

QUALITY OF STIRRED BUFFALO MILK YOGURT BLENDED WITH APPLE AND BANANA FRUITS

Amna Mahmood, Naheed Abbas and A.H. Gilani

Department of Rural Home Economics, University of Agriculture, Faisalabad

Plain, apple and banana fruit stirred yogurts were prepared using buffalo milk at household level. The objectives of the study were to investigate the effects of adding apple and banana pulp on the nutritional, sensory and microbiological quality of stirred yogurts. The apple pulp was added at 8 and 16 percent levels, where as banana was added at 8 and 10 percent levels. Yogurt with 8% apple and 8% banana pulp were liked in all sensory attributes. There were significant changes in pH, acidity, moisture, protein and carbohydrate (lactose) contents. An increase in protein and carbohydrate (lactose) was observed when addition of fruit pulp was made. Highest values for protein and carbohydrate (lactose) were 3.57 and 6.70%, respectively, which were observed incase of fruit stirred banana yogurt at 10 percent level. All the types of yogurt maintained the physiochemical quality during 2 days short storage. Viable bacterial count decreased during short storage. The overall sensory quality of these yogurts was rated as good to very good. It may be concluded that with the addition of fruit pulp the quality of yogurt can be improved.

Key words: Buffalo milk, fruit stirred apple yogurt, fruit stirred banana yogurt

INTRODUCTION

Yogurt is coagulated milk product that results from the fermentation of lactose in milk by *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (Bourlioux and Pochart, 1988). Other lactic acid bacteria (LAB) are also frequently used to produce a yogurt with unique characteristics (Adolfsson *et al.*, 2004). Yogurt is a sour milk product and is one of the oldest and popular foods in Africa, Asia, Europe and USA because of its nutritive and therapeutic value (Deeth, 1984). It is nutritionally beneficial product generally considered as safe with taste and is liked by many people.

In Pakistan yogurt is mainly prepared in 2 ways; one is by traditional or conventional method and the other on commercial scale. Dahi is prepared traditionally at homes and is also available at retail shops which are conventionally prepared under comparatively more defined conditions with the starter culture (locally called as Jaag). The commercial yogurt is now prepared in factories and is being marketed for consumption. Traditional way of making yogurt is very prone to contamination. Farmers' reported that yogurt was often sour, poor textured, crumbled and has a yeast flavour (ICARDA, 2006). Another problem is higher syneresis. This gives yogurt an undesirable texture.

Fruit yogurt, a popular type of yogurt is liked by masses and is known as fruit stirred yogurt. Yogurt prepared by adding seasonal fruits are very attractive. Fruit stirred yogurt is popular among masses and particularly children who dislike the flavour of plain yogurt. This modification has made the yogurt flavour attractive for them. Addition of fruit makes the yogurt

more delicious. The product contains both the nutritive effect of yogurt and refreshing taste of fruit. Fruit stirred yogurt has more sweetness and pleasing flavour (Hursit and Temiz, 1999). The present study was designed to prepare and assess nutritional, microbiological and sensory quality of plain, fruit stirred apple and fruit stirred banana yogurt prepared from buffalo milk at household level.

MATERIALS AND METHODS

The study was conducted in the Nutrition Research Laboratory, Department of Rural Home Economics, Milk Analysis Laboratory, Department of Livestock Management, Faculty of Animal Husbandry and Microbiology Laboratory of Department of Veterinary Microbiology, University of Agriculture, Faisalabad. Buffalo milk was purchased from Dairy Farm, University of Agriculture, Faisalabad, ripened apple and banana fruits and sugar were purchased from local market of Faisalabad.

Buffalo milk was analyzed for pH, acidity, fat, total solid, solid not fat and lactose by AOAC (1990) methods. Fat and protein were estimated by the methods of Davide (1977).

Milk was heated to boiling to destroy the pathogenic organisms at 85°C for 10 minutes. It was then transferred to a container and cooled to 39±1°C. Starter culture was then added @ 2.5 percent. For this purpose commercial nestle yogurt was used. Once the starter, was completely mixed, it was then incubated at 41-43°C for 6-8 hours to complete the preparation. Apple and banana pulps were prepared. Each fruit pulp was poured in mixing bowls at different proportions.

Proportions used were 8 and 16 percent for apple and 8 and 10 percent for banana. A known quantity of plain yogurt (PY) was added to bowl containing pulp and blended till a uniform mixture was obtained. Fruit stirred apple (FSAY) and fruit stirred banana yogurt (FSBY) with different ratios of pulp were poured into pyrex containers and refrigerated. Yogurt samples were kept under normal refrigeration conditions.

