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# Study on Physico-Chemical Microbiological and Organoleptic Evaluation of Different Curd

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## Abstract

This study was planned to evaluate and compare the quality of three brands of curd available in the local markets of Srinagar, J&K viz., Khyber, Zum-Zum and white valley. These samples were collected randomly & analyzed for physico-chemical, microbiological and organoleptic properties. Physico chemical analysis like moisture, protein, total solid content, ash, solid not fat, pH, Titratable acidity revealed that three curd samples were consistent and hardly showed any variation as compared to each other. Microbiological examination showed that Total plate count in Khyber brand ($6.34 \times 10^7$ cfu/m) was less as compared to Zum Zum ($7.30 \times 10^7$ cfu/ml) and white valley ($7.34 \times 10^7$ cfu/ml). Organoleptically, curd brands of Khyber and Zum zum milk plant was found more suitable as compared to white valley.

## 1. Introduction

Curd is traditional fermented milk product known for its refreshing taste, palatability and therapeutic values [1]. As per PFA rules, (1988) curd is a product obtained from pasteurized or boiled milk fermented with a culture, includes *Lactococcus lactis, L. cremoris, streptococcus thermophilus, Lactobacillus bulgaricus, L. Plantarium* and lactose fermenting yeasts. Curd is an excellent source of calcium, phosphorus, and magnesium. These minerals in optimum ratio are present in milk and are required for optimum growth and maintenance of bones [2]. Currently around 49% of the total milk produced in the country is consumed as liquid milk [3]. Out of the remaining 51%, around 26.5% of the total milk is converted into curd and 6% is converted into butter. The remaining 11.5% milk is converted into other dairy products such as paneer, khoa, ice cream etc. Dairy products in India are currently consumed fresh with a very small share being processed for value added dairy products to grow exponentially in coming years [4] curd is reported to have better nutritive value than milk. The digestibility of curd is more than that of milk. It has been reported that calcium and phosphorus content jof curd is synthesized by specific lactic acid bacteria [5]. In Srinagar J&K the quality of curd from various brands varies from shop to shop as proper hygienic practices are not followed, poor quality milk, unpacked, unavailability and contaminates that give rise to poor grade of curd with 1-2 days of storage period at room temperature [6]. So, the study was taken up with a view to evaluate the quality of available curd in local market of Srinagar J&K for physico-chemical analysis, microbiological and organoleptic properties.

## 2. Materials and Methods

### 2.1. Collection of Sample

Three commercially available brands of curd were randomly selected from local market under refrigerated conditions during the month of July 2013 and the samples were subsequently analysed. The trade and manufacturers names, ingredients and packaging methods were obtained from the dairy plants and were recorded. Samples were evaluated by a random experiments with three repetitions for each sample and the mean of the three values was recorded.

### 2.2. Physico Chemical Analysis

#### 2.2.1. Moisture Content

The moisture content of the curd products was determined

according to the [7]. Each product (10g) was placed in an oven at 105$^0$C for 3 hours. Readings were taken till constant weight was achieved. The moisture content was then expressed as the percentage (%) of the dry weight of sample by the formula given below:

$$\frac{weight\ of\ fresh\ sample - weight\ of\ dry\ sample}{weight\ of\ fresh\ sample} \times 100$$

### 2.2.2. Protein Determination

The protein content in curd samples ranged from 3.12 to 3.41 per cent. Protein content of curd samples coincided with the result of [8] and 10 ml of curd was pipette out into a 100ml titration flask. Few drops of phenolphthalein indicator were added to it. 0.4ml of saturated potassium oxalate solution was added and kept aside for 2-4 minutes without disturbing. The milk was titrated against 0.1N NaOH to end point. 2ml of neutral formalin was added and mixed well till the pink color disappeared. Titration of the same was done to end point with 0.1N NaOH. Protein content was calculated by using the formula:

$$\text{Protein \%= V} \times 1.7$$

$$\text{Casein \%= V} \times 1.38$$

Where, volume of NaOH In second titration is V.

