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Effect of Starter Culture on Bacterial Activity and Nutritive Value of Fruit Yoghurt

Shanza Mukhtar

Department of Nutrition and Dietetics, the University of Faisalabad, Punjab, Pakistan.

shanzakhan11@yahoo.com

Abstract

Yoghurt is a cultured, semisolid and curdled food product. It is made from fermented milk by a bacterium. Whereas, the fruit yoghurts are milk products that are fermented by special cultures of Lacto bacteria. The aim of the study was to examine the nutritional quality by proximate analysis and also to find out microbiological status by total bacterial and plate count of fruit yoghurt. The variation in nutritive value and microbiological load among fresh and stored fruit yoghurt was also evaluated. The results revealed that the carbohydrates are increased in commercial yoghurt and decreased after storage in both types of yoghurts. Similarly, moisture, Ash, fat, protein and acidity were significantly increased after storage in both types of yoghurts. The pH values were significantly decreased during storage. Fruit curd was highly acidified rather than fruit yoghurts. The total viable count was also highly significant in both types of yoghurt during storage. High bacterial activity was found in fruit curd than in fruit yoghurt. *Lactobacilli* were identified in all fruit curd than in fruit yoghurt thermophilic bacteria were also detected.

Keywords: *Fermented milk, microbiological load, bacterial activity, Lactobacilli, thermophilic bacteria.*

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1. Introduction

Basically, yoghurt is a cultured, semisolid and curdled milk food product. It is made from fermented milk by a bacterium. It has slightly lower sugar content than pure raw milk and has more easily digestible proteins. Commercial dairies make yoghurt by inoculating sterilized milk with bacteria, *Streptococcus thermophillus* or *Lactobacillus acidophilus* and then incubate. The World Health Organization has developed certain standards for the use of yoghurt internationally [1]. Many studies have used probiotic or health bacteria from yoghurt cultures [2-3]. The role of probiotics on gut flora and as primary immune system has been widely studied. The two bacterial genera, *Lactobacillus bulgaricuss* and *Streptococcus thermophillus* were found in yoghurt. *Lactobacilli* and *streptococci* stimulate an enzyme that helps the synthesis of cytokines. The level of this enzyme increases in humans due to ingesting yoghurt. Yoghurt contains live and active bacterial cultures [2, 4].

Those fruits which contain high content of fructose for sweetening and flavoring called egute products. Peaches and nectarines contain significantly good amount of major nutrients. They are good sources of beta carotene and vitamin A, which have anti-aging agents. The sweetened fruit preparation is processed by blending whole, sliced or crushed fruits. The ratio between fruit and sugar such as 3:1, 4:1 and 7:1 is mostly preferred. A good quality fruit is used in manufacturing the product. These products are used in yoghurt or ice-cream and other dairy products [5].

Fruit yoghurts are milk products that are fermented by using special cultures of lacto-bacteria. The consistency of fruit yoghurts is jelly-like. These contain different types of fruit as additives that may be randomly or homogenously sprinkled in layers form. Fruit preparation through pectin is used in dairy products. Pectin has a stabilizing effect in fruit yoghurt. Fruit has been prepared separately from yoghurt without any effect of jelly. Pectin provides a smooth and creamy texture in fruit yoghurt. They contain high nutritive values and healthy whey proteins [6]. In minimally processed fruit yoghurt some phytopreservatives such as vanilli act as antimicrobial agents. Fruit yoghurt made from minimally fresh fruits increases the consumption rates of fruit yoghurt rather than plain yoghurt. For controlled microbial spoilage of fresh fruit yoghurt, the use of vanilli and nisin has been increased. The growth of microbial spoilage suppresses with the addition of vanilli [7].

