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A COMPARATIVE STUDY OF CHEMICAL QUALITIES OF RAW MILK OF COW AND SHEEP

[1]Poonam Sharma, [2]Dr. U.K. Shukla, [3]Anoop Shukla

[1]Department Of Fnimal Science and Fisheries, AKS Univeristy Satna (MP)
[2]Livestock Production and Management, Faculty of Agriculture, Mahatma Gandhi Chitrakoot GramodayaVishwavidyalaya, Chitrakoot, Satna,
[3]Department of Agriculture Extension EducationAKS Univeristy Satna (MP)

ABSTRACT

A comparative study of chemical qualities of raw milk of cow and sheep was conducted at Livestock production and management (unit), Department of NRM, faculty of agriculture, MGCGV Chitrakoot–Satna (M.P.) during January, 2020. The objective was to find out the comparative chemical qualities of raw milk of cow and sheep for three animal each viz. cow and goat for ten days as replication different parameter were subject to statistical analysis applying the technique of analysis of variance (f-test) the most widely used method for determining protein content by kjeldahi method for nitrogen determination since nitrogen is a characteristic can be finding. In view of the finding and results presented above, it may be concluded that the chemical quality of milk of cow was superior tosheep milk, due to higher protein, specific gravity, fat content, lactose, total solid and solid not fat and lower ash and water content in cow milk.

Key Words: Raw milk, chemical quality, Cow and sheep.

INTRODUCTION

Bovine milk and dairy products have been part of the human diet, from birth to old age, for millennia. However, beyond its nutritional role, milk is the subject of active research aimed at elucidating the relationship between its consumption and human health. In order to summarize the current scientific evidence, NFI–Nutrition Foundation of Italy convened a panel of experts and representatives of Italian medical and nutritional scientific societies, who discussed the available scientific evidence concerning cow's milk nutrient composition, its technological and safety aspects, its nutritional role across age groups and in physiological conditions, and the possible relationship between milk consumption and specific diseases and disease risk factors.**(Muehlhoff E. et al., 2013).**

Compositionofmilk of every mammalian species is unique in its sense and specifically designed in order to meet the requirements of that particular mammal species. It is very likely that the milk of one species may not suit the requirements of another species and even be harmful to them.

Humans, not only the infants but also the adults, are the only species that drink the milk of another species, particularly cow's milk. **(Sudith C Juskerich and Grey Guyer C,1990)**

The health and hygiene of the cow, the environment in which the cow is housed and milked, and the procedures used in cleaning and sanitizing the milking and storage equipment are all key in influencing the level of microbial contamination of raw milk. Raw milk quality remains an important component in assessing the performance of dairy chains. It is generally based on chemical components fat; SNF and protein contents which are influenced as a result of feeding practices **(Demeyer and Doreau, 1999)** breed and lactation stage **(Kelsey et al., 2003).** Fat and protein contents are key elements affecting the possible uses of milk. The most important factor in milk is its safety. **(Jayarao et al., 2004).** observed that milk producers and cooperatives viewed bulk milk tank (BMT) analysis as an important part of milk quality assurance program. Besides, **(Bonfoh et al., 2003).** Despite of nourishing and wholesome effect of milk, bad quality of milk i.e. milk produced and handled under unhygienic condition can be source of number of diseases. In some cases, milk may be rendered dangerous and may be the cause of serious hazards to human life. Therefore it is very essential to control production, processing and marketing of milk all stages **(Yadav et al.,1993).**

Cow's milk naturally contains the large amount of protein needed for her calf. That amount of protein is not only unnecessary but unhealthy for humans. Excess protein in our diets causes calcium to leach out of our bones. This can be a cause of osteoporosis. Studies have also shown that there are certain proteins in cow's milk which acts as allergen particularly to breast fed infants. These allergens cause hypersensitivity reactions, lymphadenopathy and hepato-splenomegaly. Studies have revealed that more than 100 distinct antigens are released by digestion of cows' milk which stimulates humoral responses and formation of different antibodies.The common problems in children are GIT disorders, acute gastrointestinal blood loss, milk borne infections, lack of minerals, abdominal pain, bedwetting, asthma, intestinal bleeding, colic and diabetes. **(Ziegler EE. et al., 1990).**

Along with this milk from infected cows may contain pus and blood. Milk also gets contaminated during milking with dirty hands of milkers and faecal material from the tail and perineum leading to heavy bacterial contaminations. Salmonella, E. coli, and Staphylococcus infections can be traced easily in milk. After milking the milk is kept for long time before being distributed and utilized by consumers. At this room temperature the number of bacteria in milk multiply rapidly, increase in number and the milk quickly rottens. Few of them even survive pasteurization. Example being the Mycobacterium paratuberculosis avium (etiological agent for Johne's diseases in animals) can cause Crohon's disease in humans (needs further study for its establishment) and Mycobacterium tuberculosis which cause tuberculosis in humans. (**Am J Epidemiol, 1989).**

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Sheep milk is also important in the Near East and North Africa, with 7.5% production, and somewhat less important in sub-Saharan Africa (5.6%) and East and Southeast Asia (3.9%). Milk production by small ruminants, including sheep and goats, has grown over the years and is now in search of new consumer markets.**(Selvaggi et al., 2014).**

In Europe, sheep milk production was approximately 9.1 million tons in 2009, but its consumption in liquid form is rare**(Tamime et al., 2011).** Currently, sheep milk is considered a delicacy in many countries, including the United States. Therefore, sheep dairy products have gained market size due to the product's quality, high yield, and nutritional value; the high nutritional value is due to the higher concentrations of proteins, fats, vitamins, and minerals when compared to the milks from other domesticated mammals.**(Park et al., 2007; Milani and Wendorff, 2011).**

