STUDIES ON MILKING MANAGEMENT PRACTICES AND ITS EFFECT ON MILK COMPOSITION AND SOMATIC CELL COUNTS OF BUFFALO UNDER RURAL AREAS OF KARNAL DISTRICT

THESIS SUBMITTED TO THE
NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL
(DEEMED UNIVERSITY)
IN PARTIAL FULFILLMENT OF THE REQUIREMENT
FOR THE AWARD OF THE DEGREE OF

MASTER OF VETERINARY SCIENCE
IN
DAIRYING
(LIVESTOCK PRODUCTION AND MANAGEMENT)

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This Thesis is Dedicated to

My Beloved Parents

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This is to certify that the thesis entitled **"STUDIES ON MILKING MANAGEMENT PRACTICES AND ITS EFFECT ON MILK COMPOSITION AND SOMATIC CELL COUNTS OF BUFFALO UNDER RURAL AREAS OF KARNAL DISTRICT"** submitted by **DR. AMIT KUMAR** towards the partial fulfillment of the requirement for the award of the degree of **MASTER OF VETERINARY SCIENCE IN DAIRYING (LIVESTOCK PRODUCTION AND MANAGEMENT)** of the **NATIONAL DAIRY RESEARCH INSTITUTE (DEEMED UNIVERSITY)** , Karnal (Haryana) , India , is a bonafide research work carried out by him under my supervision and guidance and no part of the thesis has been submitted for any other degree or diploma.

Date: 17 June,2008

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ABSTRACT

The main objective of this investigation was to study the milking management practices followed for buffaloes under village conditions of Karnal district. Sixty six milk samples were collected from six villages of Karnal district and were analyzed for milk composition and somatic cell count. The operations at the time of milking were recorded along with milk yield of individual animals. Milk samples collected from 47 Murrah and 19 Murrah-type buffaloes were analyzed for fat, protein, lactose, SNF and SCC to investigate the influence of milking practices on milk constituents and SCC. The most common management practices followed by majority of farmers were semi-intensive housing with pucca floor. More than 70% rural households adopted various management practices including regular washing animals before milking, udder washing, full hand milking, calf sucking as milk letdown reflex, milking at a separate dry place to maintain the quality and nutritive value of milk through clean milk production. Clean milking practices like teat dipping, washing of udder after milking, screening of udder for mastitis, and dry cow therapy were not reported by farmers. Average milk yield per day for buffalo under rural conditions was 7.67 ± 0.403 kg and 6.53 ± 0.612 kg for Murrah and Murrah-type buffaloes respectively. Effect of milking management practices on milk composition was found not to be significant on the contrary fat, protein, lactose and SNF were higher under hygienic milking conditions. How ever milk somatic cell count was found to be significantly lower *($P<0.05$)* under hygienic milking conditions. It is emphasized that advanced milking practices like teat dipping, washing udder after milking dry cow therapy may be followed by farmers for clean milk production under village conditions.

सारांश

प्रस्तुत रिसर्च का मुख्य उदेश्य गांव मे भैंसो के रख रखाव एवं प्रबन्धन का अध्ययन करना था। अध्ययन के लिए करनाल के नजदीक 6 गांवो का चयन किया गया। छेहासट दुग्ध सेम्पल गांव से लाया गया, जिसमे 47 मुर्रा और 19 मुर्रा-टाइप भैंस की थी। दुग्ध निकालते समय दुग्ध सैम्पल किसानो से लिया गया और उनके द्वारा प्रयोग की गई क्रियाकलापो और रख रखाव को लिख लिया गया। दुग्ध मे उपस्थित फैट, प्रोटीन, लैक्टोज, एस.एन.एफ और दैहिक कोशका का गणना प्रयोगशाला मे किया गया। अधिकांश किसानो के द्वारा गांव मे भैंस के रखने के लिए सेमी इन्टेनसिव घर जिसमे पक्का फर्श हो का प्रयोग किया गया। किसान दिन मे दो बार सुबह और शाम भैंस से दूध निकालते थे। सत्तर प्रतिशत से ज्यादा किसान हाथ धोने, भैंस धोने, दुग्ध बर्तन धोने और थन धोने का काम दूध निकालने से पहले करते थे। किसान पुरी मुटटी से भैंस का दूध निकालते थे। स्वच्छ दुग्ध उत्पादन क्रिया जैसेः टीट डिपींग, दूध निकालने के बाद थन की सफाई, ड्राई काव थैरापी आदि का प्रयोग नही करते थे। औसत दुग्ध उत्पादन मुर्रा भैंस के लिए 7.66$\pm$ 0.403 किलो और मुर्रा- टाइप के लिए 6.53$\pm$ 0.612 किलो था। दुग्ध निकालने की प्रक्रिया का दुग्ध मे उपस्थित योगिको पर कोई सार्थक असर नही देखा गया। जबकि फैट, प्रोटीन, लैक्टोज स्वच्छ रख रखाव मे अधिक पाया गया और दैहिक कोशिका सार्थक रूप से कम पाया गया।

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LIST OF ABBREVIATIONS

A.M.	=	Ante meridien (before noon)
ANOVA	=	Analysis of variance
Av.	=	Average
yCLR	=	Corrected lactometer reading
CMT	=	California mastitis test
df	=	Degree of freedom
EC	=	Electrical conductivity
FAO	=	Food and Agriculture Organization
g	=	Gram
IDF	=	International dairy federation
h	=	Hour
ISI	=	Indian Standards Institution
Kg	=	Kilogram
m	=	Metre
min	=	Minute
ml	=	Millilitre
%	=	Percentage
µl	=	Microlitre
MSS	=	Mean sum of squares
NDRI	=	National Dairy Research Institute
P.M.	=	Post meridien (Afternoon)
PMN	=	Polymorphic nuclear
SCC	=	Somatic cell count
S.E.	=	Standard error
SNF	=	Solid not fat
TS	=	Total solid
Vs	=	Versus
Viz.	=	Namely

1. INTRODUCTION

India is the largest milk (102.42 million ton. 2007-08) producing country in the world. This increase in milk production has been due to proper breeding, feeding and management of dairy animals. Unfortunately, the milk quality has not shown any improvement over the years. Most of our milk comes from rural areas, where people are unaware of good milking practices. As consumers are becoming more health conscious and general awareness to produce clean milk is increasing, there is a need to educate dairy farmers to follow clean milk production and management practices, so that they get a good price for their milk and it matches international quality.

All the developed countries are using milk Somatic Cell counts (SCC) as a marker to determine the mammary health and quality of milk. Livestock production including dairying plays a multiple role in Indian economy and the country with a total milk production about 102.42 million ton (2007-08) has emerged as the world leader in milk production. In spite of a large population of high yielding crossbred cows, the contribution of buffalo milk to the total milk pool of the country still remains close to 53.66 per cent. The current bovine population of the country is 283 million, which comprises 185.2 million cattle and 97.9 million buffaloes (Livestock Census, 2003). The buffalo population in India accounts for 57 per cent of the world buffalo population (FAO, 2006). However, in spite of large volume of milk produced, the quality aspects of milk production has not received adequate attention and it has been the major obstacle in realizing the large export potential of milk and milk products and the vital aspect of clean milk production and herd health including udder health still remains a major concern.

The major cause of elevated levels of SCC in milk is mastitis which is a major concern for dairy farmers in India and across the world. In India, the average incidence of sub clinical and clinical mastitis in buffaloes and cows has been reported as 24.40 and 43.9 % and 24.75 and 54.74% respectively.

Buffalo has traditionally been considered less susceptible to mastitis on account of certain characteristic features like, the long narrow teat canal and tighter sphincter muscles in comparison to cattle. Milk somatic cell count is an

important parameter in the evaluation of herd health and milk quality. Somatic cells are closely associated with inflammation, udder health, quality and quantity of milk. Somatic cells are secreted during normal process of lactation in milk and their primary function is to eliminate udder infections and tissue damage and as such they are present at low level in the normal milk. Somatic cells represent the second line of defense, the first being the anatomical and chemical barriers of the teat apex and canal. These cells are of two types, the leucocytes (white blood cells) and the epithelial cells. Epithelial cells are shed from the lining of mammary gland and the leucocytes are derived from blood and consist of macrophages, lymphocytes, and polymorphonuclear neutrophils (PMN). Whenever udder is infected , milk compositional changes due to alteration of membrane permeability within the mammary gland and reduced synthesis of milk components .process of filtering and synthesis of various milk components are modified ,which bring about imbalance in its composition .changes in filtering capacity of gland leads to increase in soluble protein content and some mineral elements like sodium, whereas ,the reduced capacity of udder for synthesis causes reduction in lactose content. The most important factor affecting somatic cell counts is an infection of mammary gland (Dohoo and Meek 1982). Moroni *et al.* (2006) observed that the somatic cell count was distinctly greater in infected quarters, 100% of quarters with higher than 200,000 cells/ml had intramammary infection, whereas 98% of quarters with less than 200,000 cells/ml were uninfected.

Vecht *et al.* (1989) reported that several factors including breed, season, geographical region, type of housing, use of teat disinfections, and the interaction of parity and stage of lactation and the infection status of the animals significantly influenced somatic ell counts in milk. Schukken *et al.* (1992) observed significantly lower mean SCC in April and highest mean SCC in October month. They suggested that SCC of milk was higher during declining phase of lactation. The somatic cell counts in buffalo milk has been reported to change during different seasons being higher during hot humid season and low during hot-dry and cold seasons (Singh and Ludri, 2001a). Harman (1994) however, reported that no evidence exits that SCC in normal secretion from uninfected quarters is

significantly influenced (i.e. exceeds 200,000 cells/ml) by parity, stage of lactation, or heat stress. Sethar *et al.* (1979) reported highest somatic cell counts just after calving, decreased during days 31 to 60 of lactation and then increased slowly towards the end of lactation. Kennedy *et al.* (1982) observed that effect of stage of lactation was significant for all lactation age groups (≤ 2 to ≥ 6). Singh and Ludri (2001a) found that the mean SCC values in buffalo milk were high during early lactation decrease during mid-lactation and increased marginally during late lactation. Munoz *et al.* (2002) in their studies in Brazil observed that the SCC in Murrah buffaloes decreased in the second month of lactation and increased thereafter, up to the ninth month of lactation.

The information on loss of milk production associated with the elevated levels of somatic cell counts has also been documented by some researchers. Hortet and seegers, (1998) observed that with each doubling of SCC above 50,000 cells/ ml results in a loss of 0.4 kg and 0.6 kg of milk per day in first lactation and older cows, respectively. Jones (1986) reported that increase in SCC from 0.6 to1 million cells/ml was associated with 8 to 12% reduction in herd milk production. According to Harmon (1994), the elevated SCC is associated with a decrease in lactose, α-lactalbumin, and fat in milk because of reduced synthetic activity in the mammary tissue.

According to Jones (2002) “there is no evidence that any particular cell count *per se* has any significant effect on human health. Increased somatic cell count is also associated with reduced suitability of the raw milk for processing into products for human consumption.

In recent years, regulatory limit for milk SCC have been imposed on the dairy industry worldwide. In the European Union, New Zealand, Australia, Switzerland, and Norway 400,000 cells/ml accepted as the upper limit of somatic cells (Hillerton 2001). Canada has now agreed on 500,000 cells/ml of milk. In USA the federal regulatory limit was reduced from 750,000 to 400,000 cells/ml in first January 2005. However, no such regulatory limit at present exists in any of the developing countries including India.

To reduce this loss and increase the quality of our milk products so that they are accepted internationally, proper monitoring, counting and setting a standard for milk quality based on somatic cell counts is needed. Screening dairy animals for milk somatic cell counts at periodic intervals can be used as a reliable tool for trouble shooting herds with multiple milk quality and mastitis related problems. It gives a broad picture of udder health status of the animal/herd, which may form the basis for taking future managemental decisions.

The dairy industry's demand for quality milk has made it easier to get the dairy farmer involved. Most dairy plants are now offering cash premiums for lower SCC milk. The farmer not only gets more milk, but a higher price as well for the better quality milk. Thus, quality milk programs will increase the profitability of the dairy farmers.

Keeping these in view, the present study was conducted with the following objectives:

1. To reveal the milking management practices for buffalo under rural areas of karnal district.
2. To find out the effect of milking management practices on milk composition and somatic cell count of buffalo.

Milk plays a vital role in human health and therefore, it is important to devise steps to ensure production of 'clean' and 'safe' milk free from visible dirt and extraneous particles, harmful micro-organisms and hazardous chemicals such as residues of antibiotics and pesticides. Improving the method of milk production in villages would be the foremost step in the introduction of any comprehensive system of public health supervision and quality control. It is therefore, necessary to establish a minimum set of practices that would improve significantly, the quality of milk at the level of individual producer.

2.1 **Milking the buffalo**

Buffaloes have been used for milk production for centuries. They have not been subjected to the same upgrading and breeding like cattle of the western world. However, the buffalo is an excellent milk producer, given the correct circumstances. Milking the buffalo is not a difficult task. One should, however, take care not to implement cattle milking techniques directly on the buffalo cow (Hogberg, 2003).

The anatomy of buffalo teats is slightly different from cattle teats. The epithelium of the streak canal is thicker and more compact in buffaloes than in cattle. The sphincter muscle around the streak canal is thicker in buffaloes than in cattle. More force is therefore required to open the streak canal. The teat sphincter tonus has been reported to be at least 400 mmHg negative pressures in buffaloes (the tension falls some what after calf suckling and hand milking). This is the cause of buffaloes being "hard milkers" (Hogberg, 2003).

2.2 **Milking Practices**

Dang and Anand (2006) reported that washing of animals, hands, udder and teat and collecting vessels before milking were followed under village conditions whereas washing of udder after milking, teat dipping and screening of udder for mastitis were not followed.

Hogberg (2003) stated that the 'knuckling' or 'stripping' method is used in the wrong belief that it is necessary in order to overcome the resistance in the teat sphincter. These milking methods might cause elongation and damage to the teats. A much more comfortable and appropriate method is the "full hand" technique. This technique imitates the calf's suckling and is therefore a better stimuli. About 90% rural households have adopted udder washing/teat dipping practices not only for improving and sustaining the milk by reducing the incidence of clinical and sub clinical mastitis but also to maintain the quality and nutritive value of milk through clean milk production in the project area(10 village of Karnal district) (Chakravarty *et al*., 2004).

Merril *et al.* (1987) have determined that a twelve-hour interval between milkings is optimal in the case of twice daily milking. A correct milking routine includes different working operations: teat and udder cleaning, manual pre-stimulation, fore-milking, milking unit attachment to the cow, removal of milking unit, and effective post-milking teat disinfection (teat dipping). Calhoun, (1995) have indicated that more than 50% of the working time is spent on milking. Cleaning the udder should be done with a lubricated towel (washable textile or disposable paper). Separate towels should be used for each buffalo. The udder should never be splashed with water (Hogberg, 2003).Nowadays the milking process is largely mechanized. Improper and careless milking may result in decreased milk let-down, increased incidence of udder diseases and low milk quality, which are ultimately causing considerable economic loss for dairy producers.

