RESEARCH ARTICLE

Influence of Parity on Milk Production and Composition, Udder Morphology and Resumption of Ovarian Cyclicity in Postpartum Surti Buffaloes (*Bubalus bubalis*)

Karpenahalli Ranganatha Sriranga[1]*, Thakur Krishna Shankar Rao[2], Kallambella Ramakrishnegowda Harini[3], Rana Ranjeet Singh[4], Navin Babulal Patel[5]

Abstract

The objective of the present study was to investigate the influence of parity on milk yield, udder biometry and health, and ovarian cyclicity in postpartum Surti buffaloes. Based on parity, fourteen Surti buffaloes were grouped as primiparous and multiparous. Milk yield was recorded on daily basis (up to 80 days) and milk samples were collected on the day of calving, 7th, 15th, 30th, 45th, 60th and 80th day post- calving for composition analysis and somatic cell count (SCC). Serum progesterone level was assayed on 0th, 15th, 30th and 60th day of calving. Higher milk yield was observed in multiparous animals, consistent with the higher udder biometrical parameters as compared to primiparous animals. Parity did not affect significantly the milk composition (milk protein, lactose and SNF), except for milk fat and total solids. Serum progesterone concentration was not influenced by parity. Overall SCC was higher in primiparous animals along with delayed initiation of ovarian cyclicity. From this study it could be conferred that parity significantly affects the milk productivity and reproductive performance in postpartum Surti buffaloes. Therefore, multiparous buffalo could be selected on farmer's door step keeping in view its production, better udder health and fast resumption of ovarian cyclicity.

Key words: Ovarian cyclicity, Parity, Surti buffalo, Udder biometry, Udder health.

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Introduction

Buffaloes are popularly called as "Black Gold" of Asia owing to their versatile qualities and immense economic values. Presently, India is the largest milk producer in the world accounting for 209.96 million tonnes (Annual report-DAHD, 2020-21). Buffaloes contribute to 45% of the total milk production in India and became the first choice of milch animals at the farmers doorstep. The success of dairy industry depends mainly on the quantity and quality of milk production. Parity of the animal is one among several factors that affect milk production in dairy animals. Udder size is positively correlated with milk yield (Mingoas *et al*., 2017) and is affected by the parity of the animal.

Somatic cell count (SCC) is primarily used to assess udder health and is a key component of international and national regulations for milk quality (Sharma *et al*., 2011). SCC in buffalo milk varies with many factors such as breed, parity, calving age, stage of lactation, season, stress, and milking interval along with environmental and managemental practices. The resumption of ovarian cyclicity after parturition is an important physiological activity that determines reproductive efficiency. The primiparous animals were observed to take a longer period for the first service as compared to multiparous animals owing to their greater negative energy balance. (Folnozic *et al*., 2016). There is a paucity of information regarding the influence of parity on milk yield, composition and their relationship with udder health, biometry, and also ovarian cyclicity in buffaloes. Therefore, the present study was designed to assess these aspects in postpartum Surti buffaloes (*Bubalus bubalis*).

[1-4]Department of Livestock Production Management, Vanbandhu College of Veterinary Science &Animal Husbandry, Kamdhenu University, Navsari, Gujarat - 396450, India

[5]Livestock Research Station, Navsari Agricultural University, Navsari, Gujarat - 396450, India

Corresponding Author: Karpenahalli Ranganatha Sriranga, Department of Livestock Production Management, Vanbandhu College of Veterinary Science & Animal Husbandry, Kamdhenu University, Navsari, Gujarat - 396450, India, Ph no. +91 9909139621, E-mail: srirangabvsc@gmail.com

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Materials and Methods

The present study was conducted following IAEC approval at Livestock Research Station, Navsari Agricultural University, Navsari which is located at 20° 51´ 0" North latitude and 72°

55´ 0" East longitude at an elevation of 11.89 meters above mean sea level. For this study, fourteen postpartum Surti buffaloes were considered and grouped as primiparous and multiparous (from 2nd to 5th lactation). Similar management practices were followed for all the animals under study. The animals were milked twice, *i.e.,* during morning and evening h. Milk yield of individual buffalo was recorded daily, *i.e.,* morning and evening, throughout the experiment (up to 80 days) by electronic weighing balance and milk samples were collected on the day of calving, and on day 7th, 15th, 30th, 45th, 60th and 80th post-calving. Milk composition such as milk fat, solid not fat, milk protein, lactose and total solids were tested using Milkoscan milk analyser. The somatic cell count (SCC) was determined manually under oil immersion lens of the microscope as per the standard protocol (Schalm *et al*., 1971).