A comparative study on microbiological analyses of fruit-flavoured yoghurt, plain yoghurt, and sugar-added plain yoghurt concluded that these types of yoghurt should not be stored for a longer time period. They should not be stored for more than 7 days. Since contamination of yeast and bacteria will occur likely in all types of yoghurt after that period [8]. Yoghurt is good source of protein, riboflavin, vitamin B_{12}, calcium, magnesium and potassium as well. Whereas, fortified yoghurt contains a high level of vitamin A and D since fruits are a good source of vitamins A, C, folate, potassium and fiber [9]. Several health benefits can be had from some species of lactic acid bacteria. They improve the nutritional values of foods. These bacteria also help to control intestinal infections and improve the digestion of lactose. It also helps to control some types of cancer and is also good for the control of cholesterol levels in the body [10]. Yoghurt in the form of *bifidobacteria i*s good for improving intestinal health. Yoghurt appears to be a miracle food for dieters, babies, health nuts or those who prefer natural foods. It carries higher nutritional value though; it is low in calories and fat. Yoghurt is also considered to be a well-balanced and perfect food [13]. The project at hand was planned to determine the type of bacteria of starter culture used for making fruit yoghurt and count the microbial load on fruit yoghurt. The aim of the study also involves determining the nutritional value of fruit yoghurt and

comparing the nutritional value and total viable count of commercial and homemade fruit yoghurts before and after storage.

2. Materials and Methods

It was a comparative study in which the nutritive value (Proximate analysis) and microbiological status (total bacterial count) of fruit yoghurt were determined a fresh as well as stored for 7 days.

2.1 Sample Size

A total 8 samples were used in comparative study. In all 4 samples of commercial fruit yoghurt in to three replicates were collected from the local market of Faisalabad. Whereas, equal (4) samples of fruit yoghurt, in three replicates were prepared at home.

2.2. Preparation of Fruit yoghurt

Strawberry yoghurt were washed and cut edible portion. Strawberry puree was prepared first by adding sugar and strawberry in blender and blend till it smooth puree was obtained. Fruit puree was poured in mixing bowls and a known quantity of plain yoghurt (made from buffalo milk) was added to bowl and stirred it till a uniform mixture was attained. Commercial and homemade yoghurts were prepared in same procedure and same ratios.

2.3. Area of Research

The fruit yoghurt samples were brought and processed in the Nutrition Research Laboratory of the Institute of Animal Nutrition and Feed Technology and Microbiological Laboratory of the Institute of Veterinary Microbiology, University of Agriculture, Faisalabad.

2.4. Proximate Analysis for determination of nutritional values

The proximate analysis of fruit yoghurt for protein, fat, crude, ash, soluble carbohydrates, pH and acidity were determined by using the method given by [11]. The same method was applied on both types of fruit yoghurt on condition, fresh and stored samples.

2.5. Microbiological Analysis

The total viable counts of bacteria per gram were assessed by [12]. Determine the microbial count of both types of fruit yoghurt on fresh and stored conditions. Also determined was the bacteria of the starter culture and the growth of bacteria.

2.6. Statistical Analysis

The resulting data were subjected to analysis of variance on SPSS software the significant results was put on the Duncan Multiple Range Test [12] to interpret the results.

3. Results and Discussion

3.1. Starter Identification.

While analysis of the starter culture, *Lactobacilli* were identified in all homemade yoghurts and in commercial fruit yoghurt but in some commercial samples thermophilic bacteria were also detected. Most of the bacteria were gram-positive.

2.7. Nutritional values

3.2.1. Moisture

Moisture was significantly high in samples of homemade fruit yoghurt in after storage as compared to the commercial fruit yoghurt. The moisture of both commercial and homemade fruit yoghurt were significant ($P<0.01$) increased after storage (table 1). A study reported that the moisture content to range from 77 to 96 % [15]. A comparative study concluded that the moisture content was increased during storage. Their result is correlated with this study. The increase in moisture during storage is due to the decrease in total solids [16].

3.2.2. *Ash*

Ash was significantly increased in commercial fruit yoghurt in after storage as compared to homemade samples. The ash in commercial samples was found to be significantly high ($P<0.01$) and in homemade fruit yoghurt was found to be significantly ($P<0.05$) increased after storage (table 1). A study reported that the ash contents recorded in fruit yoghurt is 0.71 to 0.75 which is coordinated to the present study. The increased amount is due to the high total solids in yoghurt. Significant changes recorded during storage were found in the study [17] which showed similar findings to the present study.

