Original Article

Effect of Storage on Physio-Chemical Properties of Peanut Yogurt

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Abstract:

Peanuts may be consumed in a variety of processed forms like roasted, raw and processed etc. and represent as a multimillion dollar crop worldwide with many potential dietary benefits as it contains high protein and health effective oils. **Objective:** The present investigation was planned to evaluate the physio-chemical properties of peanut milk yogurt by the addition of different concentration of peanut milk (0 %, 10 %, 20 % and 30 %), skimmed milk liquid (60 %, 70 %, 80 %, and 90 %), skimmed milk powder (9 %) and sugar (1 %). **Methods:** The physio-chemical tests (pH, acidity, moisture, ash, fat, protein, syneresis, and viscosity) were examined after every 5 days of interval for a period of 15 days at 4 ºC. **Results:** The results of physio-chemical analysis revealed that pH, ash, fat, protein and viscosity decrease during storage period where as acidity, moisture and rate of syneresis increased during storage. Treatment T_1 (10 % peanut milk) was comparatively best for manufacturing of peanut milk yogurt followed by T_2 (20 % peanut milk + 70 % skimmed milk liquid + 9 % skimmed milk powder + 1 % sugar) while peanut milk yogurt from (30 % peanut milk + 60 % skimmed milk liquid + 9 % skimmed milk powder + 1 % sugar) had the lowest degree of firmness. **Conclusions:** It was noticed that correlation among fat, total solids and protein contents in peanut milk affect the extent of serum separation and pH of yogurt. The storage had significant effects on all physio-chemical parameters. Treatments had significant effect on all physio-chemical parameters.

Key words: Peanut yogurt, Physiochemical properties, Peanuts

Introduction:

Milk and different dairy products are crucial for human health owing to their higher content of protein, vitamin and minerals mainly calcium, potassium, magnesium and phosphorous etc. [1]. The word yogurt originated from Turkey, dating back to 2000 B.C, when Middle Eastern civilization used fermentation for preserving milk [2]. Yogurt is a fermented milk product made by using selected microorganisms like *Streptococcus thermophilus* and *Lactobacillus Bulgaricus* to develop the characteristic flavor, body and texture of yogurt [3]. The nutrient value of curd or yogurt depends on the milk composition and substances added to it during manufacturing [4]. Yogurt improves lactose digestion, nutritive value, antimicrobial, anti carcinogenic properties and reduce cholesterol level. In addition it is an immense source of calcium, phosphorus, potassium and water soluble vitamins mainly thiamin and riboflavin [5]. The need of consumers for functional foods has been inflated by the relation between diet and health. Scientific research accomplished throughout the earlier years pointed out several potential health benefits from food components in addition to basic nutrition [6]. Peanut has an important role in fighting against malnutrition [7]. Peanuts are also paying attention as a functional food. Numerous beneficial elements present in peanuts comprising magnesium, flavonoids and vitamins like vitamin E, make it an energy rich food and good for long and healthy

life. Peanuts and tree nuts consumption was analyzed by which clinical studies verified useful effects on lipoproteins and lipids as they lower the lipoprotein and total cholesterol level as well as triglycerides [8]. Yogurt made from peanut milk had almost parallel qualities as marketable animal milk and it was a good substitute particularly where cost is major concern and also found that values of methionine, lysine and tryptophan is increased during fermentation [9]. Peanut milk has been used as a source of protein in yogurt manufacturing by keeping the overall quality of peanut milk yogurt acceptable. Due to containing protein rich important minerals and essential fatty acids peanut milk yogurt is nutritionally beneficial, and it is safe for children which are allergic to cow milk proteins [10]. The chemical and sensory characteristics of peanut milk were examined by fermentation effects with *Lactobacillus bulgaricus and Streptococcus thermophilus* alone as well as in combination. During fermentation, changes in titratable acidity, pH and viable cell population showed that there was a synergistic relation between *L. bulgaricus* and *S. thermophilus.* The acetaldehyde present in peanut milk is increased during fermentation. A momentous enhancement in creamy flavor and decline in beany flavor occurring as a result of fermentation is illustrated by the co-relation of sensory evaluation scores and changes in concentration of these volatiles [11].

