



Quantitative and Nutritional Value Evaluation of Low Fat and High Fat Contents Buttermilk Samples Available in Local Market

Patil Pandurang N*., Moza S. Al-Hashami, Iman M. Al-Abri, Hajir A. Al-Shaqsi, Anoud J. Al-Wahshi

Chemistry Section, Department of Applied Sciences, University of Technology and Applied Sciences, Muscat, Sultanate of Oman

*Corresponding Author Email: patil.narayan@hct.edu.om

Abstract Aim of our present study to analyze nutritional fact of various buttermilk samples. Buttermilk is considered as an excellent source of nutritional elements such as minerals (potassium, phosphorus, and calcium), vitamin B12, riboflavin, enzymes, and protein. Buttermilk is very famous fermented drink in India as well as in other Middle Eastern countries.

In the present research, various physico-chemical parameters were studied. We choose both full fat and low fat two samples each and one mango flavored samples. We have analysed various physico-chemical parameters such as pH found in the range of 4.29 – 4.39, conductivity 0.883 - 1.747 MS/cm, % water 81.3 – 91.7%, acidity 0.603 – 0.765 g/100 gm, ash 0.17 - 0.88%, Fat 0.55 – 3.3 %, protein 2.26 – 8.02 g/100gm, sodium was found 49.78 - 0.22 mg/100 gm, potassium 22.68 - 27.87 mg/100gm, Iron was found 0.111 - 0.437 mg/100 gm etc.

Keywords Buttermilk, Quantitative analysis, nutritional value, mineral contents

Introduction

Buttermilk, a low-fat milky liquid leftover after the churning of cream, is one of the most important, healthy functional dairy products that have excellent health and disease curing potentials. All over the world consumers are highly interested for this product. In addition, buttermilk is also considered as an excellent source of nutritional elements such as minerals (potassium, phosphorus, and calcium), vitamin B₁₂, riboflavin, enzymes, and protein [1]. Buttermilk is very famous fermented drink in India as well as in other Middle Eastern countries.

The consumption of buttermilk varies from climate and from region to region. It is used as fresh milk drink in especially in hot climates. The consumption of buttermilk among countries within warm climates such as Pakistan, India, Afghanistan, Sri Lanka and southern United States is high. However, the consumption of buttermilk within European countries is generally quite low [2]. Buttermilk is a dairy ingredient widely used in the food industry because of its special emulsifying capacity and its impact on flavor. Commercial buttermilk is sweet buttermilk, a by-product from churning sweet cream into butter. However, other sources of buttermilk exist, including cultured and whey buttermilk obtained from churning of cultured cream and whey cream, respectively [3].

Cultured buttermilk is probably the easiest fermented milk product to produce but still the exact quantity of production of buttermilk is not assessed. However, the quantity of buttermilk production can be estimated on the



basis of production of butter. Approximately, 6.5%–7.0% of total milk produced worldwide is used for the preparation of butter that yields high amounts of buttermilk as a by-product [4].

Buttermilk contains water-soluble components such as milk protein, lactose, and various minerals. It also contains material obtained from milk fat globule membrane, are disrupted during the churning and mostly migrates to the buttermilk fraction [5]. Buttermilk also shows various therapeutic potentials such as cholesterol reduction, blood pressure reduction, antiviral effects, and anticancer effects [6]. Protein contains 2.66 to 3.75 g/100 g for protein content of conventional buttermilk fat contains (0.3–2.5 g/100 g) given for commercial cultured buttermilks [7].

Material and Methods

Five different brand buttermilk samples were selected from the local market. Two samples were full fat two samples low fat one sample with mango flavored. We called them as Full Fat samples are MFF & SFF, low fat samples MLF & SLF and mango flavored sample called as AMM. After collection of samples from the market we kept it in the refrigerator and start immediate some physical and chemical parameter testing. In the present study we studied various nutritional value of buttermilk sample and analysis of minerals of all these five samples.

pH is representing concentration of H^+ ion in the sample. It represents the acidic nature of the sample. We used 5 ml sample from each pack in to the 100 ml beaker and add 20 ml distilled water. It becomes 25% (v/v) sample. Measure the pH of all samples 3 times and record the difference in the pH using metteler made pH meter available in the laboratory.

