

# Physicochemical Analysis of Milk Samples - A Comparative Study

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**Abstract:** Man from the beginning of his evolution, deeply connected with the milk and milk products. Hence the importance of milk in human life is significant. Milk is a complete diet as it contains minerals, vitamins, proteins, carbohydrate, fats and water in it. The percentage of each of these components will depend upon the breed of cow as well as their lactating period and milking process. The present study was conducted to evaluate the quality of various milk samples in the dairy industry. Physicochemical properties such as calcium, magnesium, casein, fat content, water, pH and total dissolved solids of selected breeds of cow under different conditions were analyzed and compared. Qualitative analysis of different nutrients and minerals of the samples were also done.

**Index Terms:** Casein, fat content, Calcium, Magnesium, water content and Total Dissolved Solids.

## I. INTRODUCTION

Milk and milk products production and also their consumption have registered a continuous global augmentation. In the last 10 years, milk demand and milk supply have increased. The importance of milk derives from its nutritive value as well as its versatility for technological conversion through a very large number of dairy products [1]. Milk is an extremely beneficial drink for the health of the human body as it contains minerals, vitamins, proteins, carbohydrate, fats and water in it. Milk is the best source of calcium that we can supply to our body. Unlike supplemental calcium, high intakes of dietary calcium along with magnesium reduces the risk for kidney stone and hypertension [2], protects the body from major chronic ailments such as cancer [3], bone loss, arthritic conditions and also functions as a healthy aid in losing unwanted fats and reducing weight [4]. Milk protein is highly digestible. It contains all essential amino acids in right proportions which can't be synthesized our body. Casein in milk has the ability to reduces or prevent the effects of enamel erosion.

Milk composition is influenced by a lot of factors, most important are: breed, season, region of production, age and type of feeding for the animal, especial on lactation time [5][6]. Parameters for Milk quality are vitamins, proteins, carbohydrate, fats and water Content, Calcium, Phosphorous, Magnesium, Iron, Total Dissolved Solids (TDS) and PH. By determining these factors, we can analyze the milk quality [7].

The study was conducted over a period of 5 months by collecting the samples of milk from five houses located at different geographic regions from Mala. The milk samples selected were mainly from four breeds which include Holstein cows, Jersey, Native cows and Kasaragod Dwarf. Morning and evening milk of Holstein cow at two lactating stages namely first and third week of lactation were also collected. Since milk is a life-giving nectar, the main objective of this paper was to analyze variation of composition of cow milk with breed variety, milking process and stages of lactation.

## II. MATERIALS AND METHODS

Milk from different breed varieties such as Jersey, Holstein, Native and Kasaragod Dwarf were collected from five houses located at different regions of Mala. In addition to this morning and evening milk of Holstein cow at two lactating stages namely first and third week of lactation are also collected. Volumes of milk collected from each house comprised 500 ML per day. The samples were put into sterile plastic tubes, and kept under refrigeration conditions (4°C) until their arrival at the laboratory. Labels were used to prevent sample misidentification. Different methods of analysis have been done for the fortitude of quality of Milk. Physical analysis was done on the basis of TDS. pH of the Milk samples is determined with the help of pH meter. The chemical parameters such as Casein content, Calcium & Magnesium, Fat Content and Water Content were computed by Precipitation Method, Complexometry, Extraction Method and Evaporation Method respectively.

## III. RESULTS AND DISCUSSION

The collected samples were analyzed for various physico-chemical parameters which include total Casein Content, Total dissolved solids, pH, Calcium, Magnesium, Fat Content and Water Content. The chemicals and reagents used for analysis were of annular grade. All the measurements were carried out in the temperature of 330C and are expressed as percentage. Calcium and Magnesium were expressed in the unit of mg/l. The results are given in the following Tables.