Sheep milk is mainly used for the production of fine cheese varieties, yogurt, and whey cheeses**(Haenlein and Wendorff, 2006).**The high levels of protein, fat, and calcium by casein unit make it an excellent matrix for cheese production**(Moatsou et al., 2004; Barłowska et al., 2011**).Even though sheep milk production is booming, from the livestock point of view, sheep milk does not have as high a production yield as cow and goat milk due to seasonality**(Albenzio at al., 2016).** Thus, medium-and small-sized sheep milk farms freeze the raw milk as a way to accumulate enough amount milk for processing into dairy products**(Milani and Wendorff, 2011).**Sheep milk frozen at −27 °C preserves protein stability for up to 12 mo of storage. However, to maintain the high quality of sheep milk, it must be rapidly frozen and stored at temperatures below −20 °C **(Wendorff, 2001).**

Raw milk has not been pasteurized or homogenized.It primarily comes from cows but also goats, sheep, buffalos or even camels.It can be used to make a variety of products, including cheese, yogurt and ice cream.An estimated 3.4% of Americans drink raw milk regularly **(Caroline Hill and MHumNutr, 2018).**

MATERIALS AND METHODS

DURATION AND PLACE OF STUDY-

The period of experiment was one month (January- April, 2020). Milk was collected at the Mini Dairy Farm Rajola Livestock Production and Management (Unit), Department of Natural resource management (NRM), Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot – Satna (Madhya Pradesh).

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COLLECTION OF SAMPLE

The objective was to find out the comparative chemical qualities of raw milk of Cow and sheep for three animal each viz. cow and sheep for ten days as replication different parameter were subject to statistical analysis applying the technique of analysis of variance (f-test) the most widely used method for determining protein content by kjeldahi method for nitrogen determination since nitrogen is a characteristic can be finding.

DISTRIBUTION OF COW AND SHEEP

Cow no.: 70,80,90
Sheep no.: 111,112,113

Cow			**Sheep**		
C_1	**C_2**	**C_3**	**S_4**	**S_5**	**S_6**
70	80	90	111	112	113

Determination of Protein

Add to the clean and dry Kjeldahl flask, 5-10 boiling aids, 15g K_2SO_4, 1.0ml of the copper sulphate solution, approximately 5±0.1 g of prepared milk sample (or milk product sample containing equipment amount of protein), weighed to the nearest 0.1mg, and add 25ml of concentrated sulphuric acid. Use the 25ml acid also to wash down any copper sulphate solution, K_2SO_4 or milk left on the neck of the flask. Gently mix the contents of the Kjeldahl flask. Titrate the boric acid receiving solution with standard hydrochloric acid solution (0.1 N) to the first trace of pink colour. Take the burette reading to at least the nearest 0.05ml. A lighted stir plate plate may aid visualization of the end point.

Calculate the nitrogen content, expressed as a percentage by mass, by following formula-

$$Wn = \frac{1.4007 \text{ X } (Vs - Vb) \text{ X } N}{W}$$

Wn = nitrogen content of sample, expressed as a percentage by mass;

VS = Volume in ml of the standard hydrochloric acid used for sample;

VB = Volume in ml of the standard hydrochloric acid used for blank test;

N = Normality of the standard hydrochloric acid expressed to four decimal places;

W = mass of test portion in g, expressed to nearest 0.1 mg.

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Specific Gravity

The specific gravity of milk were determined by lactometer.

Determination of Fat

The milk is mixed with sulphuric acid and iso-amyl alcohol in a special Gerber tube, permitting dissolution of the protein and release of fat. The tubes are centrifuged and the fat rising into the calibrated part of the tube is measured as a percentage of the fat content of the milk sample. The method is suitable as a routine or screening test. It is an empirical method and reproducible results can be obtained if procedure is followed correctly.

Measure 10 ml of sulphuric acid into a butyrometer tube, preferably by use of an automatic dispenser, without wetting the neck of the tube. Mix the milk sample gently but thoroughly and fill the milk pipette above the graduation line. Wipe the outside of the pipette and allow the milk level to fall so that the top of meniscus is level with the mark. Run the milk into the butyrometer tube along the side wall without wetting the neck, leave to drain for three seconds and touch the pipette's tip once against the base of the neck of the butyrometer tube. Add 1 ml of Amyl alcohol, close with a lock stopper, shake until homogeneous, inverting it for complete admixture of the acid. Keep in a water bath for 5 min. at 65±2 ^{0}C taking care to have casein particles if any to dissolve fully, and centrifuge for 4 min. at 1100 rpm. The tubes should be put in centrifuge, so as to conform to radial symmetry, and as evenly spaced as possible, in order to protect bearings of the centrifuge. Allow the centrifuge to come to rest. Remove the butyrometer tubes and place in water bath for 5 min. at 65±2 ^{0}C. Read the percentage of fat after adjusting the height in the tube as necessary by movements of the lock stopper with the key. Note the scale reading corresponding to the lowest point of the fat meniscus and the surface of separation of the fat and acid. When readings are being taken hold the butyrometer with the graduated portion vertical, keep the point being read in level with the eye, and then read the butyrometer to the nearest half of the smallest scale division.

Determination of Lactose

Pipette 5 ml each of working standard lactose and unknown solution into 25 ml test tubes. Add 5 ml of glycine NaOH buffer, 0.5 ml of methylamine solution and 0.5 ml of sodium sulphite solution in each tube, mix thoroughly. Heat tubes in a thermostatically controlled water bath at 65 ^{0}C for 25 min. and cool immediately in an ice water bath for 2 min. to stop the reaction. Read absorbance against blank at 540 nm in a spectrophotometer or a suitable spectrophotometer. Draw a standard curve by plotting absorbance against concentration of lactose and determine the concentration of lactose from it.

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Determination of Ash

Weigh accurately about 3 g of the dried milk sample in the crucible, previously dried in a hot air oven and weighed. Heat the crucible gently on a burner or hot plate at 20 ^{0}C till grey ash is obtained. cool±first and then strongly in a muffle furnace at 550 20^{0}C for 30±the crucible in a desiccators and weigh. Repeat this process again at 550 min. Cool the crucible in a desiccators and weigh. Repeat this process of heating for 30 min, cooling and weighing until the difference between two successive weighing is less than 1 mg. Record the lowest mass.

$$\text{Total Ash} = \frac{(M2-M)}{(100-Mo)\ X\ (M1-M)}$$

Where,

M2 = mass in g, of the crucible with ash;

M = mass in g, of the empty crucible;

M1 = mass in g, of the crucible with the material taken for the test; and

M0 = moisture, % by mass, calculated as per the method for dried milk.