Udder biometry was recorded from the day of parturition up to 2 months postpartum at monthly interval after milking with the help of measuring tape. Udder length, width, depth and circumference were measured. Shapes of udder (Bowl, Globular, Goaty and Pendulous) and shapes of teat (Conical, Bottle, Pear, Cylindrical and Funnel) were observed and noted down at once during the course of experiment as per the score card given by Prasad *et al*. (2010).

Serum progesterone concentration was measured by standard Enzyme Linked Immuno Sorbent Assay (ELISA) technique using assay kit (Calbiotech, Inc. California) based on the principle of solid phase competitive ELISA and values were expressed as ng/mL. The data was analyzed using t-test for investigating the effect of parity on different traits under consideration. The obtained means were compared using DMRT as per standard statistical procedures (Snedecor and Cochran, 1994).

Results and Discussion

Milk Yield and Composition

In the present study, total milk yield up to the end of experiment (80 days postpartum) was significantly higher ($p<0.01$) in multiparous buffaloes (294.23±17.77 kg) as compared to primiparous buffaloes (204.8±15.14 kg). The average milk yield (kg/day) calculated for 80 days postpartum was also found to be higher ($p<0.01$) in multiparous animals (3.68±0.22 *vs* 2.56±0.19 kg). Similar findings were reported by Abdel-Raouf *et al*. (2011) and Yadav *et al*. (2013). The initial milk yield and predicted total lactation milk yield were higher in multiparous animals as they possess better nutrient digestibility, attain peak yield at the earliest and maintain peak for longer duration as compared to primiparous animals (Marumo *et al*., 2022) which might be the possible reason for improved milk productivity.

Overall milk fat (%) and total solids (%) were higher ($p<0.05$) in multiparous than in primiparous animals (Table 1). Similarly, Pawar *et al.* (2012) reported a significant ($p<0.05$) effect of parity on milk fat with no consistent increase in milk fat over the advancement of parities. On the contrary, Sundaram and Harharan (2013) reported higher ($p<0.01$) milk fat (%) and total solids content in first lactation as compared to other parities. Yadav *et al.* (2013) reported that parity does not have a significant effect on milk fat in buffaloes.

Milk protein, lactose, and SNF (%) did not vary significantly between primiparous and multiparous animals (Table 1). Similar to present observations, Yadav *et al*. (2013) also reported that parity does not affect the milk protein in Murrah buffaloes. Contrarily, Delfino *et al.* (2021) reported higher milk protein, fat, and non-fat dry extract in multiparous animals owing to their higher capacity to adapt to metabolic changes and rapid recovery from negative energy balance.

Table 1: Effect of parity on milk composition in postpartum Surti buffaloes

Milk composition	Primiparous (n=7)	Multiparous (n=7)	t-value
Milk fat (%)	5.56±0.17	6.08±0.71	2.326*
Solids not fat (%)	10.30±0.09	10.30±0.20	0.100
Milk protein (%)	4.32±0.09	4.47±0.08	1.207
Lactose (%)	4.81±0.04	4.78±0.04	0.759
Total solids (%)	16.10±0.23	16.82±0.15	2.602*

0*indicates significance at $p<0.05$ within the rows.