### 2.2.3. Total Solids Content

The weight of the sample obtained from moisture content analysis was expressed as percentage total solids using the formula below:

$$\text{Total Solids} = \frac{weight\ of\ dish + dry\ dahi\ Weight\ of\ dish}{Weight\ of\ the\ sample} \times 100$$

### 2.2.4. Ash Content Determination

The ash content of each of dry samples was determined at 550$^\circ$C. The ash content is expressed as the inorganic residue left as a percentage of the total weight of curd incinerated. One gram of sample was weighed into pre weighed porcelain crucible and incinerated in a muffle furnace (model NSW-101) at 600ºC until proper ashing of the sample. The crucible

with ash was removed from muffle furnace, cooled in dessicator and weighed. Ash content was calculated by the following formula

$$\text{Ash (\%)} = \frac{ash\ weight}{sample weight} \times 100$$

### 2.2.5. Solids-Not–Fat

Solid–not- fat was determined by conducting total solids and fat analysis. Percent fat was subtracted from percent total solids to obtain percent solids-not-fat.

$$TS = SNF + FAT$$

### 2.2.6. Fat Determination

The fat content were estimated by Gerber method [9]

To 100gm of curd in a beaker add 5ml of strong ammonia to the weighed sample and shake well to make it homogeneous. Pipette out 10.75 ml of well mixed sample of curd and transfer it to butyrometer containing 10ml of amyl alcohol. Close the butyrometer with a rubber stopper, mix so as to digest the contents and centrifuge for 5 minutes. Adjust the fat column and take readings.

### 2.2.7. pH Measurement

The pH was determined at room temperature (27$^\circ$C) using a digital pH meter (JENWAY 3505). The ph meter was calibrated with buffer standards of pH 4 and pH 10 to use . 10 ml of each sample was placed in a beaker, the probe of the pH meter was inserted and pH value was recorded. Three recordings were taken for each sample and result was taken. The probe was rinsed thoroughly with distilled water before used on sample.

### 2.2.8. Titratable Acidity

The Titratable acidity was measured by titrating 10ml of the diluted curd samples with 0.1 N sodium hydroxide until the substance reached a pH value of 8.2 corresponding to the end point of the phenolphthalein. The amount of 0.1 N NaOH used was noted and then the Titratable acidity was calculated by using the following formula:

$$\text{Titratable acidity} = \frac{Burette\ reading \times Normality\ of\ NaoH \times Eq.wt\ .of\ Lactic\ acid \times Total\ volume\ used \times 100.}{Aliquot\ taken \times Sample\ wt. \times 1000}$$

## 2.3. Sensory Evaluation

A panel of 10 judges evaluated the sensory characteristics of prepared breads. The assessment involves the consideration of crust color, texture, taste and overall acceptability, using 5-point Hedonic rating scale (5-like extremely, 4.5-like very much, 4-like moderately, 3.5-like slightly, 3-neither like nor dislike, 2.5-dislike slightly, 2-dislike moderately, 1.5-dislike very much, 1-dislike extremely).

## 2.4. Microbiological Analysis

Total plate count were determined by the method as

described by [10]

Bacterial count was determined by the method of serial dilution using Nutrient Agar Media. One gram of homogenized sample was dissolved in previously sterilized 9 ml of distilled water. In this way a dilution of 10$^{-3}$ was obtained. One ml aliquot each of 10$^{-3}$ dilution was placed on three Petri dishes containing the nutrient agar media and incubated for 24-48 hours at 32±2ºC. The colonies so formed were counted and expressed as log cfu/g of sample.

Cfu/g=No. of colonies (Mean) x Dilution factor

Volume of sample used (0.1 ml)

## 2.5. Statistical Analysis

Means and standard errors were calculated for different parameters. Factorial design of experiment was followed. The data obtained was subjected to statistical analysis [11] for analysis of variance, critical difference using MS Excel for comparing the means to find the effects between treatments and storage period for various parameters in different experiments.

# 3. Results and Discussion

The research work was carried out to analyze the different brands of curd samples available in the local market of Srinagar J&K. The different brands of curd viz., 1, 2 and 3 were collected randomly from the local mark under stringent conditions and were analyzed for physico-chemical, microbiological and organoleptic characteristics.

