Haryana Vet. (June, 2022) **61(1),** 18-21

Research Article

SOMATIC CELL COUNTS IN MILK OF MURRAH, SURTI AND NILI-RAVI BUFFALOES AND ITS RELATION WITH MILK YIELD AND COMPOSITION UNDER FIELD CONDITION

M.P. VERMA[1]* and SHIV PRASAD KIMOTHI[2]
[1]Assistant Professor, Department of Animal Production, College of Agriculture (AU, Jodhpur), Sumerpur, Pali-306902, Rajasthan, INDIA
[2]Principal Scientist and ADG, Coordination unit, ICAR, New Delhi- 110 001, INDIA

Received: 23.04.2021; Accepted: 07.07.2021

ABSTRACT

A study was conducted on 750 healthy buffaloes belonging to Murrah, Surti and Nili-Ravi breeds under field condition to find out the normal values of somatic cell counts (SCC) in milk with respect to breed, stage of lactation, parity, season, level of production and milking practices with milk yield and composition was determined using correlation coefficient. The overall mean values of SCC in field buffaloes is 0.896 $\times 10^5$ cells/ml of milk. The SCC in Murrah, Surti and Nili-Ravi breeds averaged (1.003, 0.798 and 0.888) $\times 10^5$ cells/ml of milk, respectively. The values of SCC in all three breeds were significantly ($P<0.01$) differed. The SCC was significantly ($P<0.01$) affected by stage of lactation and season of the year. The parity, level of milk production and milking practices has significantly ($P<0.05$) effect on SCC. The higher somatic cell counts were observed in knuckling (0.923 $\times 10^5$ cells/ml) as compared to full hand (0.869 $\times 10^5$ cells/ml) milking methods. The milk SCC was significant ($P<0.01$) but negatively correlated with fat, protein and SNF content of milk. In subclinical mastitis negative buffaloes SCC increased from 0.50 to >1.50 $\times 10^5$ cells/ml of milk, losses in milk yield (9.67%) as well as fat (16.00%), protein (4.88%) and SNF (4.37%) contents.

Keywords: Buffalo, Breed, Field, Milk, Milking practices, Parity, Somatic cell counts

How to cite: Verma, M.P. and Kimothi, S.P. (2022). Somatic cell counts in milk of Murrah, Surti and Nili-Ravi buffaloes and its relation with milk yield and composition under field condition. *Haryana Vet.* **61(1)**: 18-21.

The somatic cell counts (SCC) in milk is indicator of the qualitative index of milk and low level of SCC indicates better udder health condition of dairy animals. The somatic cell counts present in milk of lactating animals consists of leucocytes, which include macrophages, lymphocytes and neutrophils from immune system and udder tissue of the animal. The concentration of somatic cell counts in milk is well established that direct predictor of mammary gland inflammation that is highly correlated with the presence of intra-mammary infection. The secretion of SCC in milk is affected by the stage of lactation, parity, season, management practice, intra-mammary infections (Munoz *et al.*, 2002), physiological factors and immune system functioning in individual cow's (Lee, 2015), sanitation practice and milking practices followed by farmers and udder morphological characteristics. However, scanty in formations are available on SCC in buffalo breeds reared under field condition. Therefore present study carried out to evaluate the basal values of somatic cell counts, factors affecting somatic cell counts and relationship of SCC with milk yield and composition in Murrah, Surti and Nili-Ravi buffaloes under field condition.