Conductivity measures the concentration of ions present in the sample. 25 % (v/v) sample was used for the measurement of conductivity. Both tests were performed according to lab technique handout of the college. % of water contents in the sample was measured by using [8, 9] AOAC (2000) method of analysis. Measured quantity of sample were taken in to the previously heated and weighted crucible and heated in the temperature control oven for 3 hours at 100-105 °C.

Titrate acidity was measured by titration between standard sodium hydroxide and 25 of sample by using phenolphthalein indicator. Viscosity is measure of resistance to flow. Viscosity was measured by using direct sample from the container and with viscometer. While density is important parameter. 25 ml Picnometer was used for the measurement of density in g/ml. Empty picnometer dried and weighed then filled with 25 of water and measure the weight of 25 ml water with picnometer.

Ash is the oxides of different inorganic minerals present in the sample. Ash was determined by using [8] AOAC (2000) method first burning sample in electric burner and then combustion in furnace at 550 °C. Refractometer used for measurement of TSS according to Method.

Fat and Protein

Fat is important component in all milk and related products. Fat in buttermilk is measured by AOAC method no 905.02. Rose-Gottlieb Method was used for determination of fat in which sample was mixed thoroughly with diethyl ether and then mixed with petroleum ether and separated in separating funnel. Then fat in ether was separated from the sample and collected in previously heated and weighted dish. Fat containing dish was heated gently on water bath until completely free from any moisture. Then take weight as fat [8, 9].

Protein is important nutrient in any milk related product. Protein in the buttermilk sample was measured by colorimetric method. Standard series of protein sample were prepared using protein available from biology laboratory. 0.5 ml buttermilk sample was taken in test tube then both standard and test sample was mixed with 3 ml of biuret reagent and distilled water and color developed was measured as a optical density at 540 nm. Then using method of least square the amount of protein was measured.

Reducing sugar was determined by titrating glucose sample and sodium carbonate mixture with standard glucose solution and then with sample. Sample was prepared by 10 ml buttermilk in 100 ml volumetric flask and diluted with distilled water.



Minerals

Sodium, Potassium, Iron, Calcium, Magnesium and Zinc were measured by using flame photometer and atomic absorption spectrophotometric method. Firstly, ash was made and then it was digested with HCl and HNO₃ acids with (3:1) proportion. Then sample were filtered and diluted in 100 ml volumetric flask and same samples were used for the analysis of different minerals in the buttermilk sample.

Sodium and potassium was determined by using flame photometer. Standard solution of sodium ion and potassium ion was prepared and required dilution was made in suitable volume in 100 ml volumetric flask. Then emission intensity of standard of sodium and potassium and sample of both of them was measured and recorded a plot to obtain a calibration equation to calculate the amount. Then quantity of sodium and potassium was calculated to mg /110 gm of sample.

Then standard solutions of iron, calcium, magnesium and zinc were prepared by using salts of these minerals and prepared in a 100 ml volumetric flask at proper ppm level. Then both sample and standards were measured their absorbance in AAS in our laboratory. Calibration curve equation obtained and then amount of minerals per 100 gm was calculated [8, 9].

Result and Discussion

The result of pH found for all samples were mixed pattern. The pH range for all samples were 4.29 to 4.39. The lowest pH showed by SLF sample and highest pH was with SHF sample. The results were in the standard range value of pH. Conductivity for all samples was found to be in the range of 0.833 to 1.747 MS/cm range. The lowest conductivity was found in SFF and lowest conductivity was in the SFF samples. All five samples found very close value of conductivity except SLF. The detail results are showed in Table 1.

Table 1: Results of Physico-chemical parameters

Parameters / Sample	MFF	MLF	MMF	SFF	SLF
pH (25% v/v solution)	4.325	4.33	4.39	4.445	4.29
Coductivity (MS/cm) (25% v/v solution)	0.941	0.94	0.883	0.883	1.747
Water (%)	88.9	91.1	81.3	89.2	91.7
Viscosity	180	180	140	200	70
Acidity (g/100 gm)	0.742	0.765	0.706	0.634	0.603
Density (g/ml)	1.019	1.04	1.046	1.028	1.062
Ash (%)	0.29	0.17	0.14	0.17	0.88
TSS (%)	4.66	5	14.33	5.66	4.66
Fat (%)	3.3	0.55	0.83	2.5	0.72
Protein (g/100gm)	8.02	6.68	4.7	2.64	2.26
Reducing Sugar (%)	0.17	0.1	0.16	0.13	0.21
Total Solid (%)	11.59	9.39	10.27	11.64	8.46

Water contents in the % was found in the range of 81.3 to 91.7 %. Mango flavored (MMF) sample was found least % of water while SLF was having highest % of water contents. We found that the values obtained by our analysis was in the same range of standard value obtained from the internet. SFF sample content high viscosity i.e. 200 pSca and Mango (MMF) flavored sample was having lowest amount of viscosity i.e. 140.