Khupse *et al.* (1980) found that the continuous exposure of stress to the buffaloes will affect the milk production negatively. Change of milker or milking routine, application of wrong milking technique or milking machines in bad conditions are some reasons for the buffaloes to with hold the milk.

A sound milking management must be adopted under rural condition. In addition a sizeable amount of labors is also required for this operation, because milking operation alone required 38% of labors requirement in dairy farming (Whipp, 1983).

Milkers should wash his hand with antiseptic lotion before each milking and milking should be done with full hand quickly, gently, quietly, cleanly and complete. (Tomer *et al.*, 1988; Thomas and Sastry, 1997).

Samanta *et al.* (1998) reported that every year the world dairying suffers an enormous loss of $35 billion due to mastitis. Checking the spread of this disease calls for maintenance of proper hygienic and following proper milking procedure. Important factors for the prevention of high milk somatic cell count (SCC) are: post-milking teat disinfection, dry cow therapy, good milking management, treatment of clinical mastitis with antibiotics, and culling of problem cows (Barkema *et al.,* 1998).

The buffalo should be dried off approximately 2 to 3 months before expected calving. In a high yielding herd (above 10 kg per day) the buffalo should be dried off when the daily yield falls below 2.5 kg, even if it is still more than 3 months to expected calving (Hogberg, 2003).

Singh *et al*. (2003) mentioned that the coat of the animal should be washed, brushed and clipped regularly and the of animal should be done well before milking process, so that the dirt particles in the air do not fall into milk.

Singh *et al*. (2003) reported that the application of a teat disinfecting solution after completion of milking is an effective method for preventing and controlling mastitis.

2.3 MILK YIELD AND MILK COMPOSITION

In relation to milk composition, most research showed no differences in major constituents of milk (fat, protein and lactose) (Allard and Pellerin 1998; Toledo *et al.,* 2002; Steinshamn *et al*., 2000). One study indicated higher levels of protein and fat in milk produced by cows submitted to the organic system (Weller *et al.,* 2002). In contrast, Pabst (1994) and Weber *et al*., (1993) reported higher levels of protein and fat for the conventional system. Several factors, independent of the system, tend to influence milk composition, such as genetic merit, volume of milk produced, diet, season of year, lactation stage, milking management and health status. In relation to season, research conducted in countries of temperate climate showed higher values of SCC during summer (Bodoh *et al.,* 1976; Harmon

1998; Petkow *et al*., 2001). Lactation and milk yield depend on both genetic and non-genetic factors. The genetic influence is due to species, breed, and individual. Further, it is affected by ability to reproduce, e.g. fertility and thereby calving interval (Hogberg, 2003).

The most important finding was the higher lactose content , and lower SSC, in milk from the agro-ecological farms, the two parameters being negatively correlated (r= -0.54 and -0.33 for conventional and agro-ecological farms, respectively). Analysis of proteins in higher SCC milk showed less total casein, lower ratios of casein to total protein and higher contents of total whey proteins. Amount of αs1-casein, ß-casein, ß-lactoglobulin and α-lactalbumin decrease, whereas, amounts of immunoglobulin, serum albumin, κ-casein and pH increased (Haenlein *et al.*1973).

Sendelbach *et al.,* (1976) developed a system of index of somatic cell count for estimating milk production loss and concluded that overall mean loss within lactation was 123 lb of fat and 5.5 lb of fat for each index point.

Singh and Singh (1980) reported that high somatic cell counts in milk affected the milk constituent are fat, protein, lactose, SNF and chloride content. Lactose and SNF of milk was mostly suffered when SCC was more than 500,000 per ml of milk. They reported approximately 40 percent decreased in lactose and marked decreased in fat percentage in mastitic milk. Milk from buffaloes differs from that from cattle. The biggest difference is with respect to fat. In cattle, the milk contains between 3 to 5 %, depending on feed and breed. Hogberg (2003) reported that in buffalo milk the average fat content is usually 7 to 8% but may be as high as 13% in some breeds. The content of protein, lactose and ash is somewhat higher in buffalo milk than in cattle milk. Buffalo milk lacks or only contains traces of α-carotene (a precursor of vitamin A). This makes the milk look very white, as opposed to cattle milk which has a slight yellow shade. In buffalo milk, vitamin A is present instead of its precursor (Hogberg, 2003).

Singh *at al*., (2003) reported that water, fat, protein and lactose was 83.63%, 6.56%, 3.88% and 5.23% respectively in healthy Murrah buffalo.

Miller *et al*., (1983) reported that protein and fat percent increased and lactose percent decreased with increased milk somatic cell counts irrespective of presence or absence of bacteria. They further reported that somatic cell count and milk yield negatively associated in the mammary gland could be due to (i) residual somatic cell count elevation due to previous infections, (ii) failure to detect presence of organisms, (iii) environmental factors causing milk decline and (iv) physical damage to milk secretary tissue.

Jones *et al.,* (1984) observed the following relationship between milk fat yield & somatic cell counts.

SCC (x 000)	Milk fat yield (kg/d)
<50	0.98
100	0.96
200	0.95
500	0.92
800	0.91
1600	0.89

Ghafoor *et al.,* (1985) found that the initial cows milk pH value was of 6.8, which changed to pH 5.3 after 12 h at room temperature. In buffaloes, the initial pH was 6.9 and decreased to value of pH 5.4 after 12 hours.

Mitchell *et al.,* (1986) reported the correlation coefficient between log somatic cell counts and milk constitutes. Log SCC correlated significantly with lactose (-0.31), pH (0.23), fat (0.41), chloride (0.41) and total nitrogen content of milk (0.27). Free fatty acid of milk was not affected with somatic cell counts. In another study Mitchell *et al.,* (1986a) reported that milk fat was negatively correlated with SCC, but somatic cell counts was not correlated with pH of milk. Park and Humphrey (1986) studied different breed of goats and found that regression coefficient between somatic cell counts and percent fat and protein was significant ($P<0.01$).

El-Deeb *et al.,* (1987) reported the average fat content, fat globules, long chain fatty acids, diameters of casein micelles, casein nitrogen decreased,

whereas, short chain and unsaturated fatty acids, non-casein N, that whey protein and non-protein nitrogen increased as level of infection increased.

Verdi *et al*. (1987) found that percent true protein casein and NPN of milk remained unaffected by milk somatic cell counts. However, casein expressed as percent of true protein were lower in high somatic cell count of milk.

The percent of protein, fat and lactose were significantly lower in mastitis milk compared with normal milk, however, mastitic milk had been a significantly higher pH values than normal milk (Choudhary *et al.,* 1992).

Schukken (1992) reported a significant percent increase in fat and lactose content with decreasing bulk milk somatic cell counts and very little effect in protein percent. Silva and Silva (1994) reported that the values of pH of milk ranging from 6.12-6.87% with a mean of 6.58. Lin and Chang (1994) found that somatic cell count was positively correlated with pH values of milk and negatively correlated for fat, lactose and milk yield.

Bastan *et al*. (1997) reported a positive correlation between somatic cell count, CMT and EC, however, correlation between lactose and total protein was not established. The percentage of protein, fat and lactose were significantly lower in mastitic milk.

Samanta (1997) found that both fat and SNF contents of milk was negatively correlated with SCC of milk in different parities in both Karan Swiss and Karan Fries cattle.

Hortet *et al*. (1999) reported that milk protein content increased by 0.15 g/kg (at the test day level), while milk fat decreased by 0.20 g/kg (both at the test day and lactation level), for each 2-fold increase of SCC above 50,000 cells/ml.

Mulkalwar *et al.* (1999) observed that the pH values significantly increased with severity of mastitis (0.12 for each unit of CMT score), while lactose in milk decreased by 0.66 g/ml. Serrano *et al.,* (1999) found that elevated SCC (>1.5 x 10^6/ml) was associated with high fat and protein content in the cow milk and a lower lactose content which were statistically significant for SCC. Feeding can alter the normal composition, however, these changes are seldom extreme, but within normal intervals. Season can effect the normal milk composition, although these

changes are mostly due to differences in feeding during different seasons.The fat percentage varies with stage of lactation and with milk yield. A study on Nili-Ravi buffaloes in Pakistan showed that the fat percentage increased steadily from 5.5% in the first month of lactation to 7.5% in the 10th month of lactation. There is a negative correlation between lactation yield and percentage of total solids, fat and protein. However, the total amount of solids, fat and protein is higher in a high yielding buffalo than in a low yielding one. Digestion of concentrate on the other hand, results in a higher proportion of propionic acid which is unfavorable for milkfat synthesis. If too much concentrate is given, fat depression might occur. There is a negative correlation between lactation yield and percentage of total solids, fat and protein. However, the total amount of solids, fat and protein is higher in a high yielding buffalo than in a low yielding one (Hogberg, 2003).

Ghosh *et al.* (2004) observed the pH from healthy quarters of Murrah buffaloes milk was 6.75±0.01 and infected quarter's values was distinctly higher. The average somatic cell counts from healthy quarters was 1,11,221±4873 cells/ml. He was also observed that the pH from mild, moderate and sever infection were 6.87±0.03, 7.02±0.03 and 7.22±0.01 respectively (Ghosh, 2002).

Most of the changes in milk composition in high cell count were related to decreased synthesis or increased leakage due to damage to udder tissue Schultz (1977). Similarly, Harmon (1994) also affirmed that there is a linear inverse relation between SCC and milk production. Higher SCC values also characterized some infection and resulted in a reduction of lactose between 5 and 20 %. As all the values of SCC under different milking systems were within physiological limits in the present study, therefore, not much change was observed in the overall composition of milk.

2.4 Somatic cell counts (SCC)

Somatic cell count, or a parameter derived from this count, is often used to distinguish between infected and uninfected quarters. It has been found that 200,000 cells/ml is the most practical threshold to determine the profitability of dairy farms (Harmon, 1994; Heald *et al*., 2000; Haile-Mariam *et al*., 2003; Rogers,

1995). Somatic cells are also present in milk of healthy cows, and the increase in SCC is a normal cellular defense against udder infections (Koivula, 2005). Most countries do not widely record clinical mastitis incidences (Emanuelson *et al*., 1988; Lund *et al*., 1999). SCC is objectively recorded on a continuous scale, and it has a higher heritability than mastitis incidence (Kennedy *et al*., 1982; Pösö, Mäntysaari, 1996; Schepers, 1997; Koivula *et al*., 2004). The year 1979 was the beginning of somatic cell count registering in Estonia and from 1987 these data are measured and registered monthly in Estonian milk recording scheme (Pentjärv, Uba, 2004). Herds with high somatic cell count must adopt a short-term goal of reducing SCC as quickly as possible so that milk can be legally marketable and dairy cattle breeding sustainable. More and more attention is paid to milk quality. After the accession of Estonia to the European Union, the demands on milk quality were in compliance with the proposed EU legal limit of 400,000 cells/ml. Similar levels are required in New Zealand and Australia, whereas Canada established the requirement of a SCC < 500,000 cells/ml (Sargeant *et al*., 1998; Norman *et al*., 2000).

2.5 MILKING METHOD AND SOMATIC CELL COUNT

Farid *et al.* (1976) observed in the incidence of mastitis was higher in machine milked (36.5%) than in hand milked buffaloes.

Gomez, (1979) reported the increase frequency of sub clinical mastitis since the advent of machine milking is noted. Various factors affection udder health is mentioned. Transmission of pathogen is increased by inadequate washing and disinfection of hand, teats, udder and milking machine, especially teats cups, and by udder is increased by high or fluctuating vacuum, inadequate number of pulsations, week or narrow teat cup lines and late removal of cluster at the end of milking. The importance of correct maintenance of equipment is stressed.

Duris (1978) stated that machine milked cows had more incidence (81.0%) of mastitis than hand milked cows (63.0%) and these differences as stated largely attributed to inefficient milking management.

Manz *et al.* (1984) investigated that machine milked cows had higher cell counts than hand milked cows. Sub clinical mastitis was more prevalent in large herds milked in modern parlors.

Hamann and Stanitzke (1991) concluded that machine milking could cause disturbances of circulation within bovine teat tissue, which impair its ability to withstand mastitis pathogens. The changes in teat end thickness can be caused as a measure of circulatory impairment due to congestion and edema and were always significantly greater with machine milking than calf suckling or hand milking.

The geometric mean of cow somatic cell counts decreased over the year before installation of automatic milking system but increased suddenly at the start of automatic milking. After 6 months the somatic cell counts settled again at a lower level.

2.6 SOMATIC CELL COUNTS THE CHANGED CONCEPT

Presscott and Breed (1910) suggested the use of term 'body cell' because research at that time had suggested that the cells in milk were detached epithelial cells. For many years it was considered that main cell types to be found in normal disease free milk secretion were epithelial in origin (Zlotnik, 1947). Zlothik (1947) reported that identification of cell types through microscopic examination is difficult because of great histological similarity between macrophages and epithelial cells with or without lipid inoculation.

Graffeny *et al.* (1976) claimed that up to 90 percent cells in human colostrums and milk were epithelial cells, less than 8 percent were PMN neutrophils and less than 1 percent is macrophages.

Lee *et al.* (1980) reported that differential counts of electron microscope of cell pallets isolated from bovine udder showed no secretary epithelial cells and very few ductal epithelial cells were present at any stage. The cell types in bovine milk were as fellows.

Cell type	Cells (%range)
Neutrophils (PMN)	0-11

Macrophages	66-88
Lymphocytes	10-27
Epithelia (ductal)	0-7

Harmon and Heald (1982), Nickerson and Pankey (1985) and Paape *et al.,* (1979) reported that one of the initial components of the inflammatory response of udder is the influx of PMN leucocytes into mammary tissue. Nonnecke and Harp (1986) reported that marked leucocytes infiltration was noticed in chronic cases of udder infection.

Thus, from the above studies conducted by different workers it can be safely assumed that increased SCC in milk is a result of white blood cells being attracted into milk and is not a random event.

2.7 VARIATION OF SOMATIC CELL COUNTS IN MILK

Bodoh *et al.* (1976) reported the mean cell number as 692,000 and 625000 cells/ml milk based on 13,733 samples drawn from 16 dairy herds and 6285 observations from 134 dairy herds respectively. Further, the median cell number in 16 dairy herds was 390,000 cells/ml. The herd percentage of cows over 1 million, between 500,000 and 1 million and below 500,000 averaged 17.9 percent, 20.52 percent and 61.6 percent respectively.

Hutton *et al.* (1990) observed that the geometric mean of SCC in dairy herds with high SCC was 460,000 cells/ml and that in herds with low SCC it was175,000 cells/ml of milk. Over a period of two years the mean number of herds in low and high SCC groups was 28 and 31 respectively. It was also suggested that herds with low SCC were using computer and paying more attention to hygiene as compared to herds with high SCC.