MATERIALS AND METHODS

The study carried out at National Dairy Research Institute, Karnal (Haryana). The milk samples collected on 300 lactating Murrah buffalo from adjoining village of Karnal (Haryana), 300 Surti from adjoining area of Vallabhnagar, Udaipur (Rajasthan) and 150 Nili-Ravi buffaloes from adjoining villages of Patiala (Punjab) in 2006. The udders of all buffaloes were tested for mastitis using Modified California Mastitis Test (MCMT) as per Sastry (1978) was performed for screening of the experimental animals against subclinical mastitis. Milk samples from MCMT negative buffaloes were included in the study. A total of 750 milk samples were collected during summer, rainy and winter seasons. The season of the year were classified as summer (May-June), rainy (August-September) and winter (December-January). The lactations were grouped into early, mid and late stages of lactation *viz.*, 10-90 days, 91-180 days, and above 180 days. The lactation numbers were grouped in to 1st parity, 2nd parity, 3rd parity, 4th parity and above 4th parities. The three milk production levels considered as: low producers (< mean -1 SE), medium producer (mean±1 SE) and high producer (>mean+1 SE). Somatic cell count in milk was counted microscopically by the methods of Das and Singh (1999). An amount of 10 µl milk sample was spread on a glass slide and was stained using methylene blue dye. The analysis of data was carried out using least square analysis of variance. The mean and standard errors and the correlation's between the parameters were also calculated (Sendecore and Cochran, 1980).

*Corresponding author: mpverma_78@rediffmail.com

RESULTS AND DISCUSSION

SCC in breeds

The overall mean SCC in buffalo breeds under field conditions was 0.896×10^5 cells/ml of milk (Table 1). The mean values of somatic cell counts shows that the SCC was significantly ($P<0.01$) higher in Murrah buffaloes (1.003×10^5 cells/ml) followed by Nili-Ravi (0.888×10^5 cells/ml) and Surti buffaloes (0.798×10^5 cells/ml). SCC was higher in Nili-Ravi as compared to Surti buffaloes but did not differ significantly. Munoz *et al.* (2002) observed somatic cell count of 63610±1856 cells/ml in Murrah buffaloes in Brazil. The arithmetic mean of SCC was 82.4×10^3 cells/ml of milk in Anatolian water buffalos raised in Igdir province (Sel *et al.*, 2020). Significant difference in SCC of milk of buffaloes revealed the separate genetic makeup of each breeds. Higher SCC in Murrah buffaloes may be due to its high milk yield as compared to Surti and Nili-Ravi buffaloes. The variation among the breeds could be explained in the shape and size of udder and managemental practices followed by farmers. SCC significantly differed among the buffalo herds due to milk hygiene, herd size, managemental practices, milking at intervals, status and gender of milking personal (Hussain *et al.*, 2018, Sel *et al.*, 2020) and udder morphological characteristics (Singh *et al.*, 2017).

SCC during stage of lactation

In present investigation it was found that the mean value of somatic cell counts (SCC) in buffaloes (Table 1) were significantly ($P<0.01$) higher during early lactation (0.995×10^5 cells/ml), lower during mid lactation (0.792×10^5 cells/ml) and further increased (0.901×10^5 cells/ml) during late lactation. This is in agreement with the earlier findings of Scott *et al.* (1991) who reported that values of SCC significantly higher in early stage of lactation may be a direct relationship between milk yield and SCC, which would involve those high yielders, may be more prone to udder inflammation because of higher udder pressure. Further the SCC in milk increased towards the end of lactation because of the higher prevalence of infection and reduced milk production, which causes less dilution of the milk leucocytes (Managuli *et al.*, 2014).

Table 1

Mean (±SE) somatic cell counts ($\times 10^5$ cells/ml) in breeds, stage of lactation, parity, season, level of milk production and milking practices of buffalo milk under field condition