Total acidity represents the g of acid per 100 gm of sample. Total acidity was measured in terms of hydrochloric acid. SLF sample was having lowest amount of total acidity i.e. 0.603 g/100gm and MLF sample was having highest amount of total acidity i.e. 0.765 g/100gm of sample. Comparison of all results with their samples are summarized in the following graph 1.



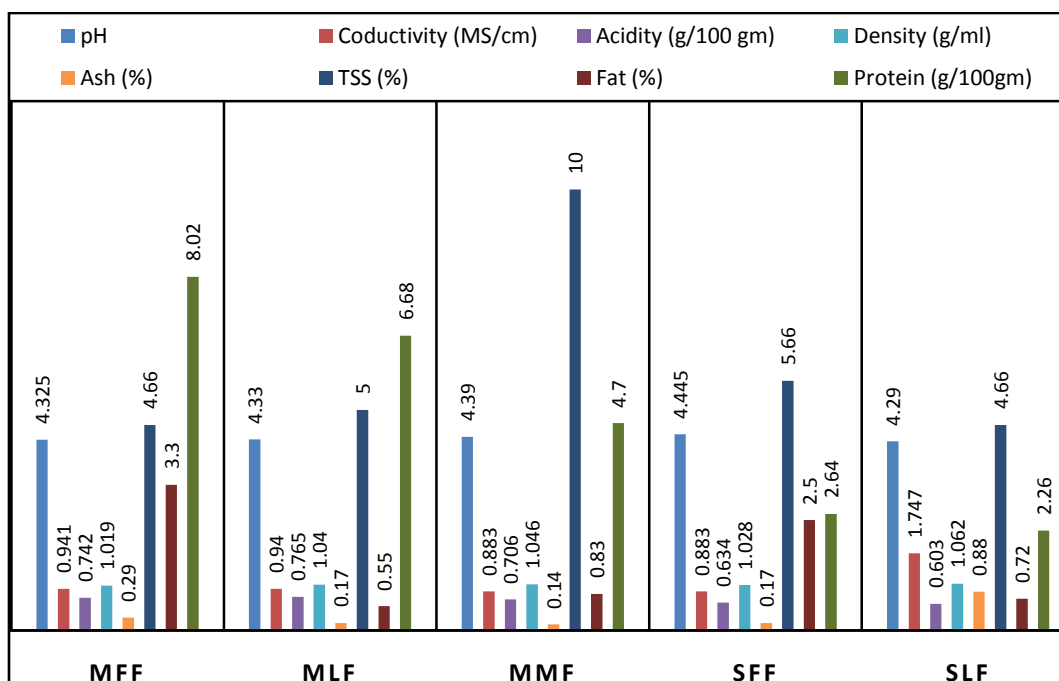


Figure 1: Comparison study of different parameters

Density of all samples were found in the range of 1.019 to 1.062 g/ml. MFF sample found lowest while SLF found highest density. Density of all samples were little higher than density of water. Highest % of ash was found in the in SLF i.e. 0.88 while lowest was found in MLF & SFF i.e. 0.17%. The amount of total soluble solid value was found in the range of 10 to 4.66 %. The amount of fat contents in all sample found in variable amount. The fat contents in full fat sample was high and low fat sample found to be low amount. The amount prescribed on the label was matching with experimental value. Two full fat samples were 3.3 and 2.5 % of fat while low fat samples were found 0.55 and 0.72 % and flavored sample found 0.83% of fat.

Higher amount of protein was found in both samples of same company in high and low fat samples i.e. MFF 8.02 and MLF 6.68 g/100 gm of sample. The another company i.e. SFF and SLF (full and low fat) found 2.64 and 2.26 g/100gm respectively. Mango flavored sample was found moderate amount of protein i.e. 4.7 g/100 gm. The amount reducing sugar was found in the range of in the range of 0.1 to 0.21 %. Highest in SLF and lowest in MLF sample.

