

Physiochemical comparative analysis between garlic and oat fiber based yogurt

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Abstract: The study was conducted to determine the effect of different concentrations of garlic and oat fiber in yogurt and its physiochemical analyses during storage. In this research, analyses were carried out for each sample to evaluate its different parameters such as moisture, ash, protein, lactose, fat and solid mass after storage 0, 5, 10 and 15 days at 4°C. It was concluded that garlic and oat fibers slightly enhanced the quality of yogurt as compared to control sample of yogurt. It was observed that the protein, lactose, ash, fat and solid mass slightly increased whereas the moisture depleted during storage. Different concentrations of garlic and oat fibers have different effects on the quality of yogurt.

Keywords: Yogurt, garlic powder, oat fiber, comparative analysis.

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INTRODUCTION

Yogurt is one of the most widely distributed dairy products. Yogurt has a smooth texture, mildly sour and pleasant flavor. It is obtained from milk soured by *Lactobacillus bulgaricus* and *Streptococcus thermophilus*¹, and also by *Lactobacillus Helvetius* and *Lactobacillus delbrueckii* spp². Yogurt in different forms with diverse local names is made throughout the world³. Different starter cultures i.e. bacterial species being used to provide more functional properties with different flavored^{3,4}. Flavor and texture are the most pronounced factors that influenced the quality of yogurt⁵.

The composition of yogurt is dependent on the type and source of milk and a range of seasonal factors⁶⁻⁸. Dairy products have generally been considered an excellent source of high-quality protein, calcium, potassium, phosphorus, magnesium, zinc, and the B vitamins riboflavin, niacin, vitamin B-6, and vitamin B-12⁹. Proteins in yogurt are of excellent biological quality, as are that in milk, because the nutritional value of milk proteins is well preserved during the fermentation process¹⁰. Both the caseins and the whey proteins in yogurt are rich source of Amino acids (93%) and high in nitrogen availability is high^{11, 16}. Amino acids like proline and glycine are present in free form and higher contents in yogurt than in milk¹².

Garlic is a frost-hardy bulbous perennial erect herb of 30–100 cm in height with narrow flat leaves and bears small white flowers and bulbils¹³. It has long been taken as a tonic, a bactericide and a popular remedy for various ailments¹⁴.

More recently; however, it has been recognized as a medicinal plant for the prevention of blood circulatory disorders¹⁵, cancer¹⁷ and memory loss¹⁸.

Garlic has been considered as a rich source of carbohydrate, proteins and phosphorus. Ascorbic acid contents are reported to be very high in green garlic²⁰.

Dietary fiber is the indigestible portion of plant foods that pushes food through the digestive system, absorbing water and easing defecation sometimes called roughage. Some plants contain significant amounts of soluble and insoluble fiber. For example plums have a thick skin covering a juicy pulp²¹. The oat grain is a hardly cereal which resembles wheat and can withstand poor soil condition. Constituents in dietary fiber may interact with food components during processing leading to changes in the nutrients. The effect of fiber addition to dairy products has deals with stabilizer and emulsifier for texture improvement²².

MATERIALS AND METHODS

Nestle milk

Gelatin, sugar and garlic powder (National) are used as raw material. *Lactobacillus spp.* was used as starter culture. Yoghurt was prepared with the method described by Aggarwala and Sharma (1961). Different concentration of galic was added in yogurt. (0.05 and 0.1 i.e., 5% and 10%) and then mixes it. Garlic based yoghurt was packed in disposable cups, covered with aluminum foil. The cups were stored in refrigerator at 4°C for further experimentation.

Physiochemical analysis

The physio-chemical analysis was carried out during 15 days of storage period.

Protein

Protein and nitrogen contents of yogurt samples were determined by Kjeldahl method according to the BS 1741-5.2²³.

Fat

Fat was determined (on wet weight basis) by Soxhlet's method by using this formula, % Fat = g of fat in dry sample/g fat of in wet sample* 100²⁴.

Total solid

Total solids were determined by following formula, % Total solids (wt/wt)=wt. of dry sample/wt. of wet sample* 100²⁵.

Moisture

Moisture contents of yogurt were determined by oven dry method²⁶ and calculations were carried out by using following formula: Moisture %=wt. of fresh sample-wt. of sample after drying x 100/weight of sample.

Ash

Ash contents were determined by following formula: Ash % = wt of crucible and Ash - wt of crucible x 100/wt of sample

Lactose

The lactose in yogurt sample was determined by the gravimetric method described by AOAC official methods²⁷.