Silva and Silva (1994) found that the total somatic cell count in normal buffalo milk may vary from 50,000 to 3,75,000 cells per ml and a considerable variation was observed in the counts among the buffaloes. Neutrophil, the most frequently observed cell type in buffalo milk constituted an average of 56% (22-88%) of the total somatic cell counts. The second most commonly observed leucocyte type in buffalo milk was lymphocyte, which constituted an average of

20% (10-54%) of the total somatic cell counts. The macrophages, epithelial cells and eosinophils were 8%, 5% and 1% respectively of the total somatic cell counts.

2.8 RELATIONSHIP BETWEEN SOMATIC CELL COUNTS, MILK YIELD AND MILK COMPOSITION

The information in the relationship of milk somatic cell count with yield and composition of milk in buffaloes is lacking but in cow, milk yield and milk components decline as milk somatic cells increase.

2.7.1 MILK YIELD

Schultz (1977) reported after conducting experiment on 874 quarters. Separate recording was done for rear and fore quarters. Milk losses on quarter basis stated about 5-lakh cells/ml of cows milk. The losses of milk at 1 million cells it was 7.5 percent, at 2 million cells it was 15 percent and at 5 million cells it rise up to 30 percent.

Meijering *et al.* (1978) investigated relation of quarter milk yield with quarter cell count and found progressively lower milk yield as the cell count increased. According to these finding losses was evident even at cell counts between 1.0 lakh to 2.0 lakh cells per ml. Moxley *et al.,* (1978) found at 581 herds that each increase of 1 lakh cells/ml of milk in herd average of 4,20,300 cell counts was associated with a decline of 59 kg average production in the herd.

Estimated infection prevalence and losses in milk production losses were associated with elevated BTSCC as reported by Eberhart *et al*. (1982).

BTSCC 10^3/ml	Infected quarter in herd	Production losses
200	6	0
500	16	6
1000	32	18
1500	48	29

Raubertas and Shook (1982) concluded that estimates of milk losses were associated with increase in somatic cell concentration, which are relatively free of confounding effects. Milk yield loss per unit increase in lactation, average log

(5.145) SCC was around 135±20 kg in first lactation and 270±30 kg for all subsequent lactations.

The relationship between somatic cell counts, milk production and episodes of clinical mastitis were evaluated in 32 southern Ontario Holstein herds. The largest reduction in milk production was associated with LSCC (log somatic cell count) between 5.0 and 6.0 (149,000- 403,000 cells/ml) with an intermediate loss associated with LSCC less than 5.0 (< 149,000 cells/ml) and smallest milk loss found when LSCC exceeded 6.0 (≥403,000 cell/ml). The estimated loss in milk production attributable to a unit increase in the LSCC was 1.44 kg or 6.1 % of the mean daily milk production (23.5 kg) (Dohoo *et al.,* 1984).

Jones *et al.* (1984) observed that in second and older lactation, somatic cell counts was <50 $\times 10^3$cells/ml and milk yields was 28.0 kg but when increased to 1600$\times 10^3$ cells/ml, milk yield decreased up to 24.6 kg, the following is the relationship between milk yield & SCC.

SCC (x 000)	Milk yield (kg/d)
< 50	28.0
100	27.4
200	26.9
500	26.0
800	25.4
1600	24.6

Batra (1986) observed the relationship between somatic cell counts and milk yield using the data of 2181 composite milk samples from 665 cows. The effect of genetic group, parity, stage of lactation, season of calving and SCC was significant for daily milk yield. Average daily milk yield loss was 0.5 kg in first lactation and 0.7 kg for later lactation in cows, when somatic cell count increased from 200$\times 10^3$ to 400$\times 10^3$ cells/ml, lactation milk yield losses per unit increased in average log SCC was 74 kg in the first lactation and 88 kg for later lactation.

Jones (1986) suggested that SCC of 0.6 to 1 million cells/ml were associated with 8 to 12% reduction in herd milk production. Randy *et al.,* (1988) reported low

and negative correlation coefficients between the milk yield and somatic cell counts. A negative relationship between somatic cell counts and milk yield was reported by Gill *et al.,* (1990). The second lactation cows from a sample average 55 cow herd were studied which had 35.78 kg of milk, 1.30 kg of fat, and 1.08 kg of protein per day in their first stage of lactation at a zero SCC score.

The database containing 3,97,172 milk test records obtained from Michigan DHIA was from 504 Holstein herds. The model predicted the mean herd loss a mean of 1.17 kg of milk/cow per day associated with SCC (Bartlett *et al*., 1990).

Singh and Ludry (2001) observed that there was significant ($p<0.05$) correlation coefficient between SCC and milk yield during different stage of lactation and Parity. They also reported the changes in milk yield of primiparous and multiparous buffaloes were significant.

The somatic cell counts decreased in the second month of lactation and increased thereafter up to the ninth month of lactation. The relationship with milk yield observed by Munoz *et al.,* (2002) during the first month of lactation milk yield was 6.87 kg which increased to 7.65 kg during the second month, and then decreased until the ninth month of lactation (3.83 kg). The milk and lactose yield decreased with transformed SCC.

Summary values observed by Seegers *et al.* (2003) for losses of milk production were proposed at 375 kg for a clinical case (5% at the lactation level) and at 0.5 kg per 2-fold increase of crude SCC of a cow.

Highly significant negative correlation was found ranging from (–0.84 to 0.32) between bulk tank somatic cell counts and milk yield. Increase of 364,00 somatic cells/ml in bulk tank of cow milk had been associated with a corresponding milk loss of 0.361 kg per animal/day and in buffaloes 20383 cells/ml and milk loss 0.208 kg/animal/day (Panday, 2004).

Jorge *et al.* (2005) observed the somatic cell counts and milk production from 38 Murrah buffaloes in year of 2002 and 2003. The somatic cell counts were average of 63,380 cells/ml while average milk production and milk production adjusted (270 days) were 4.07±1.3 kg and 1214.25± 293.54 kg, respectively. This was a non significant correlation between milk yield and somatic cell counts.

Buffaloes from São Paulo State, the study aimed to quantify the related losses in milk due to somatic cell counts, there was no relation between milk yield and the SCC in the buffaloes at first parity. For the second parity in the months 1, 2, 5, 6 and 7 of lactation, there was a negative and significant relationship between SCC and milk yield. For parities of three or more there was a significant and negative regression coefficient during every month of lactation between milk yield and SCC. The average losses varied from 0.18 to 2.2 milk liters per unit of SCC (Sanchez *et al.* 2006).

2.9 FACTORS AFFECTING MILK COMPOSITION SOMATIC CELL COUNTS

Vecht *et al.* (1989) reported that several factors like breed, season, geographical region, type of housing, and use of teat disinfections significantly influenced milk composition and somatic cell counts. The interaction effect of parity x stage of lactation x infection status on milk composition and SCC in milk was also significant.

Jorstad *et al.* (1989) observed the effects of teat canal diameter in cow milk on milk composition and somatic cell counts. They found highly significant association between leakage of milk and high somatic cell count, and a significant association between teat injury and high somatic cell counts. An association between the shape of the teat end and somatic cell count was also found to be significant. Correlation between teat canal diameter and somatic cell counts was highly significant.

Hanns and Suchanek (1991) studied the effect of some internal and external factors on milk composition and SCC. The mean SCC was 3.69×10^5 cells per ml of milk.

Gencurova *et al.* (1993) reported higher somatic cell count in milk from farms having lower production efficiency. Among other factors affecting somatic cell counts was parity with first calvers giving lower somatic cell count ($P<0.05$). Use of udder disinfectants prior to milking did not have a significant effect on somatic cell count.

Hamann and Reichmuth (1993) reported that physiological values of somatic cell counts are within100,000 cells/ml. Stressful situations can affect

somatic cell count by increasing the infection risk of mammary gland or by directly increasing the somatic cell counts in previously infected quarters. Additional factors such as change of housing, feeding or physiological stresses as in early lactation may impair immunity, resulting in increased numbers of new infections of the mammary gland. They further reported that healthy quarter, generally exhibit stable somatic cell count even during stressful events.

Schoder (1993) reported that various stress factors such as restriction in water, omission of milkings, gradual or sudden transfer from winter to summer, transfer to pasture following constant stabilizing all result in increased cell count in milk.

Brien *et al.* (1998) investigated the effects of unequal (16:8h) and equal (12:12h) milking intervals on somatic cell counts and reported that milking time interval had no significant effect on somatic cell counts in total daily milk, although some differences were observed in somatic cell counts in morning and evening milk.

2.10 EFFECT OF BREED ON SOMATIC CELL COUNTS

As the information on the SCC of different breeds of buffaloes is at present very scarce the available information on cattle and goats have also been reviewed.

Narayanan and Iya (1953) reported leucocyte counts ranging from 2.5 x 10^5 to 11 x 10^5 cells per ml of milk in Red Sindhi, Gir, Tharparkar, crossbred cows and buffaloes.

Geneurova *et al.* (1993) reported the average somatic cell count for 212 dairy herds to be around 241,000 ± 83,000 cells per ml. The breed of cow had a significant effect on somatic cell counts.

Singh and Ludri (2001b) observed that somatic cell counts in Tharparkar, Sahiwal, Karan Swiss and Karan Fries breeds of cows during hot humid season were 1.49±0.11, 1.61±0.09, 2.46± 0.11 and 2.28± 0.05 $\times 10^5$ respectively.

Dang *et al.* (2002) have also found that SCC values were higher ($P<0.01$) in cows (1.27 x 10^5) than buffaloes (1.12x10^5 cells/ml) under field condition.

2.11 SOMATC CELL COUNTS AND STAGES OF LACTATION

Sethar *et al.* (1979) observed highest somatic cell counts just after calving which decreased up to days 31 to 60 of lactation and thereafter increased slowly to the end of lactation.

Kennedy *et al.* (1982) observed that effect of stage of lactation was significant for all lactation age groups, ($\leq$ 2 to $\geq$ 6). Somatic cell counts were highest shortly after calving, declined rapidly to a nadir between days 25 to 45 and then rose slowly throughout the remainder of lactation. The period of lowest somatic cell count coincided fairly closely with peak lactation.

Sheldrake *et al.* (1983) reported that there was a significant relationship between SCC and stage of lactation, within lactation the SCC of quarters free from infection rose from approximately 80-83$\times10^3$ cells/ml 35 days of postpartum to 160$\times10^3$ cell/ml 285 days postpartum.

Miller *et al.* (1991) observed the variation in milk somatic cells of heifers at first calving by collecting samples during the first 75 days of lactation. Milk somatic cell counts were lowest at 9-10 weeks. For milk somatic cell counts, variation between cows was small (3-24%) and was much greater for the differential cell counts (46% of the total for lymphocytes and 34% for epithelial cells).

Kamote *et al.* (1994) observed the effect of once daily milking on somatic cell count which had either high or low somatic cell count at the start of experiment in late lactation. In all 36 cows were used of which 18 had low somatic cell count and 18 had higher somatic cell count. The effects of once daily milking on milk yields were higher in case of cows which had higher somatic cell count.

Prasad and Singh (2001) observed that the normal values of SCC in buffalo milk during early lactation (average 42.5 days) varied from 0.54 to 0.75 x 10^5 cells/ml and oxytocin (2.5 IU) administration increased SCC ($P<0.01$) in buffalo milk.

Singh and Ludri (2001a) reported that the mean SCC values in the milk of 1st lactation buffaloes were higher during early lactation (<90d) (1.10-1.27$\times10^5$ cells/ml), which decreased during mid-lactation (90-120d) (0.90-.99$\times10^5$ cells/ml) and increased marginally during late lactation (0.99-1.07$\times10^5$ cells/ml).

Singh and Ludri (2001b) reported that, overall mean SCC values in cows were higher during first 30 days of lactation ($1.54 \pm 0.07 \times 10^5$ cells/ml) which decreased during day 31-60 ($1.41 \pm 0.08 \times 10^5$ cell/ml) and thereafter fluctuate up to day 300 of lactation. The effect of stage of lactation on SCC was not significant.

Vliegher *et al.* (2004) estimated the impact of somatic cell counts in early lactation from Belgian dairy heifers on test-day somatic cell count (SCC) in first lactation. Geometric mean of SCC (5 to 14 day in milk) of the 14,766 available samples was 104,000 cells/ml, and decreased from 178,000 cells/ml 5^{th} days in milk to 74,000 cells/ml at 14^{th} day in milk. Proportion of cows with SCC values >2,00,000 cells/ml was 27.5. Heifers calving in the period April-June had highest SCC. The overall mean of monthly SCC was 1,17,496 cells/ml.

Moroni *et al.* (2006) studied the relationship between SCC and intramammary infection in buffaloes and found that the stage of lactation had clear effect in IMI, the least risk of IMI was in the first month of lactation and maximum during the tenth month with an approximate difference of 6.3 fold in the probability of IMI. The prevalence of IMI quickly increased reaching a maximum of 79% during the third month of lactation and than decreased slightly to about 60% in the mid-lactation (6^{th} months) before increasing to about 75% during late lactation.

Factors affected with incidence of elevated cow composite somatic cell counts (≥200,000 cells/ml) at first test milking after first calving dairy heifer (2126) were investigated by Svensson *et al.,* (2006) in the southwest Sweden. In total, 18.1% of the animals had elevated somatic cell counts at first test milking (21 days) after calving. The risk of elevated somatic cell count increased with increase in percentage of cows in the herd that, some time during the year, had an increased udder disease score (chronically increased SCC). The other factors associated with increased risk of elevated somatic cell count were increasing amounts of concentrates having 11 to 16 month old heifers, moving to confined housing of the day of calving instead of earlier, and use of restraint measures at milking.

2.12 SOMATIC CELL COUNTS DURING DIFFERENT PARITIES

Kennedy *et al.* (1982) observed that the age of cows were significantly ($P<0.01$) for ≤2, 3, and ≥6 years old but were not significant ($P>0.05$) for 4 and 5 years old cows. The mean values of SCC were 275, 348, 421, 496 and 645 $x10^3$cells/ml for ≤2,3,4,5 and ≥6 years age respectively.

Jones *et al.* (1984) reported that the somatic cell count during first lactation was 231 x 10^3 but in second and older lactation averaged SCC were 409 x 10^3 cell/ml.

Reneau (1986) reported that the number of lactations have the greatest influence on somatic cell count variations. Consistently, older cows have higher average cell count than younger cows. One report indicated that the average milk SCC irrespective of infection status, was 232,000 in first lactation cows and 868,000 in cow over 7 year old cows.

Randy *et al.* (1988) found that the somatic cell counts were higher with increasing age of cows.