Determination of total solid

Heat a dish containing about 20g of the sand with its lid alongside and a stirring rod on top of the lid, in a hot air oven at 102 ± 2 ^{0}C for about 1 h. B. Place the lid (with the stirring rod on the top) on the dish, immediately transfer the dish to the desiccator, allow to cool for at least 45 min, and weigh the dish with lid and rod to the nearest 0.1mg. Tilt the sand to one side of the prepared dish, place on the clear space 2.0 g of the prepared test sample of condensed milk, replace the lid with the stirring rod on top and weigh the dish to the nearest 0.1 mg. Add 5 ml of distilled water to the test portion in the dish and mix with the stirring rod. Thoroughly mix together the diluted test portion and the sand, and spread the mixture evenly over the bottom of the dish. Leave the stirring end of the rod in the mixture with the other end resting on the rim of the dish. Heat the dish on a boiling water-bath, with as much as possible of the bottom of the dish exposed to steam, for approximately 30 min stirring the mixture frequently in the early stages of drying so that the mixture is well aerated and becomes crumbly. Lay the stirring rod flat inside the dish, dry the bottom of the dish and heat the dish, with its lid alongside, in a hot air over maintained at 102 ± 2 ^{0}C for 4 h. Place the lid on the dish, allow the dish to cool in the desiccators and weigh to the nearest 0.1mg. Repeat the above operations described above (heating the dish for 1 h) until the difference in mass between two successive weighing does not exceed 0.5mg. Record the lowest mass-

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Total Solids % by mass = $\frac{(M2-M)}{(M1-M)}$ X 100

Where,

M = mass in g, of the dish, lid and stirring rod;

M1 = mass in g, of the dish, lid, stirring rod and test portion; and

M2 = in g, of the dish, lid, stirring rod and dried test portion.

Determination of water:-

Water percent

Water percent = 100-T.S.

Where,

T.S. = Total Solids

Determination Solid Not Fat

Pipette 10 ml of reconstituted milk into each porcelain dish. To one dish, add 1 ml of working solution of rosaniline acetate or cobalt sulphate solution and stir with a glass rod. This solution will be external end point references. To the other porcelain dish add 1 ml of phenolphthalein solution and titrate with 0.1 N sodium hydroxide, stirring to mix the sample. Continue titration until the colour is comparable to the reference solution.

Determine solid not fat in the sample by deducting moisture and milk fat and calculate acidity in terms of ml of 0.1N NaOH/ 10g Milk solids not Fat as per requirement ofFSSAI Rule as shown below:

$$\frac{\text{volume of 0.1 NaOH x 100 x 100 x 10}}{\text{Weight of MSNF x Weight of sample}}$$

RESULT AND DISCUSSION

(1) Protein (%)

Table 1.0 and Fig. 1.0 furnish the data on protein percentage in raw milk of Cow and Sheep. The results obtained showed that Cow and Sheep registered mean protein percentage as 3.89, 3.93, 3.85 (overall 3.89) and 4.64, 4.69, 4.78 (overall 4.70), respectively. The difference in the values due to animals was significant. Due to replication the difference was significant in Cow and non-significant Sheep milk. The Protein percentage was higher in Sheep milk in comparison to Cow milk.

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Table 1.0 Protein (%) in Cow and Sheep milk

Sl. No.	Replica-tion	Cow (C)			Mean	Sheep (S)			Mean
		C_1	C_2	C_3		S_1	S_2	S_3	
1	R_1	3.88	3.93	3.68	**3.83**	4.60	4.70	4.72	**4.67**
2	R_2	3.62	3.66	3.53	**3.60**	4.68	4.68	4.77	**4.71**
3	R_3	3.81	3.83	3.91	**3.85**	4.77	4.68	4.74	**4.73**
4	R_4	3.83	3.93	3.78	**3.85**	4.60	4.70	4.75	**4.68**
5	R_5	4.08	4.15	4.14	**4.12**	4.60	4.70	4.75	**4.68**
6	R_6	4.16	4.22	4.16	**4.18**	4.62	4.70	4.75	**4.69**
7	R_7	4.08	4.06	4.00	**4.05**	4.63	4.65	4.75	**4.68**
8	R_8	4.21	4.27	4.22	**4.23**	4.65	4.72	4.85	**4.74**
9	R_9	3.50	3.60	3.40	**3.50**	4.60	4.73	4.90	**4.74**
10	R_{10}	3.70	3.60	3.66	**3.65**	4.67	4.67	4.80	**4.71**
Range	Minimum	3.50	3.60	3.40		4.60	4.65	4.72	
	Maximum	4.21	4.27	4.22		4.77	4.73	4.90	
	Mean	**3.89**	**3.93**	**3.85**	**3.89**	**4.64**	**4.69**	**4.78**	**4.70**
F- test					S				S
S. Ed. (±)					0.05				0.04
C. D. (P = 0.05)					0.10				0.08

