the kid's genotypes in arid regions conditions. Pp. 401-404 in World Congress. Genetics of Application of Livestock Poduction, Montpellier, France.

Oltenacu, P. A. and Broom, D. M. (2010).The impact of genetic selection for increased milk yield on the welfare of dairy cows. *Animal Welfare*, 19: 39–49.

Patel, Y. G., Trivedi, M. M., Rajpura, R. M., Savaliya, F. P. and Parmar, M. (2016). Udder and teat measurements and their relation with milk production in crossbred cows. *International Journal of Science, Environment and Technology*, 5(5): 3048 – 3054.

Prasad, R. M. V., Raghava Rao, E., Sudhakar, K., Gupta, R. B. & Mahender, M. (2010). Studies on udder and teat measurements as affected by parity and their relationship with milk yield in Murrah buffaloes. *Buffalo Bulletin*, 29(3):194-198.

Ruprechter G, de Adrien ML, Larriestra A, Meotti O, Batista C, Meikle A. (2018). Metabolic predictors of peri-partum diseases and their association with parity in dairy cows. *Reserved Veterinary Science*, 118:191–8.

Sam, I. M. (2012). Relationship of Haemoglobin and Potassium Polymorphism with Conformation, milk production and blood biochemical profiles in Agropastoral Goats. Ph.D Thesis, Ahmadu Bello

Singh, R. R., Triveni, D., Singh, M. and Kumar, A. (2010).Association of udder and teat dimensions with production traits in Vrindavani cattle. *Indian Journal of Dairy Science*, 63(6):455-458

Sudhir, V and Agastian, P. (2013). Expression Profile of Important Milk Producing Genes in Cattle Breeds from India. *International Journal of Advanced Biotechnology and Research, 4(1): 976-980.*

Tilki, M., Inal, S., Colak, M. and Garip, M. (2005). Relationships Between Milk Yield andudder Measurements in Brown Swiss Cows. *Turkish Journal of Veterinary and Animal Science,29*(1): 75- 81
University Zaria.

Zwertvaeghen, I., Van, W. S., Piepers, S., Baert, J. and De Vliegher, S. (2012). Variance components of teat dimensions in dairy cows and associated factors. *Journal of Dairy Science*, 95:4978–4988