Breeds	Murrah	Surti	Nili-Ravi	Overall
Stage of lactation				
Early	$1.121^{a} \pm 0.052$ (67)	$0.848^{a} \pm 0.068$ (97)	$1.014^{a} \pm 0.060$ (52)	$0.995^{a} \pm 0.026$ (216)
Mid	$0.850^{b} \pm 0.046$ (91)	$0.725^{bc} \pm 0.056$ (100)	$0.761^{bc} \pm 0.053$ (51)	$0.792^{b} \pm 0.025$ (242)
Late	$1.013^{a} \pm 0.037$(142)	$0.807^{ac} \pm 0.066$ (103)	$0.874^{ac} \pm 0.057$ (57)	$0.901^{a} \pm 0.023$ (292)
Parity Order				
1st	1.054 ± 0.036 (132)	0.805 ± 0.040 (58)	0.853 ± 0.078 (23)	$0.922^{ab} \pm 0.031$ (144)
2nd	0.959 ± 0.038 (110)	0.762 ± 0.033 (83)	0.787 ± 0.094 (19)	$0.855^{a} \pm 0.029$ (173)
3rd	0.937 ± 0.052 (49)	0.781 ± 0.036 (66)	0.813 ± 0.071 (31)	$0.847^{a} \pm 0.028$ (169)
4th	0.996 ± 0.072 (26)	0.786 ± 0.047 (36)	0.948 ± 0.069 (30)	$0.899^{ab} \pm 0.033$ (114)
>4th	1.027 ± 0.054 (49)	0.831 ± 0.039 (57)	1.015 ± 0.060 (47)	$0.958^{b} \pm 0.029$ (150)
Season of the year				
Rainy	$1.200^{a} \pm 0.042$ (100)	0.822 ± 0.029 (100)	$1.035^{a} \pm 0.056$ (50)	$1.025^{a} \pm 0.024$ (250)
Summer	$0.949^{a} \pm 0.038$ (100)	0.781 ± 0.031 (100)	$0.847^{ab} \pm 0.052$ (50)	$0.867^{b} \pm 0.023$ (250)
Winter	$0.834^{b} \pm 0.040$ (100)	0.776 ± 0.033 (100)	$0.767^{b} \pm 0.060$ (50)	$0.797^{b} \pm 0.020$ (250)
Level of production				
Low	0.916 ± 0.063(53)	0.777 ± 0.048 (42)	0.810 ± 0.045 (30)	$0.862^{a} \pm 0.035$ (125)
Medium	0.970 ± 0.031 (175)	0.763 ± 0.020 (207)	0.856 ± 0.088 (78)	$0.864^{a} \pm 0.017$ (460)
High	1.097 ± 0.048 (72)	0.839 ± 0.040 (51)	0.983 ± 0.069 (42)	$0.963^{b} \pm 0.028$ (165)
Milking practices				
Knuckling	1.005 ± 0.036 (144)	$0.856^{a} \pm 0.036$ (153)	0.929 ± 0.050 (76)	$0.923^{a} \pm 0.020$ (373)
Full hand	0.984 ± 0.034 (156)	$0.731^{b} \pm 0.034$ (147)	0.837 ± 0.044 (74)	$0.869^{b} \pm 0.018$ (377)
Overall	$1.003^{a} \pm 0.022$ (300)	$0.798^{bc} \pm 0.022$ (300)	$0.888^{c} \pm 0.029$ (150)	0.896 ± 0.015 (750)

*within the same parameter different superscripts in row indicate significant difference.
** Figures in parenthesis indicate number of observations.

SCC and parity order

The observations in present study indicated that overall mean somatic cell counts (SCC) in field buffaloes were significantly higher (P<0.01) in above 4th parities as compared to 2nd and 3rd parity, respectively (Table 1). The SCC was not significantly higher among 1st to 4th parity. The SCC of 0.922×10^5, 0.855×10^5, 0.847×10^5, 0.899×10^5 and 0.958×10^5 cells/ml were found in 1st, 2nd, 3rd, 4th and above 4th parities, respectively. The SCC was increasing beyond 3rd parity onwards parity in all three breeds of buffaloes. The higher SCC in late parity with comparison to primiparous animals may be due to fact that animal's resistance to mastitis might be lowered with advancement of age. In study of buffaloes the effect of parity on milk SCC was observed non-significantly differ from 1st to 4th parity (De *et al.*, 2011). The reason may be that SCC positively correlated with milk production.