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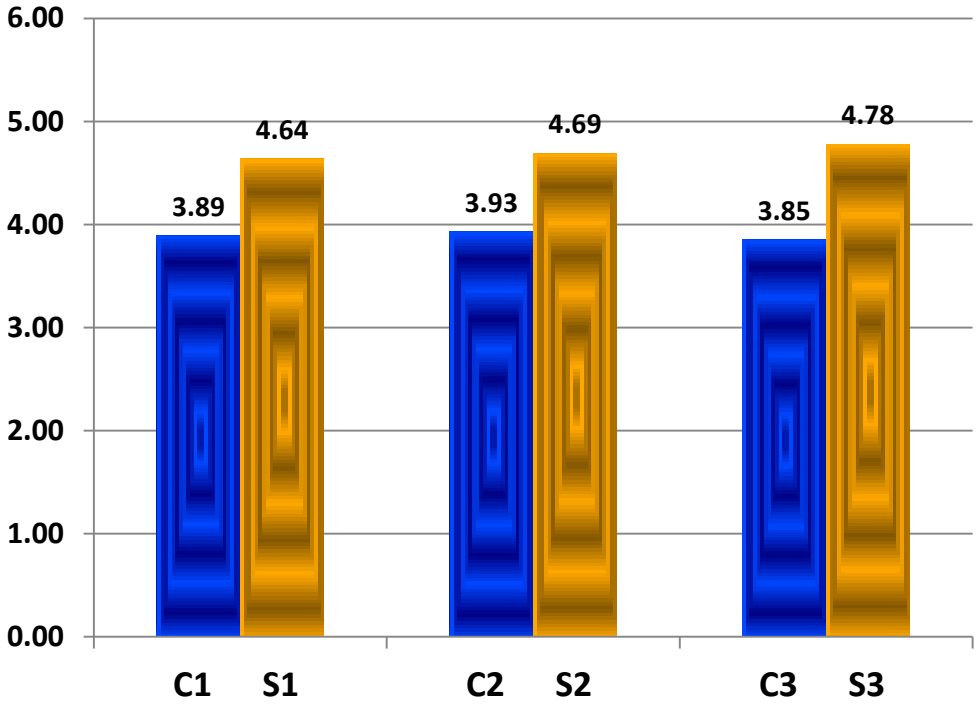

Fig. 1.0 Protein (%) in Cow and Sheep milk

(2) Specific gravity (%)

Table 2.0 and Fig. 2.0 contain the data on specific gravity (cc) of raw milk of Cow and Sheep. The results obtained showed that Cow and Sheep registered mean specific gravity as 1.060, 1.048, 1.054 (overall 1.054), and 1.076, 1.055, 1.073 (overall 1.068), respectively. The difference in the values due to animals was found significant. The difference due to replication was significant in Cow, and non-significant in Sheep milk. Specific gravity of Sheep milk was greater than Cow milk.

Table 2.0 Specific gravity (cc) of Cow and Sheep milk

Sl. No.	Replica-tion	Cow (C)			Mean	Sheep (S)			Mean
		C_1	C_2	C_3		S_1	S_2	S_3	
1	R_1	1.063	1.052	1.063	**1.059**	1.083	1.052	1.055	**1.063**
2	R_2	1.065	1.043	1.051	**1.053**	1.078	1.043	1.076	**1.066**
3	R_3	1.065	1.053	1.064	**1.061**	1.074	1.073	1.082	**1.076**
4	R_4	1.056	1.057	1.056	**1.056**	1.078	1.053	1.074	**1.068**
5	R_5	1.055	1.045	1.046	**1.049**	1.053	1.052	1.082	**1.062**

6	R_6	1.049	1.037	1.038	**1.041**	1.082	1.053	1.071	**1.069**
7	R_7	1.068	1.057	1.070	**1.065**	1.085	1.061	1.072	**1.073**
8	R_8	1.065	1.046	1.055	**1.055**	1.082	1.055	1.061	**1.066**
9	R_9	1.053	1.035	1.033	**1.040**	1.074	1.053	1.083	**1.070**
10	R_{10}	1.063	1.054	1.064	**1.060**	1.072	1.054	1.071	**1.066**
Range	Minimum	1.049	1.035	1.033		1.053	1.043	1.055	
	Maximum	1.068	1.057	1.070		1.085	1.073	1.083	
	Mean	**1.060**	**1.048**	**1.054**	**1.054**	**1.076**	**1.055**	**1.073**	**1.068**
F- test					S				S
S. Ed. (±)					0.004				0.008
C. D. (P = 0.05)					0.008				0.016

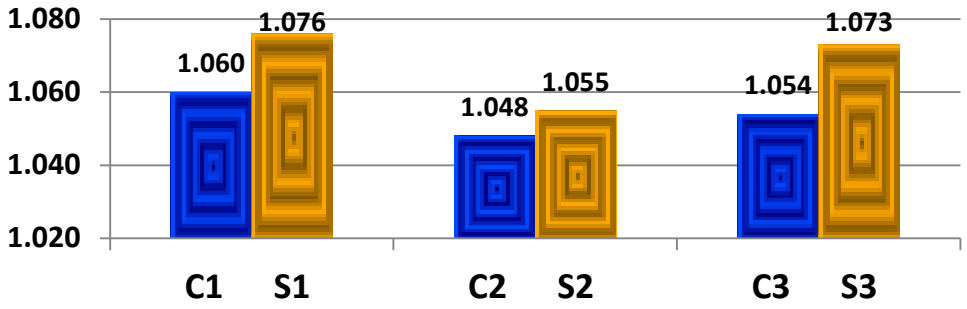

Fig. 2.0 Specific gravity (cc) of Cow and Sheep milk

(3) Fat (%)

The data on fat percentage in raw milk of Cow and Sheep are furnished in Table 3.0 and Fig. 3.0. The results contained in the Table showed that Cow and Sheep registered mean fat percentage as 4.35, 4.25, 4.32 (overall 4.31) and 3.75, 3.85, 3.80 (overall 3.80), respectively. The differences in these values due to three animals each, were found significant, but due to replication, the differences were significant in Cow milk and non-significant in Sheep milk.

Table 3.0 Fat (%) in Cow and Sheep milk

Sl. No.	**Replica-tion**	**Cow (C)**			**Mean**	**Sheep (S)**			**Mean**
		C_1	**C_2**	**C_3**		**S_1**	**S_2**	**S_3**	
1	R_1	4.80	4.70	4.80	**4.77**	8.75	8.70	8.80	**8.75**
2	R_2	5.30	5.10	5.20	**5.20**	8.75	8.70	8.70	**8.72**