RESULTS AND DISCUSSION

This study was carried out on the comparison of preparation and nutritional evaluation of garlic based yogurt and fiber based yogurt. In this study, physicochemical analysis like moisture contents, ash contents, fat contents, protein contents, total solid mass, acidity and amounts of lactose were analyzed.

Physicochemical analysis**Moisture**

The moisture content of garlic based yogurt is shown in table 1. The average moisture % of different samples is as follow: for X=84.71 %, X₁=83.44 %, X₂=83.21 % and X₃=83.12. On the other hand the moisture contents of fiber based yogurt were decreased as in control sample (S). The data in the table.2 showed that the moisture content of all the samples decreased with the addition of oat fibers. Kamruzaman, *et al.*, (2002) calculated the maximum moisture content of plain yogurt was 82.90%. They revealed that the moisture content of yogurt was decreased during storage period is due to the evaporation rate of moisture content during storage at refrigerated condition. Hamdan, *et al.*, (1971) and Bills, *et al.*, (1972) stated that the moisture contents decreased from 86.90% to 84.95% during refrigerated storage. According to Mohammad, *et al.*, (1986) the equilibrium relative humidity (ERH) of garlic powder was found to be 14%.

Table 1: Moisture % in yogurt prepared by garlic powder during storage of 15 days.

Treatments	Moisture % in yogurt within 15 days of storage			
	0	5	10	15
X	84.78	84.72	84.68	84.65
X1	83.50	83.46	83.43	83.38
X2	83.28	83.22	83.19	83.16
X3	83.18	83.14	83.09	83.05

Table 2: Estimation of moisture contents in oat fiber based yogurt within 15 days.

Treatments	Estimation of moisture contents in Yogurt within 15 days			
	0	5	10	15
S (control)	85.00%	84.95%	84.91%	84.87%
S1(0.1gm)	84.19%	84.15%	84.12%	84.08%
S2 (0.2gm)	83.99%	83.95%	83.90%	83.87%
S3 (0.5gm)	83.88%	83.84%	83.80%	83.76%

Ash

The "ash contents" is a measure of the total amount of minerals present within a yogurt. Ali, *et al.*, (2002) studied the quality of yogurt made in laboratory and available in the market and found the average ash contents 1.12 %. The content of ash of freeze-dried garlic was 3.6%²⁸. These values were resembles to our findings. The ash content of garlic based yogurt and oat fiber based yogurt is shown in Table 3 and 4 respectively. The ash % of all yogurt samples increase during 15 days of storage period. As a result, garlic and oat fiber enhanced ash contents of yogurt.

Table 3: Ash % in yogurt prepared by garlic powder during storage of 15 days.

Treatments	Estimation of ash contents in yogurt within 15 days			
	0	5	10	15
S(Control)	0.96%	0.97%	0.98%	0.99%
S1(0.1gm)	1.01%	1.02%	1.03%	1.04%
S2(0.2gm)	1.03%	1.03%	1.04%	1.05%
S3(0.5gm)	1.05%	1.06%	1.07%	1.08%

Protein

The protein % of garlic and oat fiber based yogurt is indicated in Table 5 and 6 respectively. The average protein content of probiotic yogurt was 5.4 % and that of natural yogurt was 5.3 %²⁹. There has been reported that the protein contents in garlic powder was 17.5 %³⁰ which increase the quality of garlic based yogurt. The crude protein contents ranged 17.35% in garlic powder³¹. These results were close to our findings.

Comparison between garlic and oat fiber based yogurt

Table 4: Ash contents % in oat fiber based yogurt within 15 days.

Treatments	Estimation of ash contents in yogurt within 15 days			
	0	5	10	15
S(Control)	0.96%	0.97%	0.98%	0.99%
S1(0.1gm)	1.01%	1.02%	1.03%	1.04%
S2(0.2gm)	1.03%	1.03%	1.04%	1.05%
S3(0.5gm)	1.05%	1.06%	1.07%	1.08%

Table 5: Protein % in yogurt prepared by garlic powder during storage of 15 days.

Treatment s	Protein contents % in yogurt within 15 days of Storage			
	0	5	10	15
X	4.76	4.77	4.79	4.80
X ₁	5.20	5.21	5.22	5.24
X ₂	5.28	5.30	5.31	5.32
X ₃	5.32	5.33	5.35	5.36

Table 6: Protein contents % in oat fiber based yogurt within 15 days.