All the fresh yogurt samples were analyzed for pH, acidity, moisture, ash, protein and lactose using AOAC (1990) methods. However, syneresis was measured by the method of Peri *et al.* (1985). The yogurt was stored in screw capped containers under normal refrigeration conditions for two days and some physical aspects as acidity, pH and syneresis were recorded. All the samples were examined for viable count on nutrient agar. Detection of *Lactobacillus* and fungi on MRS agar (de Man's Rogosa and sharpe agar) and sabouraud dextrose agar, respectively (De Man *et al.* 1960 and Refai, 1979).

The samples of yogurt prepared were evaluated organoleptically on 9 point hedonic scale by a panel of 9 judges (2 housewives, 4 teachers, 1 laboratory staff and 2 students). The samples were evaluated for body, texture, flavour and overall acceptability as described by Land and Shepherd (1988). The judges were briefed as to the method of scoring for different quality characteristics.

RESULTS AND DISCUSSION

Nutritional quality of buffalo milk, apple and banana pulps used for yogurt making are shown in Table 1. Nutritional quality of freshly prepared yogurt samples is shown in Table 2. The addition of fruit increased the pH and acidity of yogurt and similarly an increase in pH and acidity was noted with the increase in the amount of fruit pulp added. The increase in acidity value of fruit stirred yogurt might be due to the acidity of apple and banana fruits. The values of acidity recorded in the present study match the value of Hafeez (2002) and Khan (2001). Moisture content of different types of yogurt varied from 74.45 – 80.47 percent. Moisture content of PY was recorded as the highest i.e. 80.47 percent. The addition of fruit pulp increased the total solids of yogurt and caused a decrease in the moisture content of yogurt. As texture of yogurt depends upon the moisture content and the total solids, low moisture percentage and high total solid affected the firmness of yogurt.

The addition of fruit caused an increase in protein and lactose content of yogurt. The increase in the amount of fruit also increased the protein and lactose contents. It is hypothesized that microbes present in yogurt have

utilized fermentable sugars present in fruit (apple and banana) and converted them into protein (amino acids) and the many folds increase in protein content commensurate with the increase in fermentable sugars. An increase in the concentration of free amino acids upto two folds during storage has been recorded by Loones (1989).

The trend of increasing, sugar content in yogurt against the increase in protein content has been shown in Fig. 1. The results revealed that with the addition of banana fruit pulp, the lactose content increased most significantly. This might be due to the amount of reducing sugar (carbohydrate) present in banana fruit. Forsyth (1980) stated that banana contain reducing sugar with approximate ratio of glucose 20: fructose 15: sucrose 65. As fehling solution was used to determine the amount of lactose, it also detected other reducing sugars present in the fruit yogurt which caused an increase in the lactose (carbohydrate) content.

Syneresis is the oozing out of water on the surface of yogurt. Syneresis is one of the quality parameters for yogurt. Higher value of syneresis shows that yogurt is of low quality. Syneresis value of plain yogurt was 12 ml/2hr. Fruit stirred yogurt showed negligible amount of syneresis. Flinger *et al.* (1998) also reported the absence of syneresis similar to the findings of the present study. It may be assumed that sugar has the capacity to bind water leading to the absence of syneresis. Another reason might be the preparation of yogurt under controlled condition.

The quality of yogurt as affected by storage was checked. Variations in acidity, pH and syneresis were determined. The values for acidity, pH and syneresis estimated during short storage of yogurt samples prepared at household level are shown in Table 3.

Significant differences were recorded in FSBY (16%) and FSBY (10%). The results revealed that with addition of fruit pulp acidity increased and further rise was observed when the proportion of pulp was increased as shown in Fig. 2.

The pH value decreased on 1st day of storage and gradual increase was recorded on the 2nd day of storage (Fig. 3). The variation in pH value might be due to the environmental temperature, humidity and exposure to the sun.

A decrease in the value of syneresis was recorded over the storage, because the yogurts were prepared under controlled conditions and stored in screw capped bottles.

During storage the number of viable count decreased in all yogurt samples except in FSBY (8%) the viable count increased from 1.8×10^7 to 7.28×10^7 cfu/ml. The fungi were not present in almost all samples upto first day of storage. *Lactobacillus* was identified in all yogurt samples.