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3	R_3	3.80	3.60	3.70	**3.70**	8.80	8.70	8.70	**8.73**
4	R_4	4.10	4.00	4.10	**4.07**	8.75	8.70	8.70	**8.72**
5	R_5	4.70	4.50	4.70	**4.63**	8.75	8.70	8.75	**8.73**
6	R_6	4.70	4.50	4.60	**4.60**	8.80	8.75	8.80	**8.78**
7	R_7	4.00	3.80	4.00	**3.93**	8.80	8.70	8.80	**8.77**
8	R_8	3.30	3.40	3.40	**3.37**	8.80	8.70	8.80	**8.77**
9	R_9	3.40	3.30	3.40	**3.37**	8.70	8.70	8.70	**8.70**
10	R_{10}	4.90	4.80	4.90	**4.87**	8.80	8.70	8.80	**8.77**
Range	Minimum	3.30	3.30	3.40		8.70	8.70	8.70	
	Maximum	5.30	5.10	5.20		8.80	8.75	8.80	
	Mean	**4.30**	**4.17**	**4.28**	**4.25**	**8.77**	**8.71**	**8.76**	**8.74**
F- test					S				S
S. Ed. (±)					0.04				0.02
C. D. (P = 0.05)					0.09				0.05

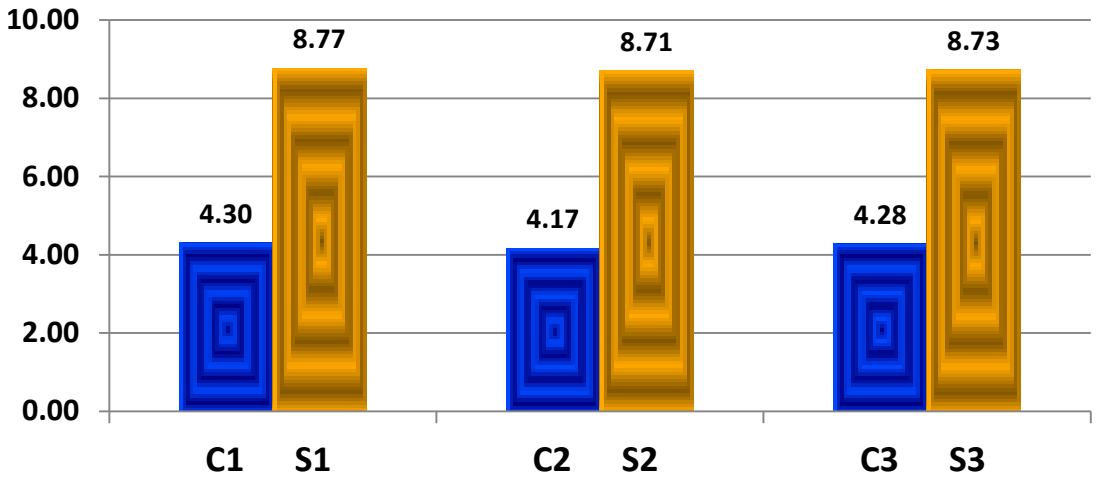

Fig. 3.0 Fat (%) in Cow and Sheep milk

(4) Lactose (%)

Table 4.0 and Fig. 4.0 presents the data on lactose percentage in raw milk of Cow and Sheep. The results contained in the Table showed that Cow and Sheep registered mean lactose percentage as 4.64, 4.49, 4.59 (overall 4.57) and 4.83, 4.89, 4.79 (overall 4.84), respectively. The

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difference in these values due to animals was significant. Due to replication, it was significant in Cow milk, but non-significant in Sheep milk. Higher lactose content was found in Sheep milk.

Table 4.0 Lactose (%) in Cow and Sheep milk

Sl. No.	Replica-tion	Cow (C)			Mean	Sheep (S)			Mean
		C_1	C_2	C_3		S_1	S_2	S_3	
1	R_1	4.90	4.85	4.90	**4.88**	4.90	4.75	4.80	**4.82**
2	R_2	4.70	4.75	4.80	**4.75**	4.80	4.90	4.90	**4.87**
3	R_3	4.85	4.80	5.00	**4.88**	4.80	5.00	4.80	**4.87**
4	R_4	4.50	4.30	4.50	**4.43**	4.90	4.90	4.75	**4.85**
5	R_5	4.50	4.20	4.20	**4.30**	4.80	5.00	4.80	**4.87**
6	R_6	4.50	4.20	4.20	**4.30**	4.90	4.90	4.85	**4.88**
7	R_7	4.80	4.75	4.90	**4.82**	5.00	5.00	4.75	**4.92**
8	R_8	4.50	4.30	4.40	**4.40**	4.65	4.80	4.65	**4.70**
9	R_9	4.60	4.30	4.40	**4.43**	4.90	4.90	4.80	**4.87**
10	R_{10}	4.50	4.40	4.55	**4.48**	4.60	4.75	4.80	**4.72**
Range	Minimum	4.50	4.20	4.20		4.60	4.75	4.65	
	Maximum	4.90	4.85	5.00		5.00	5.00	4.90	
	Mean	**4.64**	**4.49**	**4.59**	**4.57**	**4.83**	**4.89**	**4.79**	**4.84**
F- test					S				S
S. Ed. (±)					0.07				0.07
C. D. (P = 0.05)					0.16				0.14

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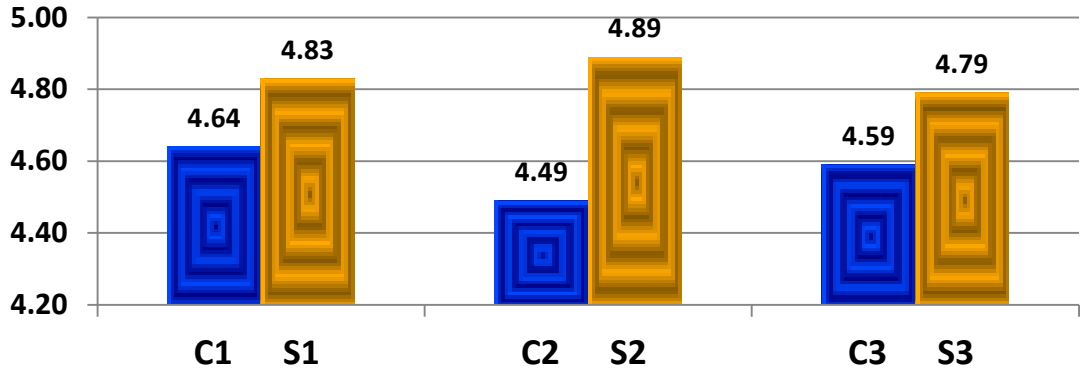

Fig. 4.0 Lactose (%) in Cow and Sheep milk

(5) Ash (%)

Table 5.0 and Fig. 5.0 presents the data on ash percentage in raw milk of Cow and Sheep. The results contained in the Table showed that Cow and Sheep milk registered mean ash percentage as 0.71, 0.75, 0.72 (overall 0.73) and 0.67, 0.69, 0.65 (overall 0.67), respectively. The differences in these values due to three animals each were significant, whereas, due to replication, the differences were found non-significant. Ash percentage was lower in Sheep milk.