**Table I: Physico -Chemical parameters of Milk for different breed variety.**

Sample	pH	TDS	Calcium (mg/l)	Magnesium (mg/l)	Casein Content	Fat Content	Water Content
Jersey	6.5	15%	1261	138	3.3%	4.8%	86.25%
Holstein	6.6	11.8%	1143	118	2.6%	3.4%	86.87%

Native Cow	6.7	11.4%	1130	106	2.5%	2.9%	87.18%
Kasargod Dwarf	6.7	12%	1340	145	3.6%	3.55%	86.55%

**Table 2: Change in Physico-Chemical parameters of Milk with Milking.**

Sample	pH	TDS (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Casein Content	Fat Content	Water Content
Holstein (Morning Milk)	6.6	11.9%	1143	118	2.6%	3.4%	86.87%
Holstein (Evening Milk)	6.6	12.1%	1150	129	2.5%	3.6%	86.42%

**Table 3: Change in Physico-Chemical parameters of Milk with Lactation.**

Sample	pH	TDS (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Casein Content	Fat Content	Water Content
Holstein (First Week of Lactation)	6.6	12.3%	1164	132	2.67%	3.7%	86.87%
Holstein (Third Week of Lactation)	6.6	11.9%	1143	118	2.6%	3.4%	86.62%

From the tables it is clear that the pH of all the milk samples were found to be within the range of 6.5-6.7 which indicates that the milk samples are fresh and not deteriorated by microorganism. The total dissolved solids of the milk samples were maximum for Jersey followed by Kasargod Dwarf, Holstein, and Native. High TDS value attributed to higher amount of fat in Milk.

From the data analyzed, we found that the amount of calcium present in the milk changes as the breed of cow varies. Among different breed varieties, Kasaragod Dwarf has higher calcium and Magnesium content and native cow has the lowest. Changes in calcium as well as Magnesium amount was also associated with milking and stages of lactation. Evening milk of Holstein is richer in calcium and Magnesium than the morning. Similarly high amount of calcium and Magnesium is present in first week of lactation than the third week lactation for Holstein cattle.

Fat Content of milk samples are determined by Extraction Method. We found that milk of Jersey contains highest percentage of fat than other breeds. The percentage of milk fat increases continuously during the milking process. The lowest fat milk drawn in morning time and the highest fat milk drawn in evening. Milk protein- casein was found to be highest for Kasargod Dwarf and least for Native cattle. And they do not show any appreciable change during milking. Stage of lactation affected milk protein and fat percentages very similarly. The highest amount of protein and fat in milk was found just after freshening, in colostrum. Levels drop to their lowest point at first week after calving. Then the percentage of casein protein and fat tends to decrease gradually as the lactation proceeds. After third week of lactation, both fat and protein found to be increases. All milk produced by animals contains carbohydrate, protein, fat, minerals and vitamins but the major component is water. Water dilutes the milk allowing its secretion from the body. On comparing the water content, it is found that Native cow has highest water content and Jersey has the lowest value. The milking time and stages of lactation also affect the percentage of water in cow milk. Morning milk of Holstein has higher water content than the evening. Also, Holstein milk of first week of lactation contains more water than third week of lactation.

The graphical representation of the results is given below.

Figure I: (a)Variation of milk quality parameters with different breeds; (b) Variation of Calcium and Magnesium for various breeds