Somatic Cell Count (Lakhs/mL)

Milk somatic cells include various types of white blood cells and epithelial cells. An increase in SCC is regarded as the primary indicator of inflammation of the mammary gland. In the present study, overall mean SCC was higher ($p<0.01$) in primiparous animals (1.87 ± 0.06 lakhs/mL) as compared to multiparous animals (1.63 ± 0.07 lakhs/mL). The higher SCC in first parity may be resulted from active defence mechanisms against mammary infection in earlier parities. Udder defence mechanism is highly developed in primiparous animals. Contrarily, Bombade *et al.* (2018) and Sabek *et al*. (2021) reported lower SCC in primiparous as compared to multiparous animals. The high milk yield in multiparous animals acts as predisposing factor to intra-mammary infection and with increase in parity animal's ability to combat udder infection decreases. The SCC was high on the day of calving and decreased thereafter till 60 day postpartum both in primiparous and multiparous animals (Fig. 1). Similarly, Sahin *et al.* (2017) reported higher SCC in early lactation and lower SCC during mid-lactation.

Udder Biometry

The mean udder length, width, depth and circumference were significantly higher ($p<0.01$) in multiparous as compared to primiparous animals (Table 2). The udder biometrical values observed in the present study were slightly lower as compared to the results reported by Prasad *et al.* (2010) and Badekar (2016) in Murrah buffaloes. The possible reason may be the breed variation in udder biometry of buffaloes along with variation in milk production between breeds.

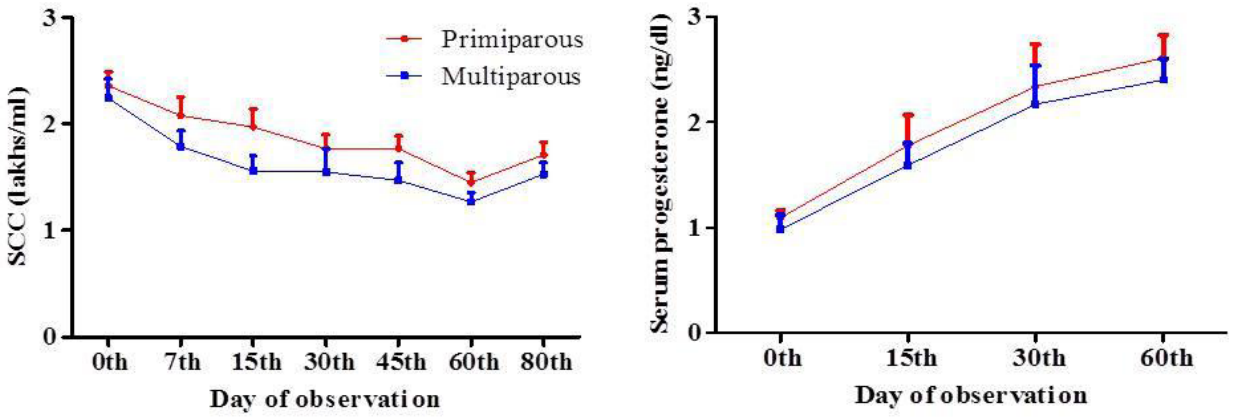

Fig. 1. Milk SCC (lakhs/ml) and serum progesterone concentration (ng/dl) on different test days of observation in primiparous and multiparous Surti buffaloes

Udder and Teat Shapes

In the present study, overall 57.1% animals had bowl shaped, 28.6% globular and 14.3% pendulous shaped udder (Table 3). However, none of the animals under study had goaty udder. Bowl shaped udder was predominant among Surti buffaloes. Possible reason for the absence of goaty udder might be due to lesser number of observations under study. Similar to present findings, Prasad *et al.* (2010) reported 61% of bowl shaped udder followed by globular (17%), pendulous (13%) and goaty udders (9%). Predominance of bowl shaped udder was reported by Badekar (2016) in Murrah buffaloes, which is in corroboration with the present findings.

In the present study, highest per cent (50%) of cylindrical teats were observed followed by pear, funnel, conical and bottle shaped teats (Table 3). Cylindrical shaped teats were more predominant among Surti buffaloes. Similar findings were reported by Prasad *et al.* (2010) and Badekar (2016).