Table 5.0 Ash (%) in Cow and Sheep milk

Sl. No.	Replica-tion	Cow (C)			Mean	Sheep (S)			Mean
		C_1	C_2	C_3		S_1	S_2	S_3	
1	R_1	0.72	0.73	0.75	**0.73**	0.66	0.62	0.67	**0.65**
2	R_2	0.73	0.77	0.72	**0.74**	0.65	0.68	0.66	**0.66**
3	R_3	0.71	0.73	0.70	**0.71**	0.66	0.70	0.64	**0.67**
4	R_4	0.71	0.72	0.70	**0.71**	0.68	0.70	0.65	**0.68**
5	R_5	0.73	0.74	0.71	**0.73**	0.68	0.68	0.66	**0.67**
6	R_6	0.73	0.78	0.75	**0.75**	0.66	0.70	0.64	**0.67**
7	R_7	0.76	0.73	0.73	**0.74**	0.65	0.67	0.62	**0.65**
8	R_8	0.72	0.77	0.75	**0.75**	0.68	0.76	0.67	**0.70**
9	R_9	0.67	0.78	0.68	**0.71**	0.70	0.71	0.66	**0.69**
10	R_{10}	0.66	0.72	0.70	**0.69**	0.65	0.65	0.63	**0.64**
Range	Minimum	0.66	0.72	0.68		0.65	0.62	0.62	

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	Maximum	0.76	0.78	0.75		0.70	0.76	0.67	
	Mean	**0.71**	**0.75**	**0.72**	**0.73**	**0.67**	**0.69**	**0.65**	**0.67**
F- test					S				S
S. Ed. (±)					0.02				0.02
C. D. (P = 0.05)					0.04				0.04

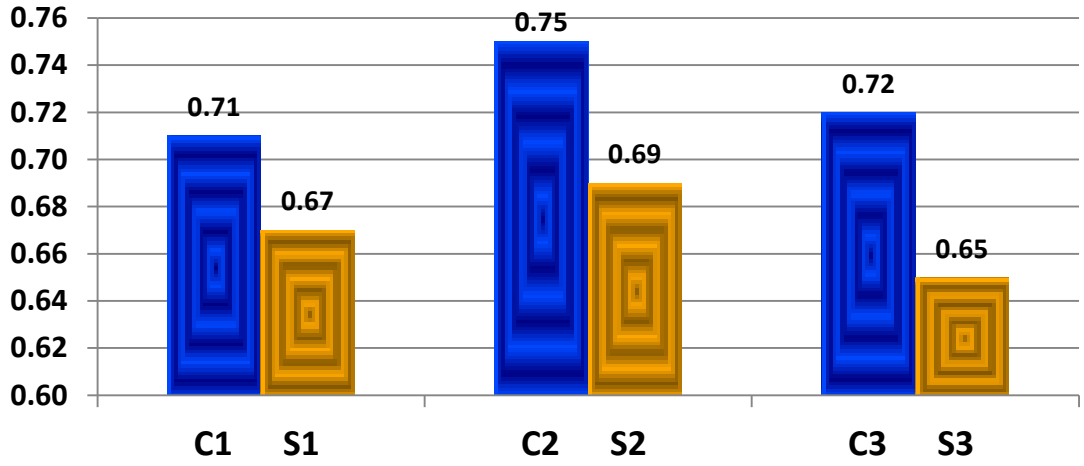

Fig. 5.0 Ash (%) in Cow and Sheep milk

(6) Total solid (%)

The data on total solid percentage in raw milk of Cow and Sheep are presented in Table 6.0 and Fig. 6.0. The results contained in the Table showed that Cow and Sheep registered mean total solid percentage as 14.06, 13.51, 13.94 (overall 13.83) and 18.26, 18.56, 18.77 (overall 18.53) respectively. The difference in these values due to animals was found significant, whereas due to replication, the differences were non-significant. Total solid percentage was higher in Sheep milk.

Table 6.0 Total Solid (%) in Cow and Sheep milk

Sl. No.	Replica-tion	Cow (C)			Mean	Sheep (S)			Mean
		C_1	C_2	C_3		S_1	S_2	S_3	
1	R_1	13.30	13.40	13.75	**13.48**	18.30	18.65	18.85	**18.60**
2	R_2	14.20	13.50	13.75	**13.82**	18.25	18.30	18.80	**18.45**
3	R_3	13.80	13.70	14.00	**13.83**	18.30	18.25	18.80	**18.45**

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4	R_4	14.20	13.70	13.30	**13.73**	18.30	18.65	18.80	**18.58**
5	R_5	13.70	13.20	14.15	**13.68**	18.30	18.85	18.80	**18.65**
6	R_6	13.80	13.80	14.00	**13.87**	18.50	18.80	18.85	**18.72**
7	R_7	14.10	13.40	14.00	**13.83**	18.10	18.45	18.65	**18.40**
8	R_8	14.00	13.10	14.00	**13.70**	18.07	18.70	18.70	**18.49**
9	R_9	14.80	14.25	14.80	**14.62**	18.10	18.50	18.70	**18.43**
10	R_{10}	14.70	13.00	13.60	**13.77**	18.35	18.40	18.75	**18.50**
Range	Minimum	13.30	13.00	13.30		18.07	18.25	18.65	
	Maximum	14.80	14.25	14.80		18.50	18.85	18.85	
	Mean	**14.06**	**13.51**	**13.94**	**13.83**	**18.26**	**18.56**	**18.77**	**18.53**
F- test					S				S
S. Ed. (±)					0.28				0.10
C. D. (P = 0.05)					0.59				0.22