Quarter milk sample from 87 lactating buffaloes were tested by Syaamsundar and Choudhri (1988) and the presence of SCM was found to be 47 percent in first lactation, 33 percent in second lactation, 35 percent in third lactation and 39 percent in fourth and above lactation.

Emanuelson and Weaver (1989) observed that log somatic cell count was clearly affected by parity due mainly to physiological variation, but possible also accentuated by variation in infection rates.

Geneurova *et al.* (1993) reported the somatic cell counts affecting by parity with first calvers giving low somatic cell count.

The overall mean InSCC in cows was 3.95 (51.9 $x10^3$ cells/ml). The In SCC differed by parity ($P=0.0075$). The least squares mean of In SCC for bacteriological negative in first, second, and third parity, respectively, were 3.80 (44.7 x 10^3 cells/ml), 3.93 (50.9$x10^3$ cells/ml) and 3.97 (53.0$x10^3$ cells/ml). Paired comparison of bacteriologically negative cows in second lactation versus first lactation was borderline significant ($P=0.0537$) and third lactation cows versus first lactation was not significant ($P=0.7434$) observed by Laevens *et al.,* (1997).

A study conducted by Schepers *et al.* (1997) observed that the natural log of somatic cell count from uninfected quarters of first parity cows was highest during the first part of the lactation because of the relatively flat-SCC curve, although the mean natural log of SCC in first parity cows was lowest.

The interaction of month of lactation and order of calving was significant in Murrah buffaloes reared in the Sao Paul, Braizil. In the first parity, the somatic cell count was lower than in all other parities (Munoz *et al*., 2002).

2.13 Constraints in adoption of dairy cattle management practices

Natrajanand and Channegowda (1986) observed that inadequate field staff at veterinary hospital and lack of clear cut policy for bringing effectiveness of dairy development programmers.

Lack of knowledge about symptoms of common contagious diseases and their preventive measures Selvaraj *et al*., (2003).

Lack of trained technical man power for better management of dairy activities (NCA, 1976).

Health care followed by feeding, breeding and management were the priority areas of training and respondents preferred short duration training programmers Gupta *et al*., (2002).

Lack of adequate health care and medicine facilities Sohal (1985).

Poor availability of green fodder Sohal (1985); Tripathi (1990).

Lack of coordinated efforts of various extension agencies with respect to propagation of feeding practices Walli (1990).

Distant location of various veterinary units Rath (1977).

Plate: 7 Karnal: Area to study the milking management practices for buffalo under village conditions

3. MATERIALS AND METHODS

This chapter is an important aspect for conducting a study in order to achieve objective, a field survey was conducted. The desired information on "Study on milking management practices" Was collected through personal interview of buffalo keeper visual observation and by chemical analysis of milk samples for its components during 2008. The detailed procedure followed in conducting the present investigation has been presented in this chapter under following sub-heads:

3.1 Selection of locale of research
3.2 Selection of farmers/lactating animals
3.3 Development of interview schedule
3.4 Validity of schedule/questionnaires
3.5 Categorisation of practices
3.6 Conducting interview and data collection
3.7 Analysis of data and interpretation of results

3.1 Selection of locale of research

The present study was conducted in six villages of Karnal on buffalo maintained by village farmers of Karnal district, viz.

1. SHEKHPURA
2. DARAR
3. RINDAL
4. NAGLA
5. KURALI
6. KHERIMAN SINGH

3.2 DETAILS OF EXPERIMENTAL ANIMALS

Lactating buffaloes of Murrah and Murrah-type breeds were selected for study in rural area.

A total of 66 milk samples were collected 11 from each village of 47 Murrah, and 19 Murrah-type buffaloes under rural conditions while

buffaloes were milked by hand at home two times a day i.e., in morning (5.00 a.m. to 7.00 a.m.), and evening (6.00 p.m. to 8.00 p.m.),

Development of interview schedule

The well structured interview schedule was prepared for the data collection, keeping in view the objective and dimension of the investigation.

3.3 Validity of schedule/questionnaires

The validity was maximised with following steps:

1. The interview schedule was prepared in consultation with the scientists of N.D.R.I., Karnal and after the discussion with major advisor and advisory committee members and the suggestions were incorporated.
2. The relevancy of each question in term of objectives, wording, logical orders, etc. was checked carefully.

3.4 COLLECTION OF MILK SAMPLES

Individual milk samples pooled for all four quarters from the entire animal were collected separately. About 100 ml of milk was collected aseptically in cleaned and milk bottles. The samples were brought to the laboratory immediately after collection and placed in refrigerator till use. For somatic cell count the slides were prepared within one hour of collection of milk samples.

3.5 DETAILS OF TESTS PERFORMED

(a)Test performed in laboratory

Milk samples were tested in the laboratory by milk testometer (milk analyser) for its components viz. Fat, Protein, Lactose and SNF.

(b) Measurement of SCC

The fine smear slide of somatic cell counts was prepared using 10 µl fresh milk sample by spreading it over a glass slide.The fine smear was dried in an oven at 30-40°C cooled and then dipped in xylene for 2 minutes to remove fat globules. Subsequently, slides were stained using methylene blue dye and excess of stain was removed from the smears with tap water. For preparation of methylene dye, to stain somatic cells and leukocytes, ethyl alcohol (54 ml) and tetrachloroethane (40 ml) were mixed in a bottle and heated in a water bath at 60 to 70°C for 15 minutes. Methylene blue dye was added to the solution carefully and kept in a refrigerator at 4°C for 30 minutes and then glacial

acetic acid was added. The dye solution so prepared was filtered using a filter paper with a pore size of 10-12 micron and stored in a colored bottle. Only those cells, which possessed a blue stained nucleus, were counted. The SCC was measured under a microscope with a magnification of 40 x 10 X in 50 fields and average number of cells per field was multiplied by the microscopic factor (0.882). The microscopic factor was determined by using ocular and stage micrometer. Somatic cell counts/ml of milk (lakh) = Average cells count in one field x 0.882. (Singh and Dang 2002)

3.6 COLLECTION OF DATA

The following information for all the buffaloes were collected from personal observation and history cum milking records individually from farmer in relevant research areas.

1) Breed of animal
2) Stage of lactation
3) Parity (Number of lactation)
4) Washing of animals before milking
5) Washing of hands before milking
6) Cleaning of utensils
7) Washing of udder and teats before milking
8) Letdown reflex for milking
9) Method of milking
10) Vessel used for milking
11) Feeding at time of milking
12) Washing of udder after milking
13) Teat Dipping
14) Screening of Udders for Mastitis
15) Method of drying milch animal
16) Method of milk disposal
17) Post milking practices
18) Milk yield per day
19) Frequency of milking
20) Type of collecting vessel for milking

3.7 CLASSIFICATION OF DATA

The data on all three breeds viz., Murrah and Murrah-type was classified according to breed, stage of lactation, parity, village and in different milking practices. All these parameter were taken into consideration as for the influencing of milk composition and somatic cell counts.

3.7.1 Stage of Lactation

The whole lactation of all individual animals was partitioned in three stages of lactation as mentioned below:

i) Early stage of lactation (1 to 90 days)

ii) Mid stage of lactation (91 to 180 days)

iii) Late stage of lactation (above 180 days)

3.7.2 Parity

All the animals were categorized under different parities according to their lactation number.

Parity No.	Code
1	1
2	2
3	3
4	4

3.7.3 Villages

1. SHEKHPURA
2. DARAR
3. RINDAL
4. NAGLA
5. KURALI
6. KHERIMAN SINGH

3.7.4 Milking management practices

3.7.4 Milking methods: -	1. Full hand and 2. Knuckling
3.7.5 Feeding at the time of milking	1. Concentrate feeding and
	2. Not feeding
3.7.6 Washing of animal be fore milking	1. Regular washing
	2. Irregular washing
3.7.7 Type of milking barn 1. Separate	2. Common
3.7.8 Let down reflex for milking	1. Calf sucking
	2. Hand stimulation
3.7.9 Drying methods for animals	1. Incomplete milking

2. Intermittent milking

3.7.10 Type of utensils — 1. Separate for each

2. Common for all

3.8 STATISTICAL ANALYSIS OF RESULTS

ANALYSIS OF VARIANCE

(i) Pooled for rural conditions (villages)

The analysis of variance was run considering milk components (Fat, Protein, Lactose and SNF) and somatic cell counts data was pooled for all the two buffalo breeds viz; Murrah and Murrah-type under village conditions. Data were analyzed by least squares analysis of variance with the model:

$$\mathbf{Y_{ijkl} = \mu + V_i + L_j + P_k + e_{ijkl}}$$

Where,

Y_{ijkl} = l^{th} observation in i^{th} village, in j^{th} lactation and in k^{th} parity.

μ = Population mean,

V_i = Effect of i^{th} Village(1-6)

L_j = Effect of j^{th} stage of lactation(1-3)

P_k = Effect of k^{th} parity.(1-4)

e_{ijklmn} = Random error. N.I.D. (0, σ2,),

Duncan's Multiple Range Test as modified by Kramer (1957) was used for testing the difference among least-squares means (using the inverse coefficient matrix).

Data were adjusted for those factors which had significant effect on corresponding characters then analysis of variance was run to find out the effect of milking practices on milk composition and somatic cell count of buffalo (Murrah and Murrah-type) under rural condition.

ANALYSIS OF VARIANCE

(ii) Pooled for of milking practices, milk composition and somatic cell count of Murrah buffalo breed.

$$\mathbf{Y_{ijklmnop} = \mu + M_i + F_j + D_k + U_l + W_m + MB_n + CS_o + e_{lijklmnop}}$$

Where,

$Y_{ijklmnop}$ = p^{th} observation in i^{th} milking practices j^{th} feeding method in k^{th} drying method , in l^{th} type of utensil , in m^{th} method of washing , in n^{th} milking barn , in o^{th} method of calf sucking

μ = Population mean,

M_i = Effect of i^{th} Milking method(1-2)

F_j = Effect of j^{th} feeding method(1-2)

D_k = Effect of k^{th} drying method(1-2)

U_l = Effect of l^{th} type of utensil(1-2)

W_m = Effect of m^{th} method of washing(1-2)

MB_n = Effect of n^{th} milking barn(1-2)

CS_o = Effect of o^{th} method of calf sucking(1-2)

$e_{ijklmop}$ = Random error. N.I.D. (0, σ2,),

To estimate whether the effect of any factor on milk composition and SCC of Murrah breed of buffalo is significant or not.

(iii) Pooled for of milking practices, milk composition and somatic cell count of Murrah-type buffalo.

$$\mathbf{Y_{ijklmno} = \mu + M_i + F_j + U_k + W_l + MB_m + CS_n + e_{lijklmno}}$$

Where,

$Y_{ijklmno}$ = o^{th} observation in i^{th} milking practices j^{th} feeding method in k^{th} , in l^{th} type of utensil , in l^{th} method of washing , in m^{th} milking barn , in n^{th} method of calf sucking

μ = Population mean,

M_i = Effect of i^{th} Milking method(1-2)

$\mathbf{F_j}$ = Effect of j^{th} feeding method(1-2)

$\mathbf{U_k}$ = Effect of k^{th} type of utensil (1-2)

$\mathbf{W_l}$ = Effect of l^{th} method of washing (1-2)

$\mathbf{MB_m}$ = Effect of m^{th} milking barn (1-2)

$\mathbf{CS_n}$ = Effect of n^{th} method of calf sucking (1-2)

$e_{ijklmop}$ = Random error. N.I.D. (0, σ2,)

To estimate whether the effect of any factor on milk composition and SCC of Murrah-type breed of buffalo is significant or not.

Plate: 1 Semi-intensive housing for buffalo under village conditions with pucca floor

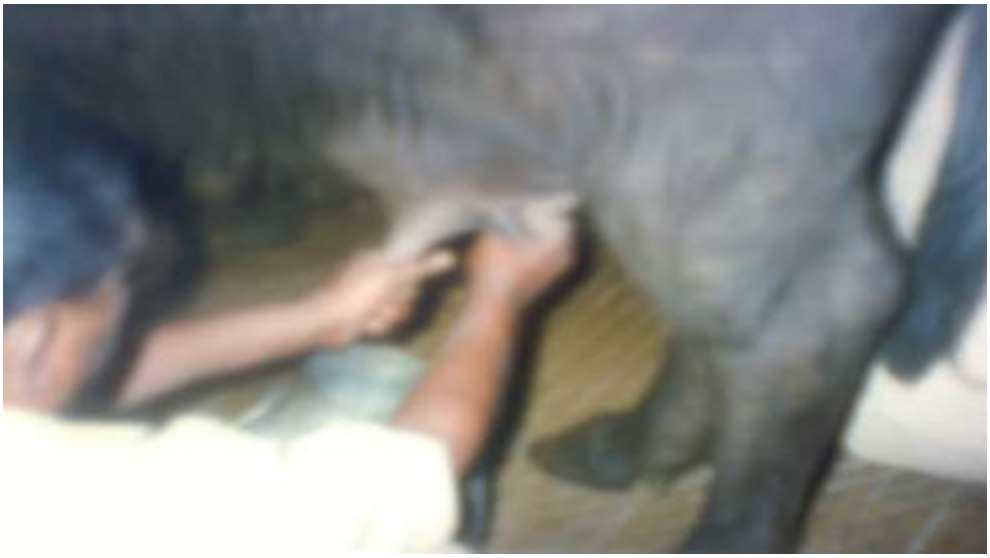

Plate: 2 Full hand method of milking for buffalo under village conditions

Plate: 3 Washing of buffalo before milking under village conditions

Plate: 4 Washing of hands before milking under village conditions

Plate: 5a Common milking place for buffalo under village conditions

Plate: 5b Separate milking place for buffalo under village conditions

The results of experiment conducted on 66 lactating buffalo (Murrah and Murrah-type) under village areas of Karnal district along with collection of milk samples and personal observation of milking practices followed by farmers at the time of milking have been presented in this chapter.

4.1 MILKING MANAGEMENT PRACTICES

Most common management practices followed by majority of farmers under village conditions are listed below :–

- Housing for buffalo was semi-intensive type of housing with pucca floor.
- Farmer washed their hand before milking.
- Milking utensils were cleaned properly before milking.
- Farmer washed udder of animal before milking with cleaned and potable water
- Milking frequency was two times per day in the morning and the evening
- Time of milking was early in the morning at 5 am to 7am and in the evening at 6 pm to 8pm.
- Stainless steel bucket was used by farmers as milking utensil.
- Disposal of milk was depended upon the economic status of farmers, farmers with milk production of more than 3 kg/day mostly used their milk for home consumption as well as for selling
- Farmers with less than 3 kg of milk production mostly used their milk for home consumption.
- Singh *et al*. (2003) reported that the application of a teat disinfecting solution after completion of milking is an effective method for preventing and controlling mastitis.