Methods:

1. Procurement of raw materials

Peanuts, raw milk, skimmed milk, sugar and chemicals (*Lactobacillus bulgaricus and Streptococcus thermophilus*) are the materials that were used for this study. All these materials were purchased from the local market. Peanut milk yogurt was manufactured and analysed in the Laboratory of National Institute of Food Science & Technology, University of Agriculture, Faisalabad.

2. Preparation of peanut milk

Firstly peanuts were washed and soaked in water for seven hours at room temperature. Then peanuts were grounded followed by water which was twice of peanut weight. Peanut milk was obtained by filtering the resultant slurry through centrifugal separator with a double layered cheese cloth. It was heated for 15 min at 90 °C [12].

3. Physio-chemical analysis of raw peanut milk

Homogenized raw peanut milk prepared was analyzed for its physio-chemical properties.

I. pH

Electronic digital type of pH meter-Hanna 8416 was used for pH determination according to method No. 981.81 of AOAC (2006).

II. Acidity

Acidity was determined by direct titration method of AOAC 947.05 (2006).

III. Ash

Ash content in peanut milk was determined by igniting the sample by following Method No. 942.05 AOAC (2006). 5 g of yogurt sample were weighed in a china dish and first ignited on flame and then in muffle furnace at 550 °C until the constant weight of white ash is obtained.

$$\text{Ash}(\%) = \frac{\text{Weight of ash}}{\text{Wt. of sample}} \times 100$$

IV. Moisture

The moisture content in yogurt was determined by drying samples in oven by the Method No. 926.08 of AOAC (2006). 5g sample of yogurt was weighed in weighed China dish and placed in oven at 105±5 °C till constant weight. Loss in weight of sample was expressed as moisture content in yogurt.

$$\text{Moisture}(\%) = \frac{\text{Weight before drying} - \text{Oven dried weight}}{\text{Wt. of sample}} \times 100$$

V. Crude Fat

Crude fat was determined following the Gerber apparatus and method number 933.05 of AOAC (2006). **Procedure:** 10.94 mL milk sample was taken in a butyrometer containing 10 mL H_2SO_4 of specific gravity 1.835 and 1 mL amyl alcohol. It

was centrifuged for six min. at 1100 rpm and then readings were noted.

VI. Crude Protein

Crude protein was determined by Kjeldhal apparatus and following the method number 976.06 of AOAC (2006). The sample (5 mL) was first digested with 25 mL concentrated sulphuric acid in the presence of digestion mixture (0.7 g HgO and 15 g powder K_2SO_4) for 5-6 hours or till the digestion mixture attained light green or transparent color. This material was diluted and taking 10 mL of material which is diluted and 10 mL of 40 % NaOH solution in the distillation kit and distillation was prepared. There was liberation of ammonia gas which was accumulated in 2 % boric acid solution including methyl red as an indicator finally the distillate was titrated against 0.1 N H_2SO_4 solution till golden brown end point. The crude protein percentage was calculated by multiplying nitrogen with a factor 6.25.

Results:

Peanut Milk Composition

The compositions of peanut milk and cow milk is in Table 1.

Analysis	Cow Milk	Peanut milk
pH	6.72±0.04	6.68±0.07
Acidity %	0.16±0.01	0.016±0.01
Water %	87±2.5	87.15±3.6
Fat %	7.0±1.4	7.71±1.45
Protein%	4.6±0.920	3.71±0.1
Ash %	0.8±0.16	0.31±0.14
Total solids %	17.86±0.35	12.3±0.29

Table 1: Composition of Peanut and Cow milk

pH value of all yogurt treatments decreased during storage. The decrease in pH at 0 to 15 days of storage was 4.70 to 4.41, 4.84 to 4.55, 4.71 to 4.42 and 4.64 to 4.35 for yogurt samples of 0% to 30% peanut milk respectively. It is evident from results that pH decreased gradually in all treatments throughout storage period of 15 days. The pH was decreased due to the increase in the acidity and alteration of lactose into the lactic acid and excessive sugar fermentation during storage period. Changes in pH are represented in Figure 1.