Table 1. Composition of buffalo milk, apple and banana used for yogurt making (on as such basis)

Foods	pH	Acidity (%)	Moisture (%)	Protein (%)	Fat (%)	Carbohydrate/lactose* (%)	Ash (%)
Buffalo milk	6.0	0.14	84.46	3.93	6.5	4.70	0.660
Apple (pulp)	4.7	0.36	82.92	2.14	1.3	13.07	0.575
Banana (pulp)	5.5	0.38	82.49	2.14	0.4	14.01	0.925

* Lactose was estimated in buffalo milk

Table 2. Percent chemical composition of different types of fresh yogurt

Types of yogurt	pH	Acidity	Moisture	Protein	Carbohydrate (lactose)	Ash	Syneresis (ml/2hr)
PY	5.10± 0.02 ^a	0.95± 0.01 ^c	80.47± 1.52 ^a	0.84± 0.00 ^d	4.46± 0.15 ^c	0.81± 0.01 ^a	12± 0.87 ^a
FSAY (8%)	5.00± 0.05 ^b	1.13± 0.11 ^b	77.81± 1.08 ^b	2.86± 0.02 ^c	3.73± 0.01 ^d	0.81± 0.06 ^a	0.2± 0.02 ^b
FSAY (16%)	5.10± 0.02 ^a	1.17± 0.00 ^b	75.45± 1.15 ^c	3.05± 0.13 ^b	4.33± 0.12 ^c	0.8± 0.13 ^a	0.00± 0.00 ^b
FSBY (8%)	5.00± 0.03 ^b	1.08± 0.01 ^b	79.03± 0.13 ^{ab}	3.52± 0.00 ^a	5.71± 0.23 ^b	0.90± 0.02 ^a	0.00± 0.00 ^b
FSBY (10%)	5.10± 0.02 ^a	1.28± 0.02 ^a	79.31± 0.63 ^{ab}	3.57± 0.07 ^a	6.70± 0.02 ^a	0.87± 0.03 ^a	0.00± 0.00 ^b

Same alphabets on means in a column show non-significant differences

PY = Plain yogurt

FSAY = Fruit stirred apple yogurt

FSBY = Fruit stirred banana yogurt

Table 3. Effect of storage on various chemical components of different types of yogurt

Storage period (days)	PY	FSAY (8 percent)	FSAY (16 percent)	FSBY (8 percent)	FSBY (10 percent)
Acidity (%)					
0	0.95	1.13	1.17	1.08	1.28
1	1.00	0.95	1.24	0.89	1.10
2	1.01	1.00	1.54	0.90	1.43
pH					
0	5.1	5.0	5.1	5.0	5.1
1	5.0	5.3	4.9	5.2	5.10
2	4.8	5.2	4.80	4.9	4.80
Syneresis (ml/2hr)					
0	12	0.2	0.0	0	0.0
1	0.2	0.2	0.0	0.0	0.1
2	3	0.3	0.1	0.0	0.0

PY = plain yogurt

FSAY = fruit stirred apple yogurt

FSBY = fruit stirred banana yogurt

The organoleptic evaluation of fresh yogurt samples prepared at household level indicated the highest scores (8.00±0.71) for color and texture of plain yogurt and for flavor and overall acceptability of FSBY (8%) also got the highest scores. All yogurt samples fell within fair to very good.

On the basis of the findings, it can be concluded that addition of apple and banana fruits enhanced the quality and favour of yogurt. Nutritional value of FSBY (10%) was the best. The most suitable proportion for

development of fruit stirred apple and banana yogurt to attain best quality was 8%.

ACKNOWLEDGEMENTS

The author acknowledges the supervisory committee for generous assistance and time to time support, and the guidance of Dr. Muhammad Latif, Assistant Prof. Dept. of Livestock Management.