- Singh *et al*. (2003) stated that the coat of the animal should be washed, brushed and clipped regularly so that the dirt particles in the air do not fall into milk.
- Dang and Anand (2006) mentioned that washing of animals, hands, udder and teat and collecting vessels before milking were followed under village conditions whereas washing of udder after milking, teat dipping and screening of udder for mastitis were not followed.
- Chakravarty *et al*. (2004) reported that about 90% village households have adopted udder washing practices for buffalo in the project area(10 village) of Karnal district.

4.2 Lack of awareness in adoption of certain standard and hygienic milking practices by farmers are listed below:–

- Teat dipping after milking was not reported by farmers.
- Washing of udder after milking was not observed.
- Farmers did not report about screening of udder for mastitis.
- Special attention to check spread of mastitis and to improve quality of milk was not reported.
- Dry cow treatment therapy was not reported during the research work.
- Culling of problem buffalo was not reported.
- The practices of sealing the teat canal at the end of milking was not followed by any of the respondents.
- Barkema *et al.(*1998) reported that the important factors for the prevention of high milk somatic cell count (SCC) are: post-milking teat disinfection, dry cow therapy, good milking management, treatment of clinical mastitis with antibiotics, and culling of problem cows.

The data on various milking practices followed by the respondents are presented in the Table 1a to 7b. Results indicated that 87.50 percent of milkers milked their buffalo at separate dry places, whereas 12.5 percent milked at same places where the buffaloes were kept (Table 5a). It was discouraging to note that all the respondents did not washed and cleaned the whole body of the buffalo

regularly before milking. Results from the Table 4a indicated that 70.83 percent of milkers regularly washed their animal before milking whereas 29.17 of milkers washed their animal irregularly. Hundred percent respondents washed and cleaned their buckets and hands with clean water regularly. Tomer *et al.* (1988); Thomas and Sastry (1997) reported that the milkers should wash his hand with antiseptic lotion before each milking and milking should be done with full hand quickly, gently, quietly, cleanly and complete. This was confirmed by Hazarika and Anand (1984), Yadav (1985) and Nataraju and Channegowda (1986). From these results it can be inferred that the milkers had quite high awareness about the above ideal practices of clean milk production. The milk letdown was done by calf sucking in majority of households (83.33 percent) in all six villages but 16.67 percent of the farmers reported Hand stimulation in field condition (Table 6a). Calf sucking was practiced in order to get more amount of milk as stated by farmers. Farmers in all villages were not aware of mastitis test, which can be done to detect sub-clinical mastitis, but mastitis was diagnosed only in later stages when flakes were seen in milk and udder was swollen. This was due lack of awareness about disease control measures. The results of present findings are in close conformity with the earlier reports of Yadav (1985), Aggarwal and Sharma (1986) and Shandhu (1987). Whereas the adoption of various milking practices was better than the earlier findings of Khupse *et al.,* (1980); Varma (1989), Dhiman (1990) and Shingh and Thomas (1992).

A critical perusal of the results emerged that though majority of the respondents followed many ideal milking practices, yet some gap existed in adoption of certain critical practices by some of respondents. Knuckling (putting thumb in between palm and teat) was a faulty method milking. This wrong practice was often practiced by milkers in study area. This may lead to constant irritation of the teat canal due to pressure of knuckle which in turn may cause mastitis in many cases and thus not recommended. Milkers hand should be perfectly cleaned and dry during milking. Wet hand milking should be avoided as it makes the teat harsh, crack and results into sores which become painful to animal. The buffalo may jump or not allow completing milking and may lead to

mastitis and other teat problems. This causes a great reduction in persistency of milking and total lactation milk yield in buffalo due to incomplete milking.

The practices of sealing the teat canal at the end of milking were not followed by any of the respondents, which ensure prevention of any infection during dry period. Thus there was great need to educate farmers about the improved milking practicesing in the villages through systematic and planned extension programmes .

Table 1a reveals that 84.84 percent of the farmers followed full hand method of milking and 15.16 percent followed knuckling. The procedure for drying of buffalo was followed by incomplete milking by 81.94 percent of farmers whereas 18.06 percent followed intermittent milking (Table 7a). Hogberg (2003) reported that in a high yielding herd (above 10 kg per day) the buffalo should be dried off when the daily yield falls below 2.5 kg, even if it is still more than 3 months to expected calving. But cutting down ration was best method suggested by Thomas and Shastry (1991).

The perusal of Table 8a and 9a reveal that the average milk production in buffalo in village areas was 7.451±0.437 kg/day. The average milk production for Murrah breed was observed to be 7.659 kg/day, for Murrah-type breed it was 6.526 kg/day. Similar result was reported by FAO Animal Production and health paper (1979) for Murrah it was 6.9 kg/day.

Perusal of Table 2a reveal that feeding concentrate was followed by 31.94 percent of the farmers whereas feeding nothing while milking was reported by 68.05 percent of farmers. Practices of using utensils for milking have been indicated in Table 3a. Most common type of utensils used for milking was Stainless steel bucket it was indicated in the above Table 3a that 91.67 percent of farmers used separate utensils for each animal while 8.33 percent of farmers use common utensils for all animals.

4.3 The effect of village, stage of lactation and parity on milk composition and SCC in buffalo.

During the experimental period, a total of 66 milk samples (47 Murrah and 19 Murrah-type buffalo) were collected from six villages were tested for milk components (Fat, Protein, Lactose, SNF) and Somatic Cell Count .

Analysis of variance was run considering all the factors like; Village, Stage of lactation and parity and milking practices separately for field buffalo pooled for Murrah and Murrah-type buffalo.

The least squares means (±SE) of milk components (Fat, Protein, Lactose and SNF) and Somatic Cell Count under field buffalo considering the effect villages, lactation stages and parity were (6.75 ± 0.341%, 3.23 ± 0.680%, 4.83 ± 0.829% and 8.50 ± 0.113%) and 2.250 ± 0.175 lakh cells/ ml of milk respectively in Murrah (Table 12) and (6.66 ± 0.471%, 3.31 ± 0.157%, 4.58 ± 0.953% and 9.30 ± 0.334%) and 1.929 ± 0.339 lakh cells/ ml of milk in Murrah-type buffalo (Table 14) respectively. Similarly Singh *at al.* (2003) found that water, fat, protein and lactose was 83.63%, 6.56%, 3.88% and 5.23% respectively in healthy Murrah buffalo.

The least square analysis of variance showed (Table 11.1 to 11.5) that the effect of stages of lactation on lactose, SNF and SCC was significant *(P<0.05)* and effect of villages on SCC of milk was highly significant *(P<0.01)*. There was significant *(P<0.05)* difference between mean of first and second stage of lactation on SNF and SCC (Table 11.1 and 11.5). There was significant (P<0.05) difference between effect of Kheriman Singh and Shekhpura, Kheriman Singh and Darar villages on SCC (Table 13.5). Sethar *et al.* (1979) observed highest somatic cell counts just after calving which decreased up to days 31 to 60 of lactation and thereafter increased slowly to the end of lactation. Singh and Ludri (2001a) reported that the mean SCC values in the milk of 1st lactation buffalo were higher during early lactation (<90d) (1.10-1.27×10^5 cells/ml), which decreased during mid-lactation (90-120d) (0.90-.99×10^5 cells/ml) and increased marginally during late lactation (0.99-1.07×10^5 cells/ml). The interaction of month

of lactation and order of calving was significant in Murrah buffalo reared in the Sao Paul, Braizil. In the first parity, the somatic cell count was lower than in all other parities (Munoz *et al*. 2002).

The least square analysis of variance showing the effect of village, lactation stage and parity on milk components (Fat, Protein, Lactose and SNF) and SCC of Murrah-type buffalo from the Table 13.3 and 13.5 indicate that effect of villages on lactose and effect of parity on SCC of milk was significant ($P<0.05$) but there was no significant difference within the sub classes. Whereas the effect of village, lactation stage and parity on milk Fat and Protein was found not to be significant in both breeds (Table 11.1 to 13.5). Jones *et al.* (1984) reported that the somatic cell count during first lactation was 231 x 10^3 but in second and older lactation averaged SCC were 409 x 10^3 cell/ml.

Schultz (1977) stated that most of the changes in milk composition in high cell count were related to decreased synthesis or increased leakage due to damage to udder tissue. Similarly, Harmon (1994) affirmed that there is a linear inverse relation between SCC and milk production. Higher SCC values also characterized some infection and resulted in a reduction of lactose between 5 and 20 %. As all the values of SCC under different milking systems were within physiological limits in the present study, therefore, not much change was observed in the overall composition of milk.

Further data for these characters were adjusted to find the effect of milking management practices on milk compositions (Fat, Protein, Lactose and SNF) and Somatic Cell Count for two breeds separately.

The least squares means for SNF in Murrah-type buffalo was not estimated because of small sample size the observations were not distributed in each subclass.

4.4 Effect of Milking management practices on milk composition and Somatic Cell Count

The least square analysis of variance showed that the effect of milking management practices viz. Milking methods, Feeding at the time of milking, Method of drying, Letdown reflex, Washing of animal and Type of milking barn on milk components (Fat, Protein, Lactose and SNF) and SCC of Murrah buffalo (Table 15a to 16) was found not to be significant.

In relation to milk composition, most research showed no differences in major constituents of milk (fat, protein and lactose) (Allard and Pellerin 1998; Toledo *et al.* 2002; Steinshamn *et al*. 2000). Weller *et al.* (2002) reported that one study indicated higher levels of protein and fat in milk produced by cows submitted to the organic system In contrast, Pabst (1994) and Weber *et al*. (1993) reported higher levels of protein and fat for the conventional system.

The results pertaining to the milk components (Fat, Protein, Lactose and SNF) and Somatic Cell Count of Murrah buffalo considering the effect of milking practices have been presented in Tables 16. The overall mean of Fat, Protein, Lactose SNF and Somatic Cell Count in Murrah buffalo was (6.87 ± 0.939%, 3.27 ± 0.178%, 4.82 ± 0.211% 8.31 ± 0.285%) and 2.028 ± 0.459 lakh cells/ml of milk respectively.

The overall mean of milk Fat, Protein, Lactose and Somatic Cell Count in Murrah-type buffalo was 6.98 ± 0.438%, 3.67 ± 0.219%, 2.68 ± 1.012% and 2.74 ± 0.646 lakh cells/ml of milk.

The least square analysis of variance showed that the effect of milking management practices on milk components (Fat, Protein, Lactose and SNF) and SCC of Murrah-type buffalo (Table 17.1 to 17.4) was found not to be significant.

4.5 Effect of Type of Milking barn on milk composition and Somatic Cell Count.

For the Type of milking barn wise comparison, Milking barns were classified into two groups, viz. Common milking barn and Separate milking barn.

The least squares means of milk composition and Somatic Cell Count of both buffalo breeds for this two type of milking barn have been presented in Tables 16 and 18. The perusal of these results revealed that the mean values for milk composition and Somatic Cell Count did not differ significantly for both breeds in buffalo in both type of Milking barn (Table 15.1 to 17.4).

The least squares means of milk Fat, Protein, lactose, SNF and SCC of Murrah buffalo in Separate milking barn was 6.94 ± 0.936%, 3.341 ± 0.177%, 4.89 ± 0.210%, 8.27 ± 0.284% and 1.873 ± 0.457 lakh cells/ml and in Common milking barn it was 6.64 ± 1.119%, 3.19 ± 0.212%, 4.74 ± 0.251%, 8.35 ± 0.340% and 2.181 ± 0.547 lakh cells/ml of milk.

The least squares means of milk Fat, Protein, lactose and SCC of Murrah-type buffalo in Separate milking barn was 6.73 ± 0.872%, 3.54 ± 0.169%, 4.89 ± 0.938% and 2.772 ± 0.553 lakh cells/ml and in Common milking barn it was 7.24 ± 1.508%, 3.80 ± 0.293%, 4.34 ± 1.512% and 2.635 ± 0.958 lakh cells/ml of milk.

4.6 Effect of Washing of animal before milking on milk composition and Somatic Cell Count.

For the Washing of animal wise comparison, practices of Washing of animal be fore milking were classified into two groups, viz. Regular washing and Irregular washing.

The least squares means of milk composition and Somatic Cell Count of both buffalo breeds for this two methods of Washing have been presented in Tables 16 and 18. The perusal of these results revealed that the mean values for milk composition and Somatic Cell Count did not differ significantly (Table 15.1 to 17.4), in Irregular washing it was 7.14 ± 0.939%, 3.25 ± 0.178%, 4.86 ± 0.210%, 8.27 ± 0.285% and 2.094±0.459 lakh cells/ml of milk. Whereas in regular washing it was 6.44±1.077%, 3.28 ± 0.204%, 4.77 ± 0.241%, 8.25 ± 0.327% and 1.959±0.526 lakh cells/ml of milk.

The least squares means of milk Fat, Protein, lactose and SCC of Murrah-type buffalo in Regular washing was 6.45 ± 1.028%, 3.69 ± 0.200%, 4.08 ±

1.023% and 2.853 ± 0.653 lakh cells/ml and in Irregular washing it was 7.11 ± 1.249%, 3.65 ± 0.241%, 3.15 ± 1.250% and 2.554 ± 0.787 lakh cells/ml of milk.

4.7 Effect of Type of utensils on milk composition and Somatic Cell Count

For the Type of utensils wise comparison, Utensils were classified into two groups, viz. Separate utensils and Common utensils.

The least squares means of milk composition and Somatic Cell Count of both buffalo breeds for this two methods of drying have been presented in Tables 16 and 18. The perusal of these results revealed that the mean values for milk composition and Somatic Cell Count did not differ significantly for both breeds in buffalo (Table 15.1 to 17.4).

The least squares means of milk Fat, Protein, lactose, SNF and SCC of Murrah buffalo in Separate utensils were 6.89 ± 0.695%, 3.25 ± 0.132%, 4.85 ± 0.156%, 8.45 ± 0.211% and 1.891 ± 0.339 lakh cells/ml and in Common utensils it was 6.97 ± 1.399%, 3.27 ± 0.265%, 4.78 ± 0.314%, 8.17 ± 0.425 and 2.163 ± 0.683 lakh cells/ml of milk.

The least squares means of milk Fat, Protein, lactose and SCC of Murrah-type buffalo in Separate utensils was 7.38 ± 0.934%, 3.56 ± 0.181%, 4.98 ± 0.928% and 2.169±0.593 lakh cells/ml and in Common utensils it was 6.68 ± 1.967%, 3.78 ± 0.382%, 3.25 ± 4.256% and 3.239±1.249lakh cells/ml of milk.

4.8 Effect of Method for letdown reflex for milking on milk composition and Somatic Cell Count.

For the Method of letdown reflex for milking wise comparison, Method of letdown reflex were classified into two groups, viz. Calf sucking and Hand stimulation The least squares means of milk composition and Somatic Cell Count of both buffalo breeds for this two methods of letdown reflex under field condition have been presented in Tables 16 and 18. The perusal of these results revealed that the mean values for milk composition and Somatic Cell Count did

not differ significantly for both breeds in buffalo in both methods of letdown reflex (Table 15.1 to 17.4).