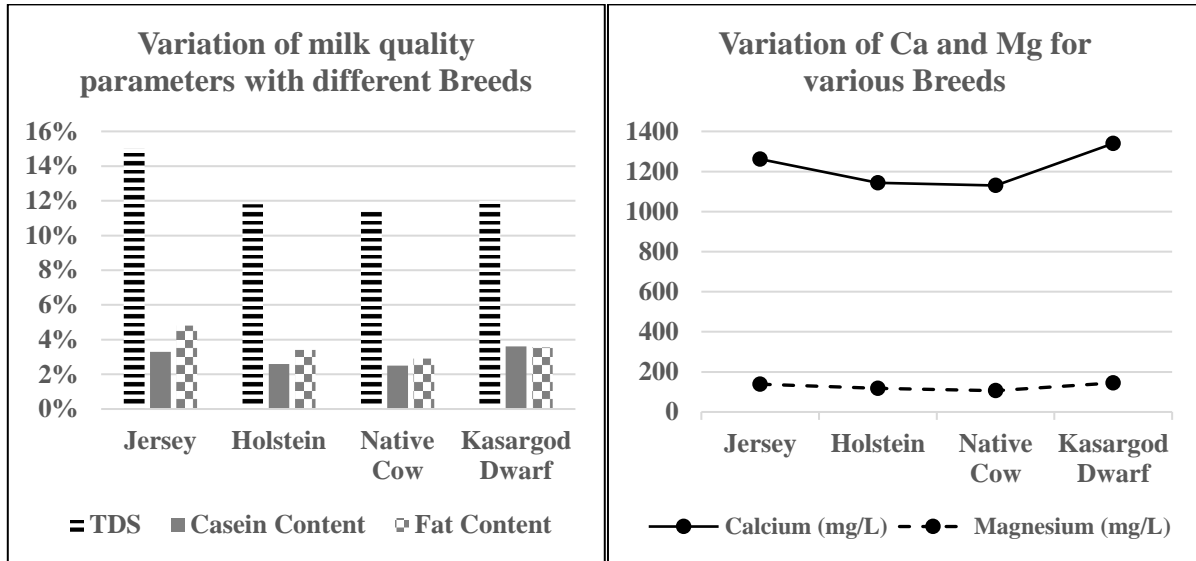
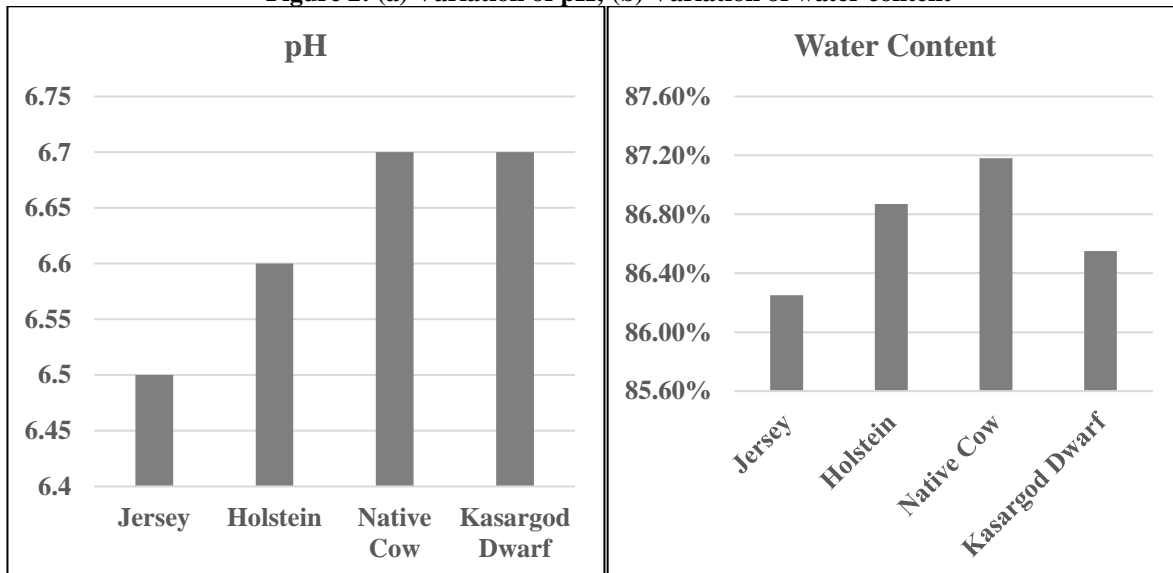


Figure 2: (a) Variation of pH; (b) Variation of water content



**IV. CONCLUSION**

In this study the quality of milk of different breed varieties under different conditions was assessed. It is found that the components of milk vary with cattle breed, milking process and lactation period. Among the selected breeds Jersey has higher fat and total dissolved solids while Kasargod Dwarf had higher Calcium, Magnesium and Casein content. The percentage of these constituents decreases as the lactation proceeds up to third week. The trend is reversed during milking [8]. Milk that contains high protein, calcium, magnesium and low-fat content will help us to improve our health.

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