Table 1: The significant effect on nutrition value in commercial yoghurt and homemade yoghurt for 0 day and 7 days storage

Parameter	Commercial yoghurt		Homemade yoghurt	
	0 day	7 day	0 day	7 day
Moisture	83.01±1.23	85.33±1.16	84.52±0.82	86.58±0.89
Ash	0.58±0.38	1.09±0.232	0.73±0.03	0.64±0.02
Fat	0.395±0.071	0.771±0.211	0.470±0.217	5.37±0.403
Protein	3.13±0.161	3.72±0.127	4.12±0.153	4.69±0.179
Carbohydrates	12.88±1.32	9.09±1.19	6.01±0.63	2.71±0.34
pH	4.58±0.04	4.28±0.04	4.13±0.04	3.94±0.03
Acidity	0.86±0.01	0.96±0.01	0.98±0.006	1.19±0.008

3.2.3. *Protein*

Protein was found to be significantly increased after storage in both commercial and homemade fruit yoghurt. Protein of homemade yoghurt was highly significant then in commercial yoghurt after storage (table 1). Study reported that the protein contents were significantly increased by using 20% of starter culture. The yoghurt contains 3.6% protein but in another study reported that yoghurt contains 2.9% protein [18]. A research study reported that the range of protein during storage was (3.61-4.34) that are in coordination with the present study [16].

3.2.4. Fat

Fat in both commercial and homemade fruit yoghurt was found to be significantly high after storage. High fat contents were found in homemade yoghurt rather than commercial yoghurt. The analysis of fat values showed a maximum increase in fat (table 1). Increase in fat content appeared to be due to acidic pH. These findings are in accordance with the results observed that the fat content of yoghurt ranged from 3.1 to 4.5% during storage [16]. In another experiment reported that the fat contents of bio yoghurt ranged from 3.1 % to 4.5 % during storage period. Some similar results also showed in the study [19].

3.2.5. Carbohydrates

Carbohydrates were significantly decreased in commercial and homemade yoghurt. It may be increased by the addition of sucrose or sweetened sources. CHO decreased due to an increase in the moisture contents in yoghurt. The total solid not-fat is higher in fruit yoghurt but during storage it rapidly decreased due to an increase in moisture contents (table 1). From a study reported the same results; they found that the total solid not-fat reduced during storage which reflected that the carbohydrates were also decreased during storage [19].

3.2.6. pH

pH was found to be decreased after storage in both type of yoghurts. In homemade yoghurt it decreased more than commercial yoghurt due to standardization. The pH values were significantly decreased after storage (table 1). Similar results found the pH value and viscosity were significantly decreased after storage [21], [20] also showed the same results that the increasing storage temperature and time can decreased the pH value

3.2.7. Acidity

High acidity was found in homemade yoghurt than commercial yoghurt. Acidity was significantly increased after storage in both types of yoghurt but more acidification was found in homemade yoghurt due to the presence of lactobacillus bacteria (table 1). The study reported that the acidity of showed significant changes during storage. The acidity significantly increased after storage. The titratable acidity had increased from 1.21% to 1.40% during storage [21].

2.8. Microbial analysis

The total viable counts were found to be high in homemade yoghurt. Microbial load were significantly increased after storage in commercial and homemade yoghurt but the ratio of bacterial growth were high in homemade samples rather than commercial yoghurt samples as shown in Table 2. A study report showed that the addition of citric fiber enhanced the growth of lactic acid bacteria [22]. Some of results are similar to present study that the significant changes in colony forming were recorded during storage period. The significant increase in microbial count is due to increase of acidification of fruit yoghurt [23]. During storage the number of viable count significantly change but no effect on lactobacillus on all yoghurt samples.

Table 2: The significant effect on microbial count in commercial yoghurt and homemade yoghurt for 0 day and 7 days storage

Groups	Total viable count	
	0 day	7 day
Commercial fruit yoghurt	133.42±5.20	154.42±4.42
Homemade fruit yoghurt	188.75±5.94	207.08±6.59

Conclusion

The study concluded that the addition of fruit pulp enhance the nutritional quality and flavor of plain yoghurt. The study obtained significant results. The results revealed that the carbohydrates are increased in commercial yoghurt and decreased after storage in both type of yoghurts. Similarly, moisture, Ash, fat, protein and acidity were significantly increased after storage in both types of yoghurts. The pH values were found significantly decreased during storage. That caused increased in the acidity of yoghurt. Homemade yoghurt was highly acidified rather than commercial yoghurts. The total viable count was also highly significant in both types of yoghurt during storage. High bacterial activity was found in homemade fruit yoghurt rather than commercial yoghurt. Lactobacilli were identified in all homemade yoghurts and in commercial fruit yoghurt thermophilic bacteria were also detected.

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