The least squares means of milk Fat, Protein, lactose, SNF and SCC of Murrah buffalo in Calf sucking was 6.77 ± 0.781%, 3.02 ± 0.148%, 4.72 ± 0.175%, 8.41 ± 0.237% and 2.228 ± 0.381 lakh cells/ml and in Hand stimulation it was 7.16 ± 1.278%, 3.45 ± 0.242%, 4.91 ± 0.287%, 8.21 ± 0.389% and 1.826 ± 0.624 lakh cells/ml of milk.

The least squares means of milk Fat, Protein, lactose and SCC of Murrah-type buffalo in Calf sucking was 6.42 ± 1.158%, 3.34 ± 0.225%, 4.52 ± 1.176% and 2.010 ± 0.735 lakh cells/ml and in Hand stimulation it was 7.14 ± 1.174%, 3.19 ± 0.228%, 3.90 ± 1.231% and 3.397 ± 0.746 lakh cells/ml of milk.

Though the effect milking practices on milk composition and SCC was found not to be significant even though it was observed that among the three milking methods fat percentage (7.182) were highest in Full hand milking for Murrah buffalo. Fat percentages (7.105) were higher in method of concentrate feeding at time of milking. SCC was lower in Full hand method (1.899) of milking than Knuckling(2.351). Fat percentage (7.165) was higher and SCC (1.996) was lower in Intermittent milking method for drying than Incomplete milking for drying. Value for SCC (1.873) in Separate milking barn was lower than SCC (2.181) value of Common milking barn.

4.9 Effect of milking methods on milk composition and Somatic Cell Count

For the milking practices wise comparison, milking procedure was classified into three groups, viz. Full Hand, Knuckling and Both milking method.

The least squares means of milk composition and Somatic Cell Count of Murrah buffalo for this three milking methods have been presented in Table 16. The perusal of these results revealed that the mean values for milk composition and Somatic Cell Count did not differ significantly for both breeds in buffalo in two different milking methods (Table 15.1 to 17.4).

The least squares means of milk Fat, Protein, lactose, SNF and SCC of Murrah buffalo in full hand milking was 7.18 ± 0.763%, 3.35 ± 0.145%, 4.98 ± 0.172%, 8.56 ± 0.233%, and 1.899±0.373 lakh cells/ml and in knuckling it was 6.86 ± 1.133%, 3.36 ± 0.214%, 4.75 ± 0.254% 8.32 ± 0.344% and 2.351 ± 0.553 lakh cells/ml.

The least squares means of milk Fat, Protein, lactose and SCC of Murrah-type buffalo in full hand milking was 7.28 ± 1.397%, 3.65 ± 0.271%, 4.48 ± 1.3965% and 2.973 ± 0.887 lakh cells/ml and in knuckling it was 7.21 ± 1.678%, 3.95 ± 0.3264%, 3.98 ± 1.667%, and 2.878±1.066 lakh cells/ml.

4.10 Effect of Feeding at the time of milking on milk composition and Somatic Cell Count

For the feeding practices wise comparison, Feeding at the time of milking was classified into two groups, viz. Concentrate feeding and not feeding

The least squares means of milk composition and Somatic Cell Count of both buffalo breeds for this two feeding practices under field condition have been presented in Tables 16 and 18. The perusal of these results revealed that the mean values for milk composition and Somatic Cell Count did not differ significantly for both breeds in buffalo in both methods of feeding (Table 15.1 to 17.4). The least squares means of milk Fat, Protein, lactose, SNF and SCC of Murrah buffalo in Concentrate feeding was 7.10 ± 1.128%, 3.37 ± 0.213%, 4.88 ± 0.253%, 8.36 ± 0.342% and 1.933±0.551 lakh cells/ml lakh cells/ml and in not feeding it was 6.48 ± 0.861%, 3.16 ± 0.163%, 4.75 ± 0.193%, 8.26 ± 0.262% and 2.121±0.421 lakh cells/ml of milk.

The least squares means of milk Fat, Protein, lactose and SCC of Murrah-type buffalo in Concentrate feeding was 6.74 ± 1.182%, 3.56 ± 0.229%, 4.56 ± 0.229% and 2.514 ± 0.750 lakh cells/ml and in not feeding it was 7.13 ± 1.082%, 3.78 ± 0.210%, 4.94 ± 1.114% and 2.894 ± 0.687 lakh cells/ml of milk.

4.11 Effect of drying methods on milk composition and Somatic Cell Count

For the Drying methods wise comparison, Drying methods were classified into two groups, viz. Incomplete milking and Intermittent milking.

The least squares means of milk composition and Somatic Cell Count of both buffalo breeds for this two methods of drying under field condition have been presented in Tables 16 and 18. The perusal of these results revealed that the mean values for milk composition and Somatic Cell Count did not differ significantly for both breeds in buffalo in both methods of drying (Table 15.1 to 17.4).

The least squares means of milk Fat, Protein, lactose, SNF and SCC of Murrah buffalo in Incomplete milking was 6.62 ± 0.975%, 3.26 ± 0.185%, 4.73 ± 0.219%, 8.14 ± 0.296% and 2.088 ± 0.476 lakh cells/ml and in Intermittent milking it was 7.16 ± 1.031, 3.27 ± 0.195%, 4.90 ± 0.231%, 8.48 ± 0.313 and 1.966±0.504 lakh cells/ml of milk.

The least squares means of milk Fat, Protein, lactose and SCC of Murrah-type buffalo in for Methods of drying in Murrah-type buffalo was not estimated because of small sample size of Murrah-type buffalo the observations were not distributed in each subclass.

MILK COMPOSITIONAL CHANGES

Hogberg (2003) reported that lactation yield and milk composition depend on both genetic and non-genetic factors. The genetic influence is due to species, breed, and individual. Further, it is affected by ability to reproduce, e.g. fertility and thereby calving interval and he reported that the water, fat, protein, lactose and SNF in Murrah was 82.7%,7.1%, 4.6%,3.6% and 10.2%. In buffalo milk the average fat content is usually 7 to 8% but may be as high as 13% in some breeds. Whenever the udder is infected, milk compositional changes due to alteration of the membrane permeability within the mammary gland reduced synthesis of milk components . Process of filtering and synthesis of the various milk components are modified , which bring about imbalance in its composition .

Changes in filtering capacity of the glands leads to increase in soluble protein contents and some mineral elements like sodium, whereas , the reduced capacity of the udder for synthesis causes a reduction in lactose contents . Mastitic milk generally has lower SNF, Fat, Lactose and higher chloride ions and Ph. A 40% decrease in lactose content has been recorded at NDRI in mastitic milk in buffalo. Low Cell Count milk has higher yield of milk protein per unit volume than high cell milk because, as leucocytes enter the milk space , they also bring blood protein with them which replace milk proteins. Leucocytes are also a source of proteolytic and lipolytic enzyme, which depress the quality of milk products thus decreasing the acceptability of dairy products by consumers Dang and Mahendra (2001).

Table 1a

Milking Method	No. of observation	Percent
Full hand	56	84.84
Knuckling	10	15.16

Figure 1b

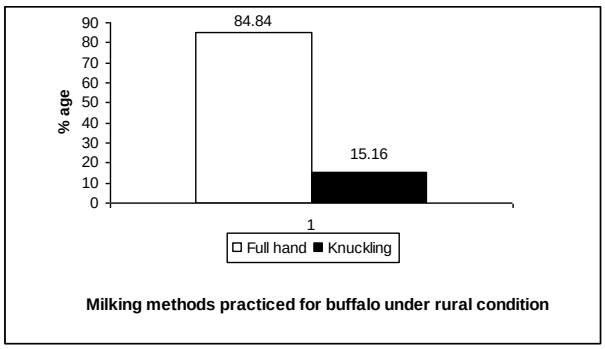

Table 1a and Figure 1b Percentage of farmers practicing different methods of milking buffaloes under village conditions

Table 2a

Feeding	No. of observation	Percentage
Conc.	21	31.94
None	45	68.06

Figure 2b

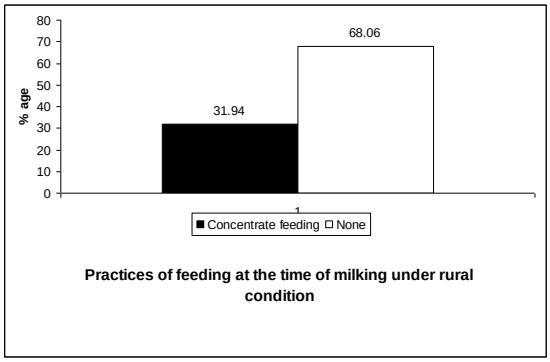

Table 2a and Figure 2b Percentage of farmers practicing feeding at the time of milking buffaloes under village conditions

Table 3a

Utensils	No of observation	Percent
Separate	60	91.67
Common	6	8.33

Figure 3b

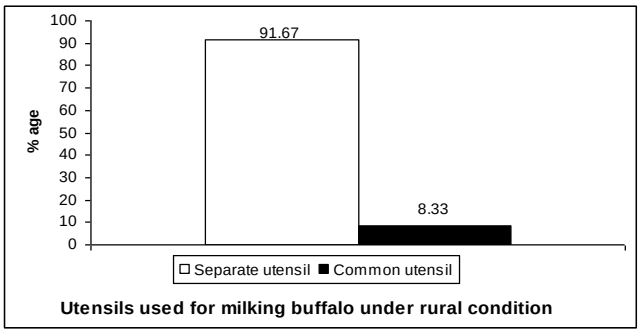

Table 3a and Figure 3b Percentage of farmers using separate/common utensils for milking buffaloes under village conditions

Table 4a

Washing 0f animal before milking	No of observations	Percentage
Regularly	47	70.83
Irregularly	19	29.17

Figure 4b

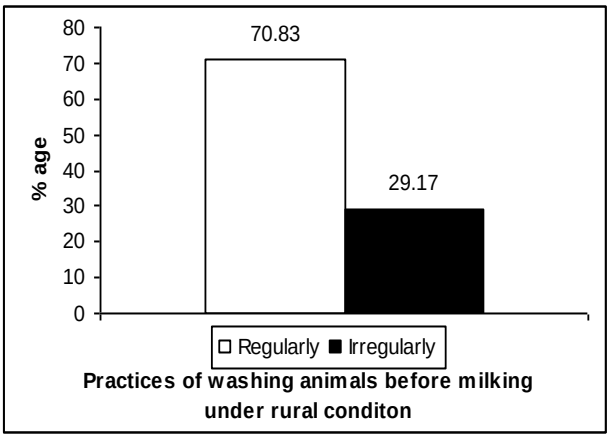

Table 4a and Figure 4b Percentage of farmers practicing animal washing before milking under village conditions

Table 5a

Type of milking barn	No of observations	Percentage
Separate	58	87.5
Common	8	12.5

Figure 5a

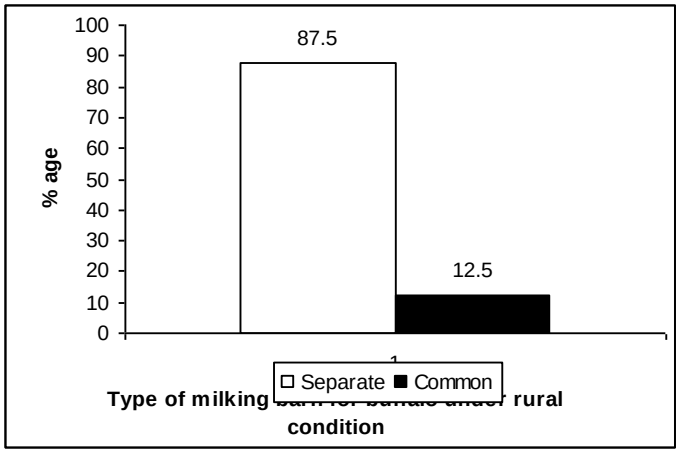

Table 5a and Figure 5b Different type of milking barn for buffaloes under village conditions

Table 6a

Letdown reflex	No of observations	Percent
Calf sucking	55	83.33
Hand stimulation	11	16.67

Figure 6a

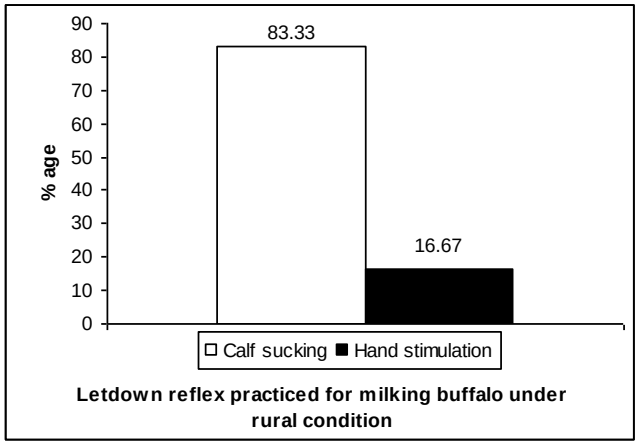

Table 6a and Figure 6b Percentage of farmers practicing letdown reflex for milking buffaloes under village conditions

Table 7a

Method of drying the animal	No of observation	Percent
Incomplete milking	54	81.94
Intermittent milking	12	18.06

Figure 7b

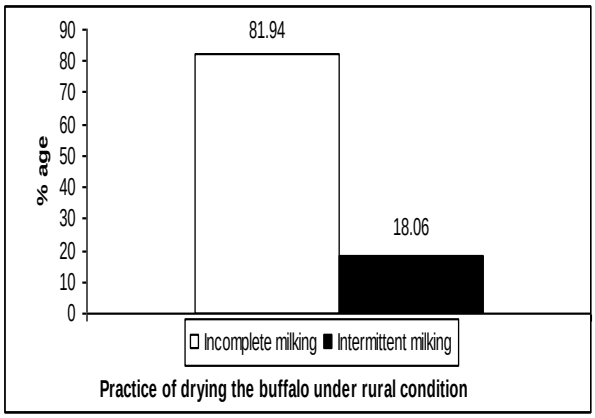

Table 7a and Figure 7b Percentage of farmers practicing method of drying of animal buffaloes under village conditions

Table 8a

Breed	No. of samples	Average yield in kg
Murrah	47	7.67
Murrah-type	19	6.53

Figure 8b

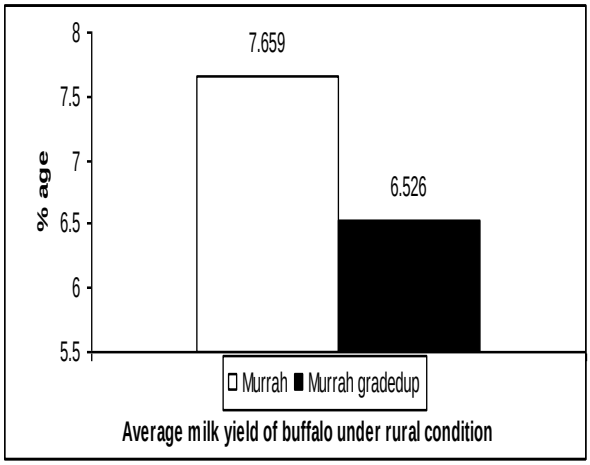

Table 8a and Figure 8b Average yield per animal breed wise buffaloes under village conditions