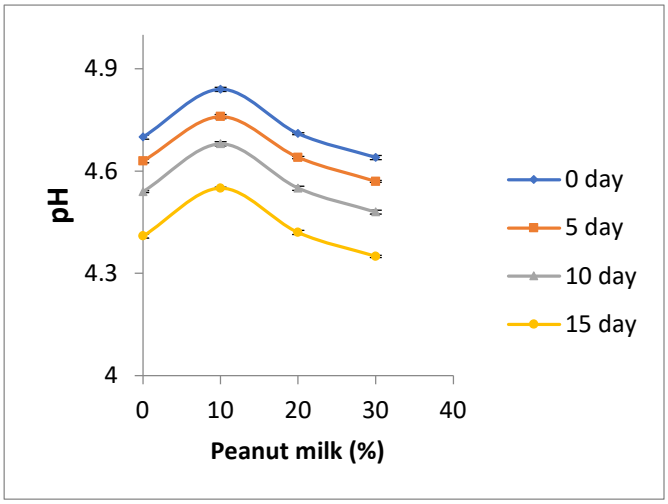

Figure 1: pH of peanut yoghurt with different concentrations during storage

The percent increase in acidity values after 15 days storage were 0.11%, 0.19%, 0.12% and 0.12% for T_0, T_1, T_2 and T_3 respectively. Yogurt quality deteriorates quickly as acidity increases with the passage of time and yogurt becomes tart and bitter. The data on changes in acidity of peanut milk yogurt during storage is presented in Figure 2.

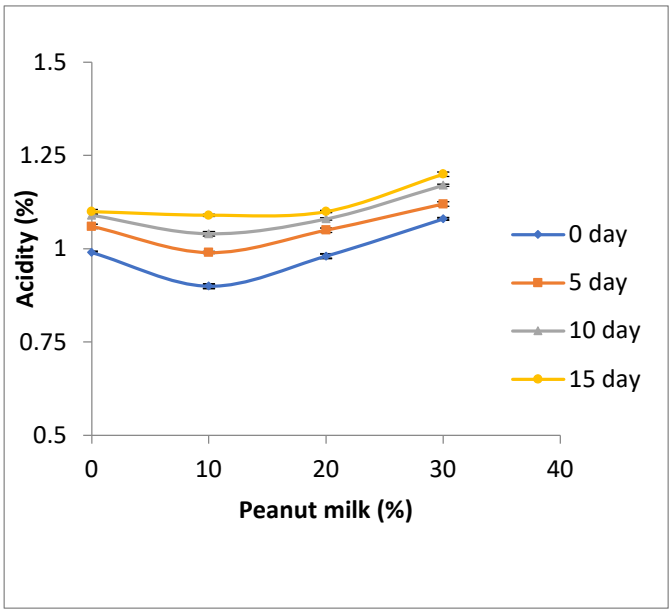

Figure 2: Acidity of peanut yoghurt with different concentrations during storage

The data on moisture contents of peanut milk yogurt under various treatments, affected by storage shown in Figure 3. The moisture scores after 15 days of storage increased from 78.33 to 78.49 for 0 % peanut milk yogurt treatment, 77.40 to 77.57 for 10 %, 74.20 to 76.40 for 20 % and 71.0 to 71.18 for 30 % peanut milk yogurt treatment respectively.

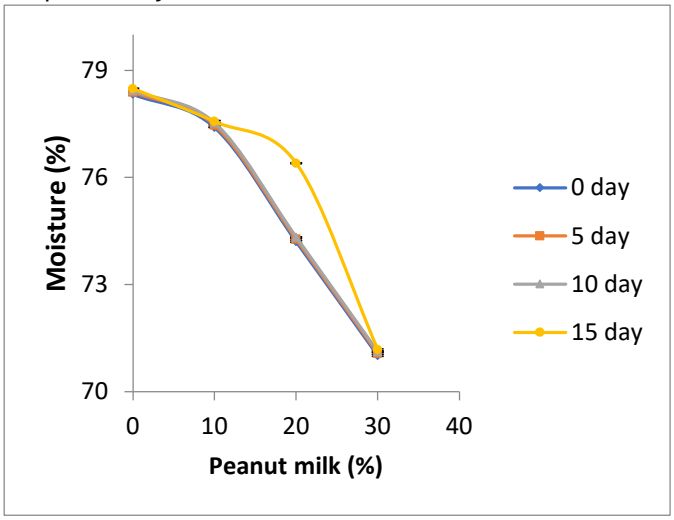

Figure 3: Moisture of peanut yoghurt with different concentrations during storage