SCC and season

The seasonal effect on SCC (Table 1) was found significant (P<0.01), being high during rainy season (1.025×10^5 cells/ml) and low during summer (0.867×10^5 cells/ml) and cold seasons (0.797×10^5 cells/ml) under field buffaloes. Similar findings was reported by Singh and Ludri (2001) that SCC higher in rainy season (1.36×10^5 cells/ml), medium in summer (1.08×10^5 cells/ml) and low in winter season (0.76×10^5 cells/ml) in Murrah buffaloes. Verma and Kimothi (2021) reported that season had significant (P<0.01) effect on SCC in buffaloes under different organized dairy farm, the mean SCC in milk was 1.115×10^5, 0.993×10^5 and 0.812×10^5 cells/ml during rainy, summer and winter season, respectively. Higher SCC in rainy season might also be attributed to greater exposure of teat ends to pathogens of wet muddy surface on which the animal lies down. The low somatic cell counts during winter season were probably due to congenial environment conditions leading to minimum stress in buffaloes.

SCC and level of milk production

Present study revealed that SCC was higher in high milk producing buffaloes (>mean+1SE) and lower in low milk producing buffaloes (<mean-1SE). The mean SCC 0.862×10^5, 0.864×10^5 and 0.963×10^5 cells/ml of milk in low, medium and high producing buffaloes (Table 1). Similar to present findings, Scott *et al.* (1991) observed that a direct relationship between milk yield and SCC, which would involve those high yielders, may be more prone to udder inflammation because of higher udder pressure. Higher cell counts in high yielder buffaloes may be due to greater stress on account of physiological function of milk producing on udder thereby rendering them more susceptible to infection.

Table 2

Correlation coefficients between SCC and milk yield & milk composition in milk of buffaloes under field condition

SCC×10^5	Murrah	Surti	Nili-Ravi	Overall
Log SCC: milk yield	-0.13*	-0.02NS	-0.12NS	-0.07*
Log SCC: milk fat	-0.45**	-0.33**	-0.20*	-0.34**
Log SCC: milk protein	-0.17*	-0.25**	-0.14NS	-0.11*
Log SCC: milk SNF	-0.22**	-0.23**	-0.24**	-0.25**

**Significant (P<0.01), *Significant (P<0.05)

Table 3

Somatic cell counts (×10^5) in relation to mean (±SE) milk yield in buffalo breeds under field condition

SCC×10^5	Murrah	Surti	Nili-Ravi	Overall
<0.50	4.19±0.22 (40)	3.65±0.17 (56)	4.18±0.25 (22)	3.93±0.12 (118)
0.50-1.00	3.78±0.13 (125)	3.58±0.10 (172)	3.95±0.16 (73)	3.72±0.07 (370)
1.00-1.50	3.62±0.13 (101)	3.53±0.16 (60)	3.84±0.24 (43)	3.64±0.09 (204)
>1.50	3.54±0.21 (34)	3.00±0.30 (12)	3.71±0.49 (12)	3.55±0.19 (9.67)* (58)
Overall	3.77±0.08 (300)	3.45±0.00 (300)	3.93±0.12 (150)	3.72±0.05 (750)

*9.67 per cent milk yield decreased when SCC increased from (<0.50 to >1.50)×10^5 cells/ml of milk

SCC and milking practices

The values of SCC were significantly (P<0.01) higher in knuckling milking method (0.923×10^5 cells/ml) comparison to full hand milking method (0.869×10^5 cells/ml). Milk SCC values lowest in gentle hand milking compared to rough hand and machine milking methods (Khalil *et al.*, 2013). In knuckling method of milking, the excess pressure generated by the thumb on teat tissue may cause increase in cell counts.