Figure 9a

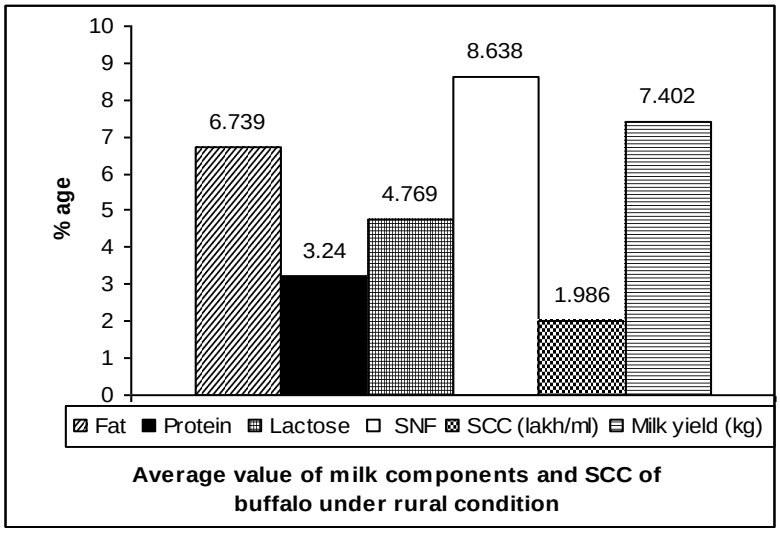

Table 9b

Milk Components	Fat%	Protein%	Lactose%	SNF%	SCC (lakh/ml)	Milk yield (kg)
Percent	6.739	3.240	4.769	8.638	1.986	7.402

Table 9a and Figure 9b Average value of milk components, SCC and milk yield for buffaloes under village conditions

Figure 10b

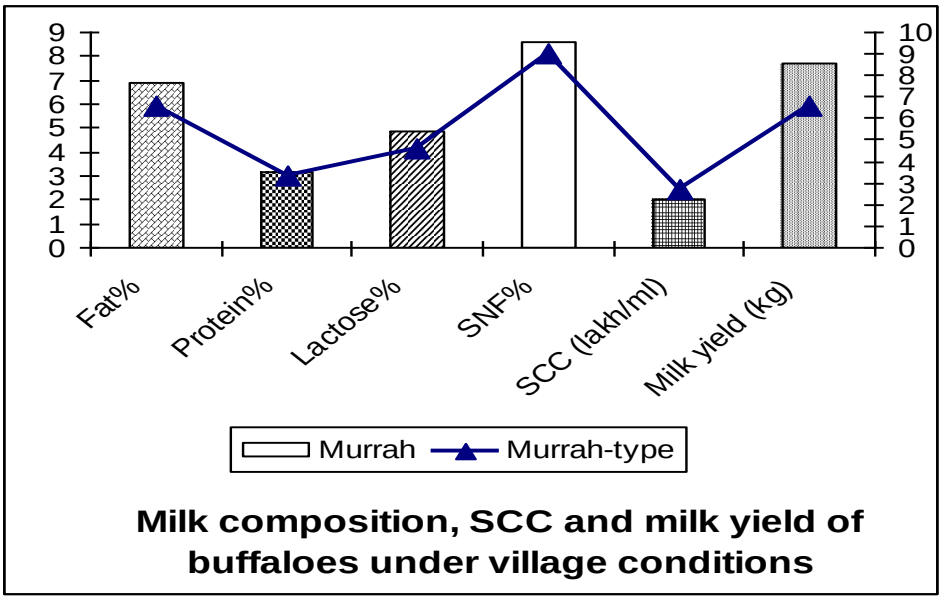

Table 10a

Milk Components	Fat %	Protein%	Lactose%	SNF%	SCC (lakh/ml)	Milk yield (kg)
Murrah	6.886	3.199	4.855	8.563	2.028	7.674
Murrah-type	6.589	3.352	4.632	8.982	2.704	6.534

Table 10a and Figure 10b Mean value of milk components and SCC under village area

Table 12: Least squares means (±SE) of milk components (Fat , Protein, Lactose and SNF) and somatic cell counts in different villages, stages of lactation, and parities in Murrah buffaloes(47) pooled for field conditions.

Factors	Fat %	Protein %	Lactose %	SNF %	SCC/ml of milk in lakhs
Murrah	6.748±0.341	3.232±0.680	4.825±0.829	8.501±0.113	2.250±0.175
VILLAGE					
Shekhpura	6.301±0.689	3.087±0.173	5.008±0.167	8.663±0.229	1.279^{a} ±0.353
Darar	8.219±0.680	3.275±0.157	4.847±0.165	8.683±0.261	1.704^{a} ±0.348
Rindal	6.771±0.788	3.293±0.146	4.861±0.192	8.573±0.217	2.194^{ac} ±0.403
Nagla	6.293±0.653	3.203±0.138	4.721±0.151	8.598±0.226	2.239^{ad}±0.334
Kurali	6.847±1.036	3.312±0.206	4.809±0.258	8.175±0.344	2.590^{ae}±0.530
Kheriman singh	6.056±0.728	3.222±0.145	4.706±0.176	8.345±0.241	3.496^{bcde}±0.372
Stage of lactation					
Early (0-90) days	6.347±0.544	3.028±0.180	4.517±0.132	8.105^{a} ±0.181	2.962^{a}±0.278
Mid (91-180) days	7.265±0.519	3.359±0.103	4.892±0.126	8.818^{bc}±0.172	1.678^{bc}±0.266
Late (181) to above days)	6.633±0.606	3.308±0.120	5.067±0.147	8.58^{ac}±0.201	2.112^{ac}±0.310
Parity					
1^{st}	6.716±0.547	3.146±0.109	4.773±0.133	8.524±0.181	2.238±0.280
2^{nd}	6.834±0.456	3.155±0.932	4.930±0.113	8.424±0.155	1.993±0.239
3^{rd}	6.901±0.564	3.227±0.140	4.926±0.171	8.567±0.233	1.914±0.360
4^{th}	6.541±0.953	3.399±0.187	4.673±0.228	8.492±0.311	2.858±0.480

Table-14 Least squares means (±SE) of milk components (Fat , Protein, Lactose & SNF) and somatic cell counts in different villages, stages of lactation, and parities for Murrah-type breed of buffalo pooled under rural conditions.

Factor	Fat %	Protein %	Lactose %	SNF %	SCC/ml of milk in lakhs
Murrah-type	6.566±0.471	3.301±0.157	4.585±0.095	9.300±0.333	1.930±0.339
VILLAGE					
Shekhpura	7.641±0.953	3.500±0.317	4.651±0.192	8.812^{a}±0.674	1.464±0.685
Darar	7.863±1.808	3.058±0.602	4.344±0.365	9.869^{ac}±1.279	1.065±1.300
Rindal	6.742±0.901	3.175±0.299	4.391±0.182	9.542^{ac}±0.637	2.996±0.647
Nagla	4.051±2.022	3.542±0.673	5.761±0.409	8.569^{ac}±1.431	2.248±1.454
Kurali	5.873±0.664	3.380±0.221	4.560±0.134	9.357^{ac}±0.469	2.200±0.477
Kheriman singh	7.226±0.947	3.147±0.315	3.794±0.191	9.661^{bc}±0.670	1.604±0.681
Stage of lactation					
Early (0-90) days	7.165±0.678	3.596±0.225	4.711±0.137	9.06±0.479	2.376±0.487
Mid (91-180) days	6.969±1.06	2.947±0.353	4.180±0.214	9.60±0.750	1.289±0.762
Late (181) to above days)	5.564±0.642	3.358±0.214	4.862±0.129	9.23±0.454	2.124±0.462
Parity					
1^{st}	4.805±0.811	3.314±0.270	4.675±0.164	8.416±0.574	3.369±0.584
2^{nd}	7.297±0.681	3.313±0.226	4.808±0.136	8.791±0.482	0.868±0.490
3^{rd}	4.053±1.21.	3.262±0.406	4.768±0.242	10.115±0.863	3.546±0.887
4^{th}	10.125±1.54	3.313±0.513	4.086±0.311	9.879±1.091	0.648±1.109

Means with similar superscripts do not differ significantly (P<0.01) from each other.

Table 16: Least squares means (±SE) of milk components (Fat , Protein, Lactose & SNF) and somatic cell counts in different in different milking practices in Murrah buffaloes pooled for field conditions.

Factors	Fat %	Protein %	Lactose %	SNF %	SCC/ml of milk in lakhs
Murrah	6.886±0.939	3.268±0.178	4.819±0.211	8.314±0.285	2.028±0.459
Milking methods					
Full hand	7.182±0.763	3.335±0.145	4.988±0.172	8.576±0.233	1.899±0.373
Knuckling	6.864±1.133	3.356±0.214	4.753±0.254	8.323±0.344	2.351±0.553
Feeding					
Conc.	7.105±1.128	3.374±0.213	4.888±0.253	8.366±0.342	1.933±0.551
None	6.486±0.861	3.164±0.163	4.751±0.193	8.263±0.262	2.121±0.421
Methods for drying of buffalo					
Incomplt	6.624±0.975	3.267±0.185	4.736±0.219	8.147±0.296	2.088±0.476
Intremtt	7.165±1.031	3.271±0.195	4.903±0.231	8.481±0.313	1.966±0.504
Utensil					
Separate	6.896±0.695	3.259±0.132	4.850±0.156	8.453±0.211	1.891±0.339
Common	6.975±1.399	3.279±0.265	4.789±0.314	8.176±0.425	2.163±0.683
Washing of animal					
Regularly	6.449±1.077	3.283±0.204	4.774±0.241	8.255±0.327	1.959±0.526
Irregularly	7.143±0.939	3.254±0.178	4.865±0.210	8.274±0.285	2.094±0.459
Milking barn					
Separate	6.947±0.936	3.341±0.177	4.892±0.210	8.272±0.284	1.873±0.457
Common	6.645±1.119	3.197±0.212	4.747±0.251	8.357±0.340	2.181±0.547
Letdown reflex					
Calf sucking	6.775±0.781	3.028±0.148	4.720±0.175	8.411±0.237	2.228±0.381
Hand	7.116±1.278	3.455±0.242	4.919±0.287	8.217±0.389	1.826±0.624

Table 18: Least squares means (±SE) of milk components (Fat , Protein, Lactose & SNF) and somatic cell counts in different in different milking practices in Murrah-type buffalo pooled for rural conditions.

Factors	Fat %	Protein %	Lactose %	SCC/ml of milk in lakhs
Murrah-type	6.983±0.438	3.675±0.	4.618±1.012	2.704±0.646
Milking methods				
Full hand	6.768±1.397	3.615±0.271	4.486±1.396	2.973±0.887
Knuckling	7.217±1.678	3.953±0.326	3.985±1.667	2.878±1.066
Feeding				
Conc.	6.745±1.182	3.563±0.229	4.293±1.183	2.514±0.750
None	7.134±1.082	3.786±0.210	4.942±1.114	2.894±0.687
Utensil				
	Fat %	**Protein %**	**Lactose %**	**SCC/ml of milk in lakhs**
Separate	7.385±0.934	3.562±0.181	3.983±0.928	2.169±0.593
Common	6.683±1.967	3.787±0.382	4.252±1.956	3.239±1.249
Washing of animal				
Regularly	6.455±1.028	3.694±0.200	4.083±1.023	2.554±0.653
Irregularly	7.113±1.249	3.654±0.241	4.151±1.250	2.853±0.787
Milking barn				
Separate	6.733±0.872	3.544±0.169	4.889±0.938	2.635±0.553
Common	7.234±1.508	3.805±0.293	4.346±1.512	2.772±0.958
Letdown reflex				
Calf sucking	6.427±1.158	3.341±0.225	4.529±1.176	2.010±0.735
Hand	7.140±1.174	3.197±0.228	3.905±1.231	3.397±0.746

Table 15.1 Least square analysis of variance showing the effect of milking practices on FAT in milk of Murrah buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.182^{NS}
Feeding	1	1.154^{NS}
Drying	1	7.077^{NS}
Utensil	1	1.861^{NS}
Washing of animal	1	0.670^{NS}
Milking barn	1	9.183^{NS}
Letdown reflex	1	4.454^{NS}
Error	38	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 15.2 Least square analysis of variance showing the effect of milking practices on PROTEIN in milk of buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.693^{NS}
Feeding	1	0.352^{NS}
Drying	1	0.117^{NS}
Utensil	1	0.112^{NS}
Washing of animal	1	0.604^{NS}
Milking barn	1	0.113^{NS}
Letdown reflex	1	0.570^{NS}
Error	38	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 15.3 Least square analysis of variance showing the effect of milking practices on LACTOSE in milk of buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.205 ^{NS}
Feeding	1	0.148 ^{NS}
Drying	1	0.219 ^{NS}
Utensil	1	0.011 ^{NS}
Washing of animal	1	0.057 ^{NS}
Milking barn	1	0.114 ^{NS}
Letdown reflex	1	0.162 ^{NS}
Error	38	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 15.4 Least square analysis of variance showing the effect of milking practices on SNF in milk of buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.466 ^{NS}
Feeding	1	0.833 ^{NS}
Drying	1	0.888 ^{NS}
Utensil	1	0.224 ^{NS}
Washing of animal	1	0.101 ^{NS}
Milking barn	1	0.392 ^{NS}
Letdown reflex	1	0.153 ^{NS}
Error	38	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 15.5 Least square analysis of variance showing the effect of milking practices on SCC in milk of buffaloes.

Source of variation	**d.f.**	**Mean Sum Square**
Milking methods	1	0.579 ^{NS}
Feeding	1	0.282 ^{NS}
Drying	1	0.118 ^{NS}
Utensil	1	0.216 ^{NS}
Washing of animal	1	0.129 ^{NS}
Milking barn	1	0.514 ^{NS}
Letdown reflex	1	0.664 ^{NS}
Error	38	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 17.1 Least square analysis of variance showing the effect of milking practices on FAT in milk of Murrah-type buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.072 ^{NS}
Feeding	1	0.261 ^{NS}
Utensil	1	0.196 ^{NS}
Washing of animal	1	0.323 ^{NS}
Milking barn	1	1.805 ^{NS}
Letdown reflex	1	6.488 ^{NS}
Error	11	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 17.2 Least square analysis of variance showing the effect of milking practices on PROTEIN in milk of Murrah-type buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.140 ^{NS}
Feeding	1	0.142 ^{NS}
Utensil	1	0.027 ^{NS}
Washing of animal	1	0.004 ^{NS}
Milking barn	1	0.101 ^{NS}
Letdown reflex	1	0.476 ^{NS}
Error	11	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 17.3Least square analysis of variance showing the effect of milking practices on LACTOSE in milk of Murrah-type buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.273 ^{NS}
Feeding	1	0.010 ^{NS}
Utensil	1	0.868 ^{NS}
Washing of animal	1	2.896 ^{NS}
Milking barn	1	0.374 ^{NS}
Letdown reflex	1	0.052 ^{NS}
Error	11	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 17.4 Least square analysis of variance showing the effect of milking practices on SCC in milk of Murrah-type buffaloes.