## 3.1. Physico-Chemical Analysis

### 3.1.1. pH

The curd samples of three different brands were analysed and results are summarised in Table 1. The mean pH value of different samples i.e. .1, 2 &3 (Khyber, zum-zum & white valley was 2.16±0.96, 2.43±0.80 & 2.90±0.36. It was observed that there was a significant difference (p>0.05) among the pH value of different brands of curd samples. Mean separation indicates that sample 3 bears the maximum pH at 2.90±0.36, whereas lowest in sample1 at 2.16±0.96. The variation in the pH of compared curd samples could be attributed due to its different types of buffering action of protein, citrates, lactose, phosphates etc [12]. In the pH of the curd, along with acid tolerant bacteria present in the starter culture, duration of the product in the market before consumption is an important matter. The result indicates that pH of the curd sample reduces with the advancement of storage time both at room temperature and refrigerator. A decrease in pH with time interval of storage is naturally expected [13]

### 3.1.2. Total Titratable Acidity

Acidity value for curd samples of 1, 2 & 3 brands were shown in Table 1. The average acidity of curd was 0.15, 0.16 & 0.16 with standard deviation of 0.06, 0.09 &0.09 respectively. Significant difference were found (p>0.05) in respect of acidity contents of samples. These results are in line with the findings of [14]. The highest Acidity was that of sample 2 and 3 at 0.16±0.09 and the lowest was that of Sample 1 at 0.15±0.06.The highest acidity of sample 2 and 3 might be due to uncontrolled incubation, postproduction handling and prolonging storage while sample 1 might be produced under controlled incubation and controlled storage temperature to controlled incubation & post production handling & at $4^0$C.

### 3.1.3. Fat

The percentage of fat content of curd samples 1,2 and 3 was 3.1, 3.0 &3.0 with standard deviation 0.50, 0.65 & 0.50 respectively. Maximum fat percentage was in sample1 (3.1±0.50) followed by sample 2 (3.0±0.65) & sample 3(3.0±0.50). The results observed confirmed the findings of [15]. There was hardly any variation in fat content of different samples of curd probably because of good manufacturing practices i.e. quality control and standardization of raw milk. The fat content of curd depends upon the initial fat content of the milk used for curd making or raw material used to prepare the curd. Adulteration may also cause a reduction in the fat content of the curd.

***Table 1.** Physico-Chemical analysis (Mean ± SD) of Curd samples collected from local market of Srinagar J&K.*

| Sample | pH | Acidity | Fat | Ash | Moisture | Total solids | protein | SNF |
|--------|------|---------|----------|-----------|----------|-------------|---------|-----------|
| 1 | 2.16±0.96 | 0.15±0.06 | 3.1±0.50 | 2.53±0.68 | 80.9±0.96 | 14.03±0.37 | 3.3±0.3 | 10.93±0.58 |
| 2 | 2.43±.80 | 0.16±.09 | 03.0±0.65 | 2.43±0.15 | 82.7±0.70 | 16.56±0.55 | 3.2±0.3 | 13.56±0.51 |
| 3 | 2.90±.36 | 0.16±.09 | 3.0±0.50 | 1.96±0.35 | 87.0±1.79 | 16.56±0.55 | 3.1±0.26 | 9.8±1.52 |
| P | p>0.05 | p>0.05 | p>0.05 | p>0.05 | p<0.05 | p<0.05 | p>0.05 | p>0.05 |

The mean value having same superscript do not differ significantly (p>0.05).
(1=Khyber, 2=zum-zum, 3= white valley)

### 3.1.4. Ash

Ash content of different curd brands is presented in Table 1, it appears that, sample 1 contains maximum ash content of 2.53 which differs less from other two samples having mean value as 2.43&1.96 with standard deviation of 0.68,0.15&0.35 respectively. Statistical analysis showed that there was significant difference (p<0.05) within the ash content of different curd samples. Highest ash content was seen in sample 1 (2.5±0.68) and lowest ash content in sample 3 (1.9±0.35). The finding of this study agrees with the work of [16]. Ash content in different brands of curd varies might be due defects in standardization of milk, difference in concentration of milk, adulteration etc.

### 3.1.5. Moisture Content

The mean value of three different brands of curd samples was 80.9, 82.7 & 87.0 with standard deviation of 0.96, 0.70 & 1.79 respectively. The moisture content was highest in sample 3 followed by sample 2&1. The moisture content was lowest in sample 1, this justifies its thickness which the panelists averagely rated very thick.

### 3.1.6. Total Solids

The mean value of curd samples was 14.0, 16.5 &16.5 with standard deviation 0.37, 0.55 & 0.55 respectively. These results are in accordance with the findings of [17]. The lowest value was found in sample 1 followed by sample 2&3(same value). The total solids significantly increased

during storage. There was hardly any variation in total solids of different samples of plant made curd brands most probably because of standardization of raw milk and quality control measures taken to ensure consistency of end product.