Mineral Analysis

Mineral in one of the important contents in buttermilk sample. We found good amount of important mineral contents in all samples. Minerals are important part in various metabolic activities. We measured amount of sodium, potassium, iron, calcium, magnesium and zinc. We compared our result with the standard value of minerals and found that all sample rich enough to provide all mineral contents. The calibration curve obtained with equation and regression equation are shown in the graph obtained during the analysis. All value of results are shown in Table 2.

Table 2: Analysis of minerals in buttermilk samples

Parameters / Sample	MFF	MLF	MMF	SFF	SLF
Sodium (mg/100gm)	30.22	30.22	31.89	33.02	49.78
Potassium (mg/100gm)	27.87	22.68	27.87	25.21	23.09
Iron (mg/100gm)	0.111	0.142	0.158	0.114	0.437
Calcium (mg/100gm)	60.81	64.32	52.5	58.74	51.5
Magnesium (mg/100gm)	2.65	2.716	2.653	2.655	2.65
Zinc (mg/100gm)	0.52	0.73	0.26	0.32	0.22



High amount of sodium was found in SLF sample i.e 49.78 mg and lowest in MFF and MLF samples i.e. 30.22 mg/100 gm. All samples found nearly similar amount of potassium contents. MFF & MMF was found highest i.e. 27.87 mg/100 gm while MLF was 22.68 mg/100gm of sample. Iron content was found in the range of 0.111 mg in MFF to 0.437 mg/100 gm SLF of sample. Mango flavored sample was also found enough amount of iron i.e. 0.158 mg/100 gm. All milk products are good source of calcium.

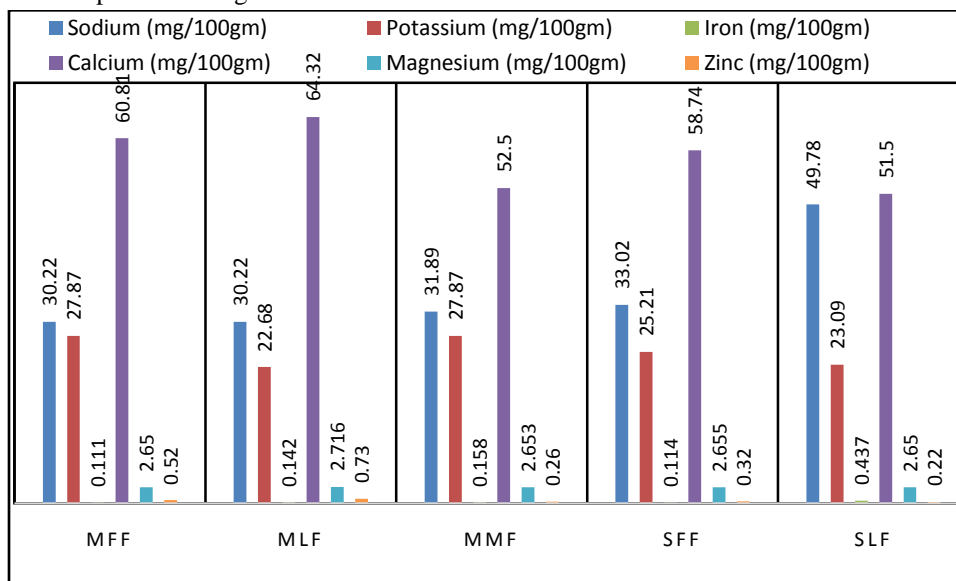


Figure 2: Comparison of minerals in all samples

So these buttermilk samples also found amount of calcium in the range of 51.5 mg in SLF to 60.81 mg/100 gm in MFF. Mango flavored sample found 52.5 mg. Both samples of same company i.e. MFF & MLF was high amount of calcium. Magnesium was found to be the similar range in all samples. It was found that 2.65 mg/ 100 gm in MFF and SLF to 2.716 mg/100 gm in MLF sample. Mango flavored sample was having 2.655 mg/100 gm of magnesium. Zinc is another important mineral that was found in the range of 0.73 mg/100 gm in MLF while 0.22 in SLF. It was observed that same company i.e. MFF and MLF samples was high amount of zinc as compared to another company sample. These all results are shown in the table 2 and figure 2 to 6.