Source of variation	d.f.	Mean Sum Square
Milking methods	1	0.183 ^{NS}
Feeding	1	0.417 ^{NS}
Utensil	1	0.618 ^{NS}
Washing of animal	1	0.247 ^{NS}
Milking barn	1	0.028 ^{NS}
Letdown reflex	1	4.258 ^{NS}
Error	11	

Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table11.1Least square analysis of variance showing the effect of village, lactation stage and parity on FAT of Murrah buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	4.859 ^{NS}
Stage of lactation	2	3.368 ^{NS}
Parity	3	0.143 ^{NS}
Error	36	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 11.2Least square analysis of variance showing the effect of village, lactation stage and parity on PROTEIN of Murrah buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	0.044 ^{NS}
Stage of lactation	2	0.435 ^{NS}
Parity	3	0.782 ^{NS}
Error	36	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table11.3 Least square analysis of variance showing the effect of village, lactation stage and parity on LACTOSE of Murrah buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	0.933 ^{NS}
Stage of lactation	2	0.928**
Parity	3	0.113 ^{NS}
Error	36	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table11.4 Least square analysis of variance showing the effect of village, lactation stage and parity on SNF of Murrah buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	0.199 ^{NS}
Stage of lactation	2	1.908**
Parity	3	0.457 ^{NS}
Error	36	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table11.5 Least square analysis of variance showing the effect of village, lactation stage and parity on SCC of buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	4.215**
Stage of lactation	2	6.157**
Parity	3	0.969 ^{NS}
Error	36	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 13.1 Least square analysis of variance showing the effect of Village, Lactation stage & Parity on FAT of Murrah-type buffaloes.

Source of variation	**d.f.**	**Mean Sum Square**
Village	5	1.254 ^{NS}
Stage of lactation	2	3.179 ^{NS}
Parity	3	6.664 ^{NS}
Error	8	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 13.2 Least square analysis of variance showing the effect of Village, Lactation stage & Parity on PROTEIN of Murrah-type buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	0.041 ^{NS}
Stage of lactation	2	0.250 ^{NS}
Parity	3	0.011 ^{NS}
Error	8	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 13.3 Least square analysis of variance showing the effect of Village, Lactation stage & Parity on LACTOSE in Murrah-type milk of buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	0.363*
Stage of lactation	2	0.266 ^{NS}
Parity	3	0.132 ^{NS}
Error	8	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 13.4 Least square analysis of variance showing the effect of Village, Lactation stage & Parity on SNF of Murrah-type buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	0.250 ^{NS}
Stage of lactation	2	0.170 ^{NS}
Parity	3	1.382 ^{NS}
Error	8	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

Table 13.5 Least square analysis of variance showing the effect of Villages, Lactation stage & Parity on SCC of Murrah-type buffaloes.

Source of variation	d.f.	Mean Sum Square
Village	5	1.008 ^{NS}
Stage of lactation	2	0.681 ^{NS}
Parity	3	4.567*
Error	8	

*Significant (P<0.05), **Significant (P<0.01), NS-Non Significant

From above table it is indicated that **villages have signi**ficant effect on SCC of milk.DMRT has been done to find out the difference in means of subclasses and it was observed that there is there no significant difference within the means of subclasses of **villages** effect on SCC of milk.

Figure 19b

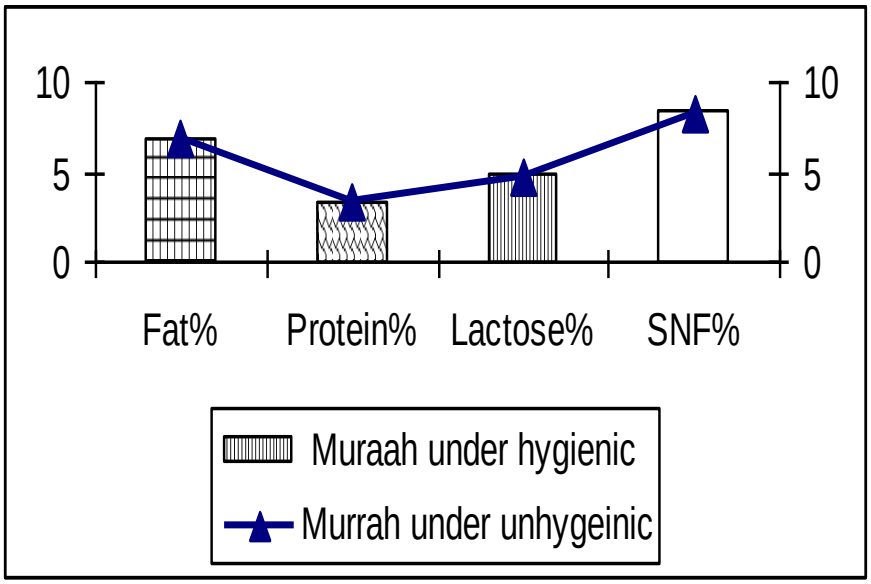

Figure 19b Mean value of milk components of murrah buffalo under village conditions

Table 19a

Mean value of Milk components (%)	Fat	Protein	Lactose	SNF
Muraah under hygienic	6.87	3.34	4.87	8.38
Murrah under unhygeinic	6.91	3.37	4.78	8.28

Table 19a Mean value of milk components of murrah buffalo under village conditions

Figure 20b

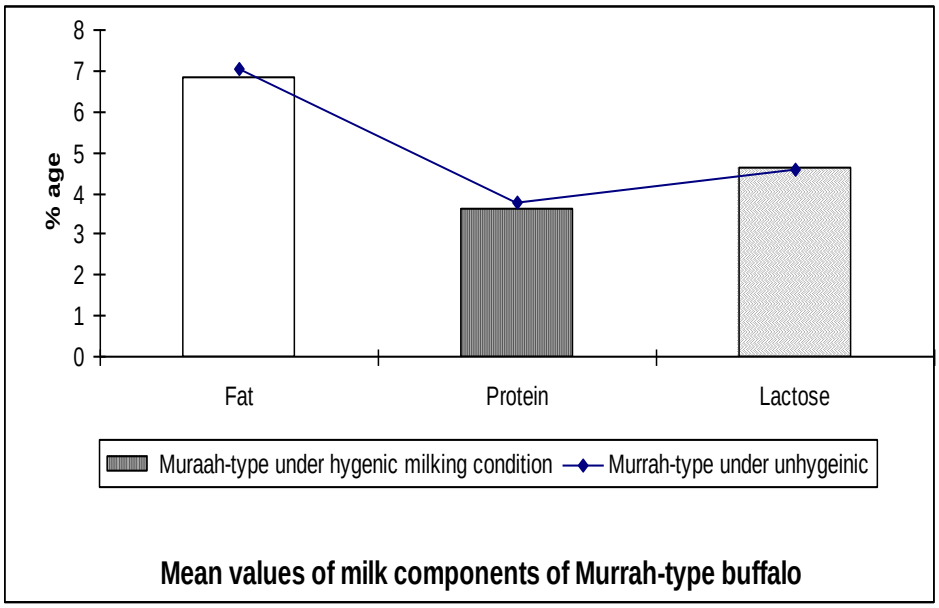

Figure 20b Mean value of milk components of Murrah and Murrah-type buffalo under village conditions

Table 20a

Mean value of milk componants	Fat	Protein	Lactose
Muraah-type under hygenic milking condition	6.84	3.6	4.61
Murrah-type under unhygeinic	7.06	3.79	4.58

Table 20a Mean value of milk components of Murrah and Murrah-type buffalo under village conditions

Table 21a

SCC of Murrah buffalo under rural conditions	lakh cells/ ml
Hygienic condition	1.905
Unhygienic condition	2.197

Figure 21b

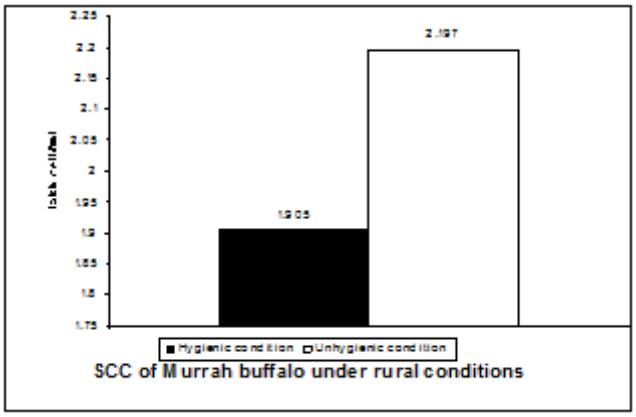

Table 21a and Figure 21b Mean values of SCC of Murrah buffalo under village conditions

Table 22a

SCC of Murrah buffalo under rural conditions	Lakh cells/ ml
Hygienic condition	2.582
Unhygienic condition	2.935

Figure 22b

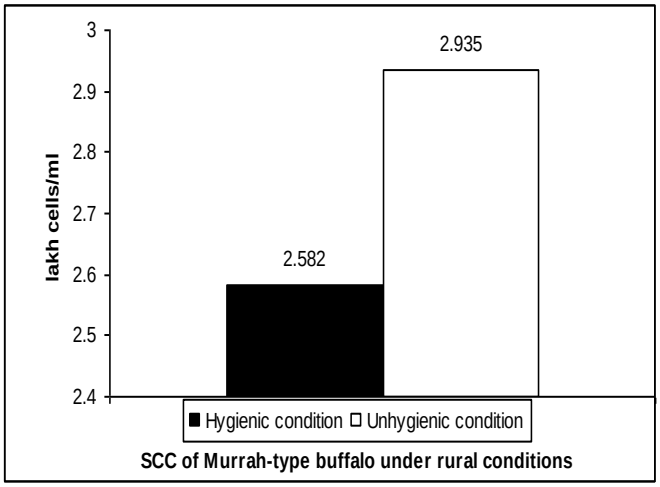

Table 22a and Figure 22b Mean values of SCC of Murrah-type buffalo under village conditions

5. SUMMARY AND CONCLUSIONS

The main objective of the present study was to study the milking management practices followed by farmers under village conditions. Six villages were selected nearby Karnal district and from each village 11 milk samples were collected in clean dry and sterile container at the time of milking and brought to laboratory in a cold container. Milk samples were tested within one hour of collection. The percentage value of fat, protein, lactose and SNF were recorded by milk analyzer and SCC was counted microscopically. The questionnaire pertaining to milking management practices was prepared and asked during sample collection. Visual observation of milking practices was recorded at the time of milking. The most common management practices followed by almost all farmers were semi-intensive housing with Pucca floor. Farmers were washing their hands, utensils and udder of animal before milking. Frequency of milking was two times per day in morning and evening. Farmers with less than 3 kg of milk production per day mostly used their milk for home consumption. More than 70% village households have adopted regular washing of their animal before milking, udder washing, full hand milking method, calf sucking as milk letdown reflex, milking at a separate dry place to maintain the quality and nutritive value of milk through clean milk production in the villages of Karnal district. Clean milking practices like teat dipping, washing of udder after milking, screening of udder for mastitis, culling of problem buffalo and dry cow treatment therapy were not reported by farmers.

The average milk production of buffalo in village areas was 7.420 ± 0.437 kg. The average milk production for Murrah breed was observed to be 7.674 ± 0.532 kg, and for Murrah-type breed 6.534 ± 0.687 kg.

Least Square Analysis of Variance was run for two breeds separately. Results pertaining to the Murrah breed revealed that the effect of village on SCC was found to be significant ($P<0.05$), and the effect of stages of lactation on Lactose, SNF and SCC was also found to be significant ($P<0.05$). Results pertaining to the Murrah-type breed revealed that the effect of village on lactose

was significant and effect of parity on SCC was found to be highly significant *(P<0.01)*. So data pertaining to the Lactose, SNF and SCC were adjusted to estimate the effect of milking management practies on milk composition and SCC. The separate Least Square Model was run for both breeds. Results pertaining to the effect of milking practices on milk composition and SCC were found not to be significant in both breeds. The milking practices like milking methods, concentrate feeding at the time of milking, washing of animal before milking, type of milking barn, method of drying, type of utensils used for milking and method for milk letdown reflex were considered as milking management practices under village conditions.

The Least Square mean of Fat, Protein, Lactose, SNF and SCC were 6.88 ± 0.939%, 3.26 ± 0.178%, 4.81 ± 0.211%, 8.314±0.285 for 2.028±0.459 lakh cells/ml for Murrah buffalo. The Least Square mean of Fat, Protein, Lactose and SCC were 6.98 ± 0.438%, 3.67 ± 0.429%, 4.68 ± 1.012% and 2.704±0.646 lakh cells/ml for Muraah-type buffalo.

Though the effect of milking practices on milk composition and SCC was found not to be significant even though it was observed that among the milking methods fat percentage (7.182) were highest in Full hand milking for Murrah buffalo. Mean value of fat percentage (7.105) was higher in method of concentrate feeding at time of milking. Mean value of SCC was lower in Full hand method (1.899 lakh cells/ml) of milking than Knuckling (2.351 lakh cells/ml). Mean value of fat percentage (7.165) was higher and SCC (1.996 lakh cells/ml) was lower in Intermittent milking method for drying than Incomplete milking for drying. Mean value for SCC (1.873 lakh cells/ml) in Separate milking barn was lower than Mean value of SCC (2.181 lakh cells/ml) Common milking barn.

CONCLUSIONS

1. Clean milking practices like washing of animals, hands, utensils, udder before milking and full hand method of milking at a separate place were practiced by more than 70% of village households.

2. Clean milking practices like screening of udder, washing of udder after milking and teat dipping was not practiced under village conditions.
3. Effect of milking practices on milk composition was not significant but Fat, Protein, Lactose and SNF were higher under hygienic milking condition.
4. Milk somatic cell count was found to be significantly lower under hygienic conditions.

On the basis of this investigation, it is emphasized that advanced milking practices like teat dipping, washing udder after milking, dry cow therapy may be followed by farmers for clean milk production under village conditions and extensive studies on a large scale may be undertaken to determine the effect of milking practices on milk compositions and somatic cell.

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