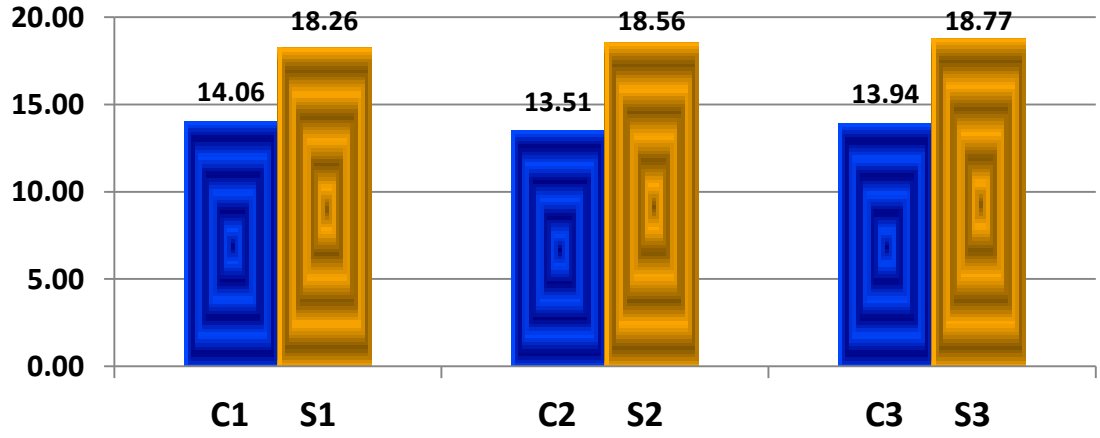

Fig. 6.0 Total Solid (%) in Cow and Sheep milk

(7) Water (%)

The data on water percentage in raw milk of Cow and Sheep is presented in Table 7.0 and Fig. 7.0. The results contained in the Table showed that Cow and Sheep milk registered mean water percentage as 85.94, 86.50, 86.07 (overall 86.17) and 81.74, 81.45, 81.23 (overall 81.47) respectively. The difference in these values due to animals has been found significant, but due to replication, the result was non-significant. Water percentage was lower in Sheep milk.

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Table 7.0 Water (%) in Cow and Sheep milk

Sl. No.	Replica-tion	Cow (C)			Mean	Sheep (S)			Mean
		C_1	C_2	C_3		S_1	S_2	S_3	
1	R_1	86.70	86.60	86.25	**86.52**	81.70	81.35	81.15	**81.40**
2	R_2	85.80	86.50	86.25	**86.18**	81.75	81.70	81.20	**81.55**
3	R_3	86.20	86.30	86.00	**86.17**	81.70	81.75	81.20	**81.55**
4	R_4	85.80	86.30	86.70	**86.27**	81.70	81.35	81.20	**81.42**
5	R_5	86.30	86.80	85.85	**86.32**	81.70	81.15	81.20	**81.35**
6	R_6	86.20	86.20	86.00	**86.13**	81.50	81.20	81.15	**81.28**
7	R_7	85.90	86.60	86.00	**86.17**	81.90	81.55	81.35	**81.60**
8	R_8	86.00	86.90	86.00	**86.30**	81.93	81.30	81.30	**81.51**
9	R_9	85.20	85.75	85.20	**85.38**	81.90	81.50	81.30	**81.57**
10	R_{10}	85.30	87.00	86.40	**86.23**	81.65	81.60	81.25	**81.50**
Range	Minimum	85.20	85.75	85.20		81.50	81.15	81.15	
	Maximum	86.70	87.00	86.70		81.93	81.75	81.35	
	Mean	**85.94**	**86.50**	**86.07**	**86.17**	**81.74**	**81.45**	**81.23**	**81.47**
F- test					S				S
S. Ed. (±)					0.28				0.10
C. D. (P = 0.05)					0.59				0.22

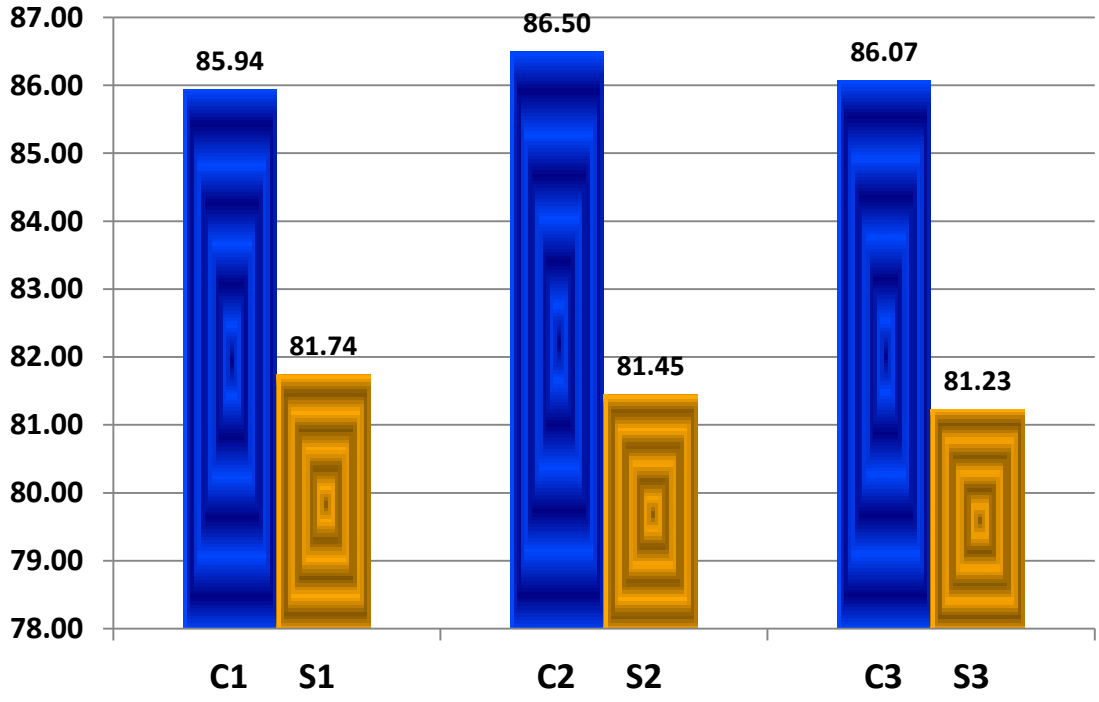

Fig. 7.0 Water (%) in Cow and Sheep milk

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(8) Solid not fat (SNF) (%)