### 3.1.7. SNF

The mean SNF content of three different brand samples was 10.9, 13.5 & 9.8 with standard deviation 0.58, 0.51 & 1.52 resp. The highest being found in sample2 (13.56±0.51) & lowest in sample 3 (9.8±1.52). The difference in SNF content may be the raw milk is used without subjecting to standardization.

### 3.1.8. Proteins

The average protein value was highest in sample1 with 3.3 values having standard deviation of 0.30 followed by sample 2 and 3 with 3.2 &3.1 with standard deviation of 0.30&0.26 respectively. There was found no significant variation in protein content of three different brands of samples because the addition of non fat dry milk &vegetable oil to skim milk improves the protein content of prepared curd.

### 3.2. Microbial Count

The Total viable count of three different brands of curd i.e. sample 1, 2 and 3 is shown in Table 2. The mean values of total viable count of 3 samples of curd were $6.34 \times 10^7$cfu/ml, $7.30 \times 10^7$cfu/ml, $7.34 \times 10^7$cfu/ml with standard deviation of 0.07, 0.04, and 0.05 respectively. These results are in line with the findings of [18]. The sample 3 has highest total viable count followed by sample 2 and 1. The variation in total viable count in different curd samples might be due to undefined starter culture in improper ratio and amount. It also contains heterogeneous mixture of lactic acid bacteria [19] so; as a result Total Viable Count in curd samples varies.

*Table 2. Microbiological analysis (Mean ± SD) of curd Samples collected from local markets of Srinagar, J&K.*

| Sample | 1 | 2 | 3 |
|---|---|---|---|
| CFU/ml×($10^7$) | 6.34 ±0.07 | 7.30 ±0.04 | 7.34 ±0.05 |

### 3.3. Organoleptic Evaluation

The organoleptic evaluation of three brands of curd i.e. Sample 1, 2 and 3 is shown in table 3. The result is different from those reported by [20]

*Table 3. Organoleptic evaluation (Mean ± SD) of curd Samples collected from local markets of Srinagar J&K.*

| Sample | Appearance | Texture | Taste | Aroma |
|---|---|---|---|---|
| Khyber.1 | 4.00[a] | 4.33[a] | 3.33[b] | 3.33[a] |
| Zum zu.2 | 3.83[b] | 3.83[b] | 4.16[a] | 3.83[a] |
| W.valley.3 | 3.00[ba] | 2.66[b] | 2.00[a] | 2.33[a] |
| LSD | 0.26 | 0.73 | 1.26 | NS |

The mean value having same superscript do not differ significantly (p>0.05).

### 3.3.1. Appearance

Data recorded in table 3 indicates score for appearance of curd under different treatments. The Khyber curd has highest mean score of 4.0 & sample 2 & 3 has 3.8 & 3.0 respectively. The sample 1 & 2 were attractive & had uniform body with smooth, yellowish, glossy appearance without any free wheying off on surface of the product. Sample 3 secured significantly lower score than rest of curd samples for appearance as free wheying off was observed on the surface of the product.

### 3.3.2. Texture

Texture of the curd depends mainly upon the rate of development of the acidity i.e. type of organisms present in the starter culture. The texture mean score of curd 1, 2 & 3 were 4.3, 3.8 & 2.6 with standard deviation of 0.57, 0.28 & 0.57 respectively. In the texture acceptability test. Hedonic scale showed that the curd sample 1 has highest value which was considered as excellent. The texture of curd was smooth & glossy while the cut surface was firm & free from cracks and gas bubbles. Sample 3 has lowest value which was considered as poor in the hedonic scale.

### 3.3.3. Taste

From table 3 the sensory score values obtained was highest in sample 2 (4.1) which was at par with sample 1 (3.3). Sample 3 has lowest score. Sample 3 has lowest score sample 2 ranked first followed by 1 as it contained delicate and clean acid taste. The curd 3 secured significantly lower score of it was lacking clean acid taste.

### 3.3.4. Aroma

The aroma has been found highest in sample 2 (3.8) followed by sample 1 (3.3) because of being prepared by using *Lb. acidophilus & Lb. delbreuckii subsp. Bulgaricus.* The lowest being found in sample 3 (2.3), it has off, unpleasant aroma because of being prepared by using *Lb. delbrueckii sub.sp.bulgaricus.*

## 4. Conclusion

From the present study it can be concluded that the curd available in local market of Srinagar city (J&K) is not of a good quality. A comprehensive research work is still required to set a standard for commercial production of curd in J&K to have uniformity and superiority in its physico-chemical, organoleptic and microbiological quality.

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