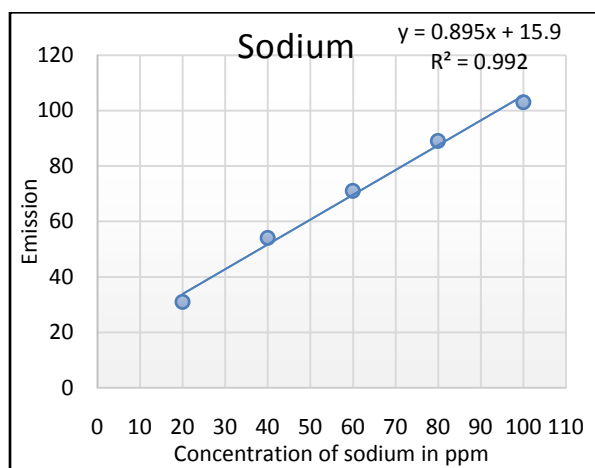


Figure 3: Analysis of sodium

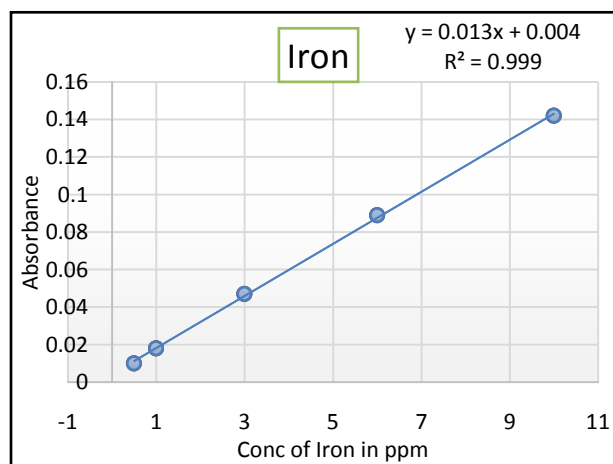


Figure 4: Analysis of Iron



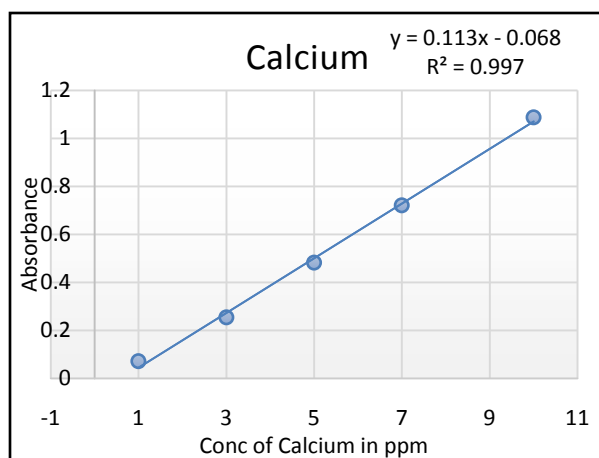


Figure 5: Analysis of Calcium

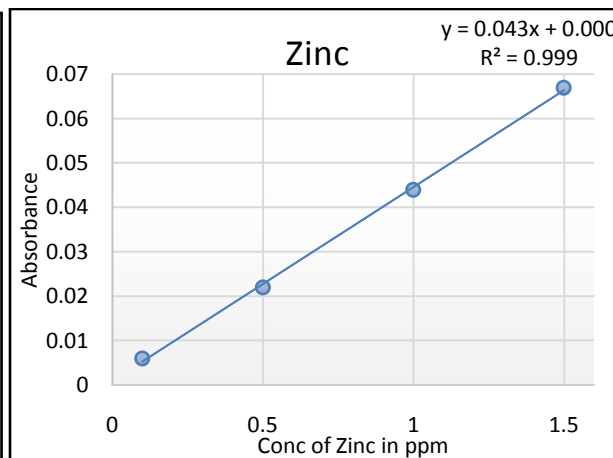


Figure 6: Analysis of Zinc

Conclusion and Recommendations

The results obtained in our study shows that protein, fat, calcium, magnesium and zinc contents in one company samples i.e. MFF (full fat) and MLF (low fat) was high amount as compared to remaining samples. While the another company samples found mixed form of result. Overall all samples found the label amount of nutrients. So these samples are as per the standard format and healthy for consumption.

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