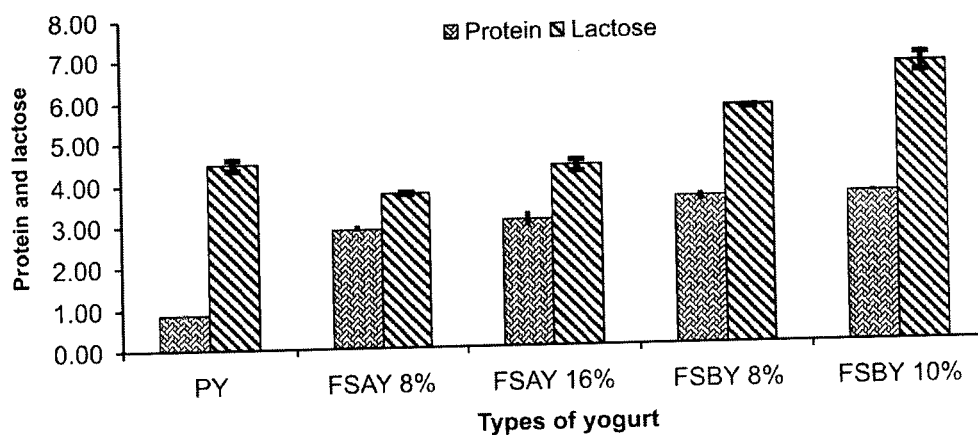


Fig. 1. Protein and carbohydrates (lactose) in different samples of yogurt

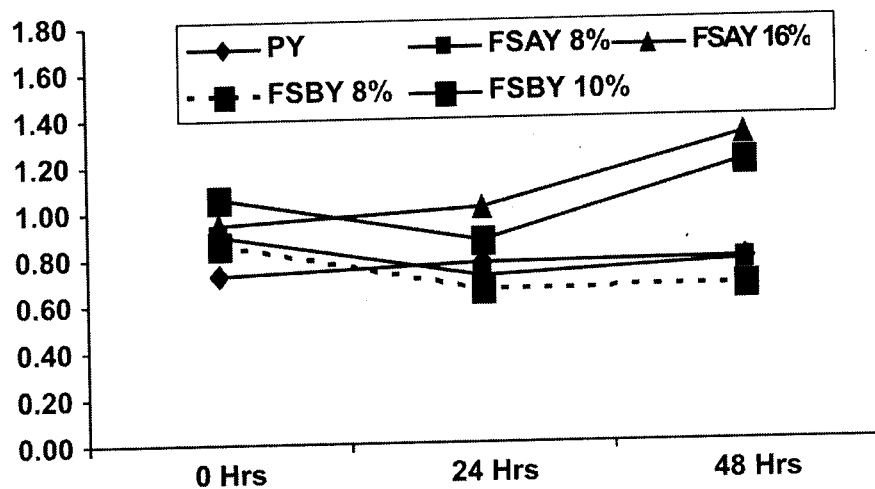


Fig. 2. Effect of storage on acidity of different samples of yogurt

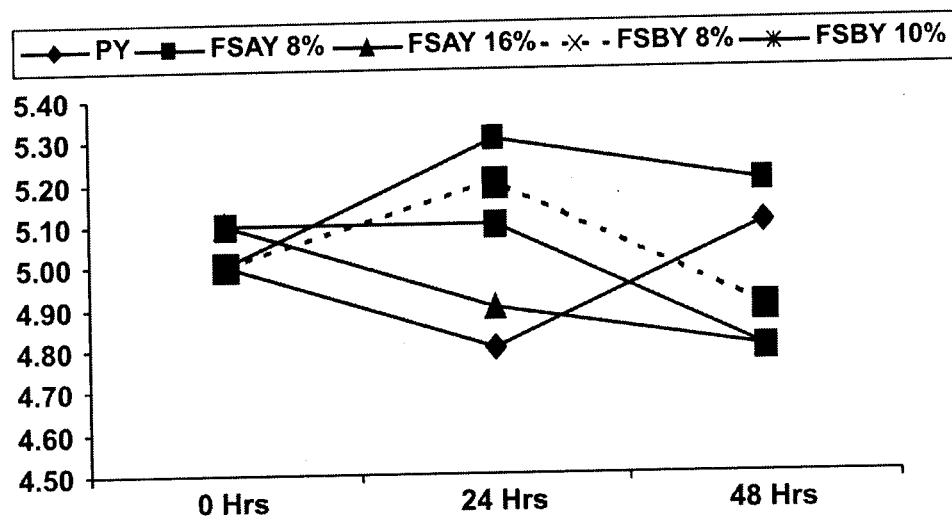


Fig. 3. Effect of storage on pH different yogurt samples

REFERENCES

- Adolfsson, O., S.N. Meydani and R.M. Russel. 2004. Yogurt and gut function. *Am. J. Clin. Nutr.* 80(2): 245-256.
- AOAC, 1990. Official Methods of Analysis. The Association of Official Analytical Chemists, 15th Ed. Arlington, Virginia - 22201.
- Bourlioux, P. and P. Pochart. 1988. Nutritional and health properties of yogurt. *World Rev. Nutr. Diet.* 56: 217-58.
- Davide, C.L. 1977. Laboratory Guide in Dairy Chemistry Practices. Dairy Training and Research Institute, Univ. Philipines, Los Banos, Laguna.
- De Man, J.D., M. Rogosa and M.E.A. Sharpe, 1960. A medium for the cultivation of *Lactobacilli*. *J. Appl. Bact.*, 23: 130-135.
- Deeth, H.C. 1984. Yogurt and cultured products. *Australian J. Dairy Tech.* 39(3): 111-113.
- Flinger, K., J.B. Lundomood and P.M.T