Association of SCC with milk yield and composition

The correlation coefficient between milk yield and composition with SCC has been depicted in Table 2. The milk yield was significantly (P<0.05) negatively correlated (-0.07) with somatic cell counts. The SCC of milk was significant negatively correlated with fat, protein and SNF contents. The correlation coefficient were -0.34, -0.11 and -0.25 with fat, protein and SNF contents, respectively. The relation between SCC and milk yield has been depicted in Table 3. The overall milk yield was highest (3.93±0.12 kg) under SCC categories less than 0.50×10^5 cells/ml and lowest (3.55±0.19 kg) milk yield was observed under greater than 1.50×10^5 cells/ml. As SCC in milk increased from category less than 0.50 to greater than 1.50×10^5 cells/ml, the losses of milk yield

Table 4

Somatic cell counts (×105) in relation to milk constituents (mean±SE) in buffaloes

SCC×105	Murrah			Surti			Nili-Ravi			Overall		
	Fat %	Protein %	SNF %	Fat %	Protein %	SNF %	Fat %	Protein %	SNF %	Fat %	Protein %	SNF %
<0.50	8.29±0.13 (40)	4.31±0.07 (40)	9.68±0.10 (40)	8.80±0.13 (56)	4.33±0.04 (56)	10.04±0.06 (56)	8.11±0.19 (22)	4.35±0.06 (22)	9.72±0.09 (22)	8.50±0.09 (118)	4.32±0.03 (118)	9.86±0.05 (118)
0.50-1.00	8.21±0.08 (125)	4.26±0.03 (125)	9.65±0.04 (125)	8.39±0.09 (172)	4.22±0.02 (172)	9.68±0.03 (172)	8.03±0.10 (73)	4.26±0.04 (73)	9.55±0.04 (73)	8.26±0.05 (370)	4.24±0.02 (370)	9.64±0.02 (370)
1.00-1.50	7.70±0.08 (101)	4.15±0.04 (101)	9.44±0.05 (101)	7.66±0.09 (60)	4.13±0.04 (60)	9.60±0.08 (60)	7.59±0.13 (43)	4.18±0.07 (204)	9.42±0.05 (204)	7.67±0.05 (204)	4.15±0.03	9.48±0.03
>1.50	7.04±0.09 (34)	4.09±0.06 (34)	9.40±0.07 (34)	7.25±0.05 (12)	4.05±0.09 (12)	9.53±0.35 (12)	7.43±0.21 (12)	4.10±0.11 (12)	9.37±0.13 (12)	7.14±0.09 -16.0* (58)	4.09±0.05 -4.88* (58)	9.40±0.06 -3.59* (58)
Overall	7.82±0.05 (300)	4.21±0.02 (300)	9.55±0.03 (300)	8.04±0.06 (300)	4.19±0.02 (300)	9.72±0.03 (300)	7.80±0.07 (150)	4.23±0.03 (150)	9.52±0.03 (150)	7.90±0.04 (750)	4.21±0.01 (750)	9.60±0.02 (750)

*16.00, 4.88 and 3.59 per cent milk fat, protein and SNF decreased when SCC increased from (<0.50 to >1.50) ×105 cells/ml of milk

9.67 percent was observed, which implies that the high yielding healthy buffaloes tend to maintain moderately high milk somatic cell counts vis a vis their low yielding counterpart. The negative correlation coefficients between SCC and milk yield as observed in present study were reported in buffaloes by Munoz *et al.* (2002). The losses of milk upto 18 per cent observed by Eberhart *et al.* (1982) on account of increased bulk milk tank somatic cell count from 200×10^3 to 1000×10^3 cells/ml of milk. The relations between SCC and milk constituents have been depicted in Table 4. The losses in milk fat, protein and SNF were 16.00, 4.88 and 3.59 percent, respectively under SCC increased from category 0.50 to above 1.50×10^5 cells/ml of milk. Bagri *et al.* (2018) recorded significant decrease in fat (15.96%), protein (6.33%) and SNF (16.83%) in infected milk as compared to normal milk of buffaloes. Similar finding was reported by Verma and Kimothi (2021) under farm condition in buffalo's milk.