Table 8.0 and Fig. 8.0 presents the data on SNF percentage in raw milk of Cow and Sheep. The results presented in the Table showed that Cow and Sheep registered mean SNF percentage as 9.76, 9.34, 9.66 (overall 9.58) and 9.49, 9.85, 10.02 (overall 9.78), respectively. The differences in these values due to animals were significant, whereas due to replication the differences were significant in Cow milk and non-significant in Sheep milk. SNF content in Sheep milk was higher than that in Cow milk.

Table 8.0 Solid not fat (%) (SNF) in Cow and Sheep milk

Sl. No.	Replica-tion	Cow (C)			Mean	Sheep (S)			Mean
		C_1	C_2	C_3		S_1	S_2	S_3	
1	R_1	8.50	8.70	8.95	**8.72**	9.55	9.95	10.05	**9.85**
2	R_2	8.90	8.40	8.55	**8.62**	9.50	9.60	10.10	**9.73**
3	R_3	10.00	10.10	10.30	**10.13**	9.50	9.55	10.10	**9.72**
4	R_4	10.10	9.70	9.20	**9.67**	9.55	9.95	10.10	**9.87**
5	R_5	9.00	8.70	9.45	**9.05**	9.55	10.15	10.05	**9.92**
6	R_6	9.10	9.30	9.40	**9.27**	9.70	10.05	10.05	**9.93**
7	R_7	10.10	9.60	10.00	**9.90**	9.30	9.75	9.85	**9.63**
8	R_8	10.70	9.70	10.60	**10.33**	9.27	10.00	9.90	**9.72**
9	R_9	11.40	10.95	11.40	**11.25**	9.40	9.80	10.00	**9.73**
10	R_{10}	9.80	8.20	8.70	**8.90**	9.55	9.70	9.95	**9.73**
Range	Minimum	8.50	8.20	8.55		9.27	9.55	9.85	
	Maximum	11.40	10.95	11.40		9.70	10.15	10.10	
	Mean	**9.76**	**9.34**	**9.66**	**9.58**	**9.49**	**9.85**	**10.02**	**9.78**
F- test					S				S
S. Ed. (±)					0.29				0.11
C. D. (P = 0.05)					0..61				0.23

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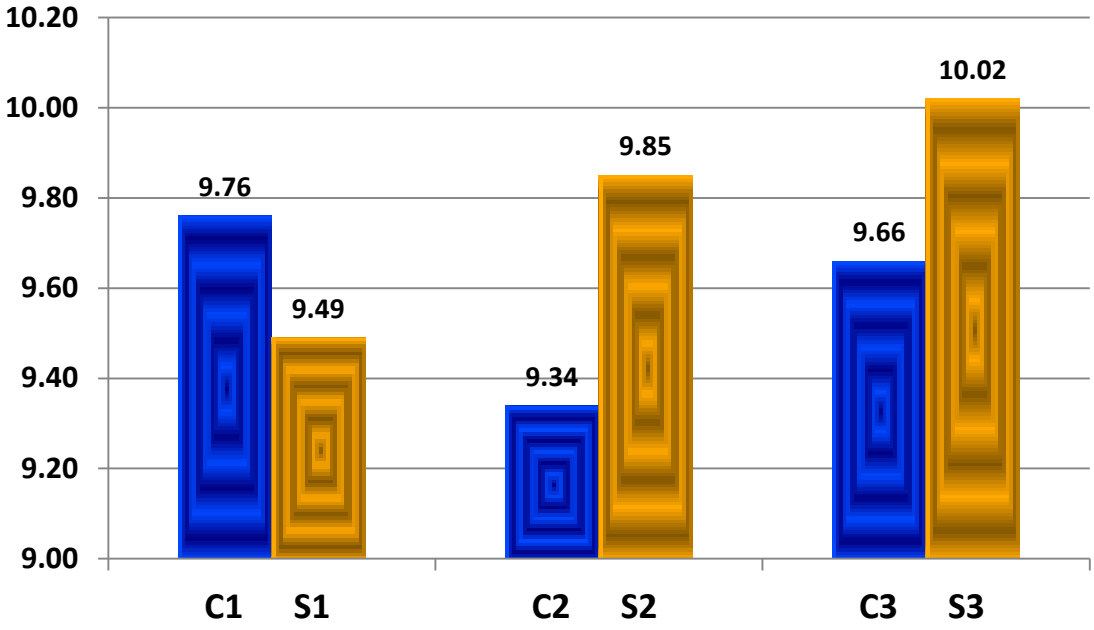

Fig. 8.0Solid not fat (%) (SNF) in Cow and Sheep milk

The results of the investigation regarding the chemical qualities of milk of Cow and Sheep, have been presented in tables, graphically represented, and discussed in the preceding chapters.

Results of the experiment are summarized below:

1. Higher protein percentage was recorded in the milk of Sheep as compared to Cow milk.
2. Specific gravity of Sheep milk was higher as compared to Cow milk.
3. Fat percentage was recorded higher in the milk of Sheep followed by Cow milk.
4. Milk of Sheep recorded higher lactose percentage followed Cow milk.
5. Lower ash percentage was found in the Sheep milk as compared to Cow milk.
6. Total solid percentage in Sheep milk was found higher than that in Cow milk.
7. Water content was recorded lower in the milk of Sheep as compared to Cow milk.
8. Solid not fat (SNF) was found higher in Sheep milk followed by Cow milk.

9. Based on the above results, chemical qualities of Sheep milk was found superior than Cow milk.

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