Peanut milk yogurt had higher contents of K, Zn, Cu and Fe than cow milk yogurt. The effect of storage on ash contents under various treatments is presented in Figure 4.

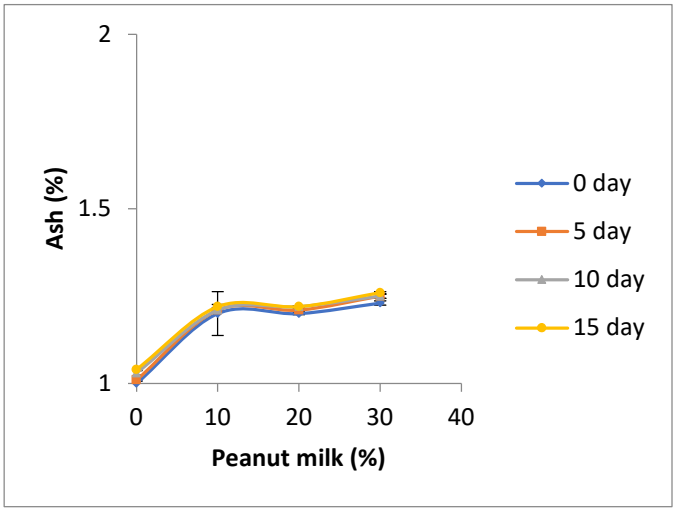

Figure 4: Ash content of peanut yoghurt with different concentrations during storage

Fat contents during 15 days of storage were decreased. Fat content decreased 0.05% for T_0 yogurt contained 0 % peanut milk, 0.04% for T_1 yogurt contained 10 % peanut milk, 0.05% for T_2 yogurt contained 20 % peanut milk and 0.10% for T_3 yogurt contained 30 % peanut milk respectively in fig. 4.7. Among treatments maximum value was observed in T_3 while T_1 had minimum value. Maximum decrease was observed on the 15th day of storage with minimum decrease on zero days.

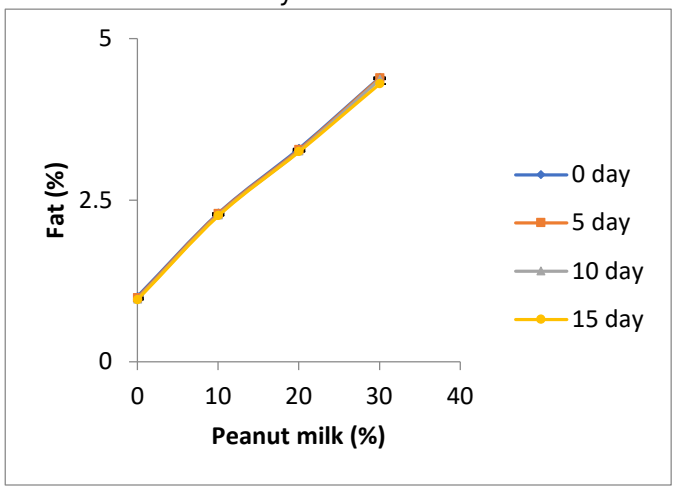

Figure 5: Fat content of peanut yoghurt with different concentrations during storage

The data on protein content of peanut milk yogurt samples prepared under various treatments during storage fig.1.6. Protein of all peanut milk yogurt samples slightly decreased during storage. Minimum decrease was observed in T_2 yogurt contained 20 % peanut milk while T_1 yogurt contained 10 % peanut milk had maximum decrease.