Table 2: Effect of parity on udder biometry in postpartum Surti buffaloes

Parameter	Days of observation	Primiparous (n=7)	Multiparous (n=7)	t-value
Udder length (cm)	0^{th}	24.43^{a}±0.65	41.14^{a}±1.50	10.209**
	30^{th}	30.86^{b}±0.59	46.86^{b}±1.26	11.471**
	60^{th}	29.57^{b}±0.48	43.86^{ab}±1.26	10.580**
Udder width (cm)	0^{th}	21.86^{a}±0.88	37.43±1.59	8.573**
	30^{th}	28.00^{b}±0.82	42.57±1.36	9.185**
	60^{th}	26.71^{b}±0.92	40.71±1.27	8.946**
Udder depth (cm)	0^{th}	9.43^{a}±0.48	12.43^{a}±0.69	3.584**
	30^{th}	11.57^{b}±0.20	15.00^{b}±0.62	5.279**
	60^{th}	10.57^{b}±0.30	13.71^{ab}±0.42	6.102**
Udder circumference (cm)	0^{th}	54.29^{a}±0.87	67.14±2.60	4.685**
	30^{th}	60.00^{b}±0.79	72.71±2.41	5.020**
	60^{th}	57.86^{b}±0.67	69.57±2.30	4.895**

**indicates significance at p<0.01, within the row.

Means bearing different superscripts within column differ significantly (p<0.05) for a character

Table 3: Effect of parity on shapes of udder and teat in postpartum Surti buffaloes

Type of udder/ Teat	Primiparous (n=7)		Multiparous (n=7)		Overall (n=14)	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Type/Shape of udder						
Bowl	5	71.4	3	42.9	8	57.1
Globular	2	28.6	2	28.6	4	28.6
Goaty	0	0.0	0	0.0	0	0.0
Pendulous	0	0.0	2	28.6	2	14.3
Type/Shape of teat						
Conical	1	14.3	0	0.0	1	7.1
Bottle	0	0.0	1	14.3	1	7.1
Pear	2	28.6	1	14.3	3	21.4
Cylindrical	4	57.1	3	42.9	7	50.0
Funnel	0	0.0	2	28.6	2	14.3

Table 4: Effect of parity on resumption of ovarian cyclicity and reproductive performance in postpartum Surti buffaloes

Reproductive performance	Primiparous (n=7)	Multiparous (n=7)	t-value	P-value
First estrus after calving (days)	48.14±2.27	30.43±1.89	6.00**	0.00
Service period (days)	119.86±24.26	68.29±6.51	2.05	0.06
Inter-calving period (days)	431.86±24.69	375.86±7.52	2.17*	0.05

* and ** indicates significance at p<0.05 and p<0.01, within the row.

Progesterone

Serum progesterone concentration reflects the activity of corpus luteum (CL) on the ovary. Serum progesterone levels did not differ significantly between primiparous (1.96±0.17 ng/dL) and multiparous animals (1.79±0.16 ng/dL). However, minimum progesterone concentration was observed on the day of calving and increased thereafter towards the end of experiment (Fig. 1). These results are in agreement with the observations reported by Kalasariya *et al*. (2017). The higher level of serum progesterone was observed on 30 and 60 day postpartum as compared to the day of calving which might be due to the presence of CL followed by postpartum ovulations.

Resumption of Ovarian Cyclicity

In the present study, the initiation of cyclical activity of the gonads was delayed in primiparous as compared to multiparous animals, which is consistent with longer service period and inter-calving period (Table 4). Primiparous animals were more susceptible for metabolic stress and imbalance in endocrinal profile (Folnozic *et al*., 2016); delay in involution of uterus (Zhang *et al*., 2010) and lower IGF-1 (Meikle *et al*., 2004) as compared to multiparous counterparts, which may collectively delay the initiation of postpartum ovarian cyclicity.

Conclusions

The production performance of multiparous Surti buffaloes was superior to primiparous animals with respect to milk yield, composition and udder health. Udder biometry was also influenced by the parity of animals. Serum progesterone was not affected by the parity, but significant difference with the test days was noticed. Early resumption of ovarian cyclicity was observed in multiparous animals indicative of better reproductive performance as compared to primiparous animals. The result suggests preferential rearing of multiparous buffaloes at farmer's doorstep keeping in view its production, udder health and resurgence of ovarian cyclicity.

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