Treatments	Determination of protein contents in Yogurt			
	0	5	10	15
S (control)	5.18%	5.29%	5.20%	5.21%
S1(0.1mg)	5.83%	5.84%	5.85%	5.86%
S2 (0.2mg)	5.87%	5.88%	5.89%	5.90%
S3 (0.5mg)	5.90%	5.91%	5.92%	5.93%

Oats are rich in protein and these oat fibers increased protein contents in yogurt in high ratio. The protein contents of yogurt samples were found to increase on fermentation. According to Law and Haandrikman (1995), the proteolytic system of lactic acid bacteria is essential for their growth in milk. The increase in protein contents in yogurt depends on the proteolytic activity of Lactic acid bacteria which hydrolyses proteins into peptides and amino acids. Lactic acid bacteria require a wide range of amino acids for growth and their proteolytic enzyme complement is able to split most types of peptide bonds³⁴. Probably, the free amino acid present in yogurt was the result of hydrolysis of protein under the influence of proteolytic enzymes. During the storage period these free amino acids again combine to form the peptide bonds that transform into protein. Hence the protein contents of yogurt increased during storage.

Fat

There was a minute increase in the fat contents of yogurt during storage. The fat contents of yogurt have the maximum range of 4.5 %³³. In another experiment Mutlu, *et al.*, (2005) reported that the fat contents of bio yogurt ranged from 3.1 % to 4.5 % during storage period. The garlic powder has the fat

contents that range between 0.1 % to 0.6 %³². It was concluded that fat content increased with the addition of oat fibers gradually within 15 days of storage. The fat contents of garlic based yogurt and fiber based yogurt is given in table 7 and 8 respectively.

Table 7: Fat contents % in yogurt prepared by garlic powder during storage.

Treatments	Measurement of fat contents in yogurt within 15 days			
	0	5	10	15
S(Control)	4.12%	4.14%	4.15%	4.16%
S1(0.1gm)	4.24%	4.25%	4.26%	4.27%
S2(0.2gm)	4.27%	4.28%	4.29%	4.30%
S3(0.5gm)	4.29%	4.30%	4.31%	4.32%

Table 8: Fat contents % in oat fiber based yogurt within 15 days.

Treatments	Fat contents % in yogurt within 15 days of storage			
	0 Days	5 Days	10 Days	15 Days
X	4.41	4.43	4.43	4.44
X ₁	4.60	4.61	4.62	4.63
X ₂	4.64	4.65	4.66	4.66
X ₃	4.66	4.67	4.68	4.69

Lactose

The garlic powder has the Carbohydrate contents 71.4 %³². In nonfat yogurts made from skim milk fortified with high milk protein powder showed the lactose contents 1.6 % to 7.9 % with different treatments in control yogurt sample³⁷. These ranges close to our findings. So there was a significance increase in lactose % as we compared different yogurt samples with the control.

Total solids

Muhammad, *et al.*, (2005), estimated the highest range of total solids in yogurt as 17.1 %. These are close to our findings. The average total solids content of probiotic yogurt was 17.75 % and that of natural yogurt was 19.2 %³¹.

Table 10: Lactose contents % in oat fiber based yogurt within 15 days.

Treatments	Quantitative analysis of amount of lactose in yogurt within 15 days.			
	0	5	10	15
S(Control)	4.34%	4.35%	4.36%	4.37%
S1(0.1gm)	4.73%	4.74%	4.75%	4.76%
S2(0.2gm)	4.84%	4.85%	4.86%	4.87%
S3(0.5gm)	4.88%	4.89%	4.90%	4.91%

Table 11: Total solids% in yogurt prepared by garlic powder during storage of 15 days.

Treatments	Quantitative analysis of total Solid mass in yogurt within 15 days			
	0	5	10	15
S(Control)	14.60%	14.65%	14.69%	14.73%
S1(0.1gm)	15.81%	15.85%	15.88%	15.92%
S2(0.2gm)	16.01%	16.05%	16.10%	16.13%
S3(0.5gm)	16.12%	16.16%	16.20%	16.24%

Table 12: Total solid mass % in oat fiber based yogurt within 15 days.

Treatments	Total solid mass % in yogurt within 15 days of storage			
	0	5	10	15
X	15.22	15.28	15.32	15.35
X ₁	16.50	16.54	16.57	16.62
X ₂	16.72	16.78	16.81	16.84
X ₃	16.82	16.86	16.91	16.95

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