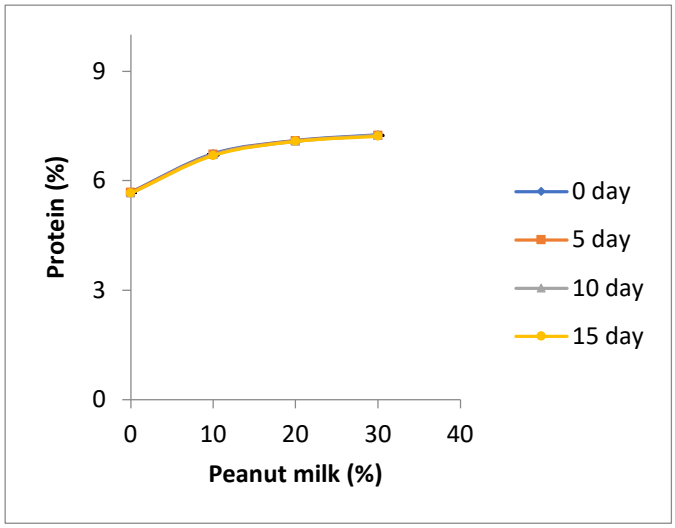

Figure 6: Protein content of peanut yogurt with different concentrations during storage

Discussion:

The compositions of peanut milk and cow milk was as reported by Saleem-ur-Rehman *et al.*, 2003 [13]. Low pH, higher acidity & sourness take much time to reach a desirable pH and acidity caused by imbalanced ratio of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* during fermentation which resulted short shelf life with poor body characteristics and syneresis. pH value of all yogurt treatments decreased during storage. The decrease in pH at 0 to 15 days of storage was 4.70 to 4.41, 4.84 to 4.55, 4.71 to 4.42 and 4.64 to 4.35 for yogurt samples of 0% to 30% peanut milk respectively. It shows that difference between initial and final values were 0.29 of all four treatments. It is evident from results that pH decreased gradually in all treatments throughout storage period of 15 days. The pH was decreased due to the increase in the acidity and alteration of lactose into the lactic acid and excessive sugar fermentation during storage period. Acidity of peanut milk yogurt is responsible for the changes from milk sugar (lactose) into LAB. Acidity of yogurt irrespective of any treatment increased during storage [14]. The percent increase in acidity values after 15 days storage were 0.11%, 0.19%, 0.12% and 0.12% for T_0, T_1, T_2 and T_3 respectively. The increase in acidity during storage is attributed to acid production in peanut milk yogurt subsequently of lactose catabolism by the bacterial cultures [15]. Result observed confirmed the findings of Lucey (2004) who observed the similar changes in the acidity of yogurt during storage. The rise in acidity was found maximum in yogurt contained 20% peanut milk and minimum in 0% peanut milk. The reason behind it is that total solids and protein have ability to bind water, which ultimately restricts the microbial activity [16]. Peanut milk yogurt had higher contents of K, Zn, Cu and Fe than cow milk yogurt. Ca supplied by yogurt had better absorption and utilization than any other available form. Therefore mineral contents in yogurt are high and readily available to the body [17]. It has been reported that replacement of saturated fatty acids with mono-unsaturated fatty acids such as oleic acid leads to the increase in high-density lipoprotein [18]. The result observed confirmed the findings of Munir (2005) who observed the similar changes in the fat of yogurt during storage. Reduction of fat in peanut milk yogurt is under the effect of acidic pH during storage and another reason might be the lipolytic activity of microflora due to the longer period of time. Protein contributes to the flavor, body and texture of the final products. It is also used for energy [19]. The consistency of yogurt is reliant on its structure, a protein network which is formed by casein micelles strings and/or clusters entrapping serum and fat globules [2]. The yogurt having large protein components (7.39 %) created less number of pores and have lower syneresis compare to lower protein yogurts [20].

Conclusions:

The results of physio-chemical analysis revealed that pH, ash, fat, protein and viscosity decrease during storage period where as acidity, moisture contents increased during storage. It was noticed that correlation among fat, total solids and protein contents in peanut milk affect the extent of serum separation and pH of yogurt. With solids content of 10 % peanut milk, peanut milk yogurt was produced without the need of stabilizers and showed greater cold storage ability with a shelf life up to 15th days.

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