In conclusion the overall somatic cell counts in milk of buffaloes under field condition is 0.896×10^5 cell/ml of milk. Somatic cell count under field condition is significantly higher in Murrah as compared to Nili-Ravi and Surti buffaloes. The SCC is affected by breed, stage of lactation, parity, season of the year, level of milk production and milking practices. The milk yield was negatively correlated with SCC in milk. The SCC is also negatively correlated with fat, protein and SNF content of milk.

REFERENCES

Bagri, D.K., Pandey, R.K., Bagri, G.K., Kumari, R. and Bagdi, D.L. (2018). Effect of subclinical mastitis on milk composition in lactating cows. *J. Ento. Zool. Stud.* **6(5)**: 231-236.

Das, M. and Singh, M. (1999). Variation in blood leucocytes, somatic cell count, yield and composition of milk of crossbred goats. *Small Rumi. Res.* **35(2)**: 169-174.

De, K., Mukherjee, J., Prasad, S. and Dang, A.K. (2011). Effect of different physiological stage and managemental practices on milk somatic cell counts of Murrah buffaloes. *Buff. Bull.* **30(1)**: 72-74.

Eberhart, R.J., Hutchinson, L.J. and Spencer, S.B. (1982). Relationship of bulk tank somatic cell counts to prevalence of intra-mammary infection and to indices of herd production. *J. Food Prod.* **45(12)**: 1125-1128.

Hussain, A., Ahmad, M.U.D., Mushtaq, M.H., Choudhry, M., Khan, M.S., Reichel, M. and Khan, I.A. (2018). Prevalence of overall and teat wise mastitis and effect of herd size in dairy buffaloes. *Pak. J. Zoo.* **50(3)**: 1107-1112.

Khalil, Z.R., Akhter, S., Rahman, A., Ahmad, I., Khan, S., Sohail, S.M., Khalil, I.A. and Ullah, F. (2013). Comparative effect of different milking methods and udder hygiene on somatic cell count and milk quality in dairy cows. *Iran. J. Appl. Anmi. Sci.* **3(2)**: 339-342.

Lee, D.L. (2015). Factors influencing somatic cell count variation in cow milk samples. Cooperative Extension, n. d. Web. 27 April. 2015.

Managuli, S.S., Nagvekar, A.S., Ingole, S.D. and Bharucha, S.V. (2014). Somatic cell count and major elements in milk during lactation in buffaloes. *Indian J. Anim. Sci.*, **84(7)**: 797-798.

Munoz, M.C., Tonhati, H., Duarte, J., Oliveira, L., Berrocal, M.M. and Gamez, H.J. (2002). Factors affecting somatic cell counts and their relations with milk and milk constituent yield in buffaloes. *J. Dairy Sci.* **85(11)**: 2885-2889.

Sastry, G.A. (1978). Clinical Veterinary Pathology. (2nd Edn.), CBS Publishers and distributors, New Delhi.

Scott, M.L., Powell, K.C., Kellog, D.W. and Mauromoustakos, A. (1991). Prevalence of subclinical mastitis in Holstein infected with bovine leukaemia virus (BLV) compared to uninfected cows. American Dairy Science Association, 86th Annual Meeting, 12-15 August, Utah State University, Logan, Utah, USA, Book of Abstracts, p. 202.

Sendecor, G.W. and Cochran, W.G. (1980). Statistical methods. (7th Edn.), Lowa State University Press, Ames, Lowa.

Sel.,V., Yilmaz, I and Yanar, M. (2020). Some factors affecting the somatic cell count in the milk of Anatolian water buffalos (*Bubalus bubalis*) raised in Igdir Province. *Pak. J. Zoo.* **52(4)**: 1225-1230.

Singh, M. and Ludri, R.S. (2001). Somatic cell counts in Murrah buffaloes (*Bubalus bubalis*) during different stage of lactation, parity and season. Asian-Aust. *J. Anim. Sci.* **14(2)**: 189-192.

Verma, M.P. and Kimothi, S.P. (2021). Factors Affecting Somatic Cell Counts in Buffalo (*Bubalus bubalis*) Milk. *Int. J. Live. Res.*, **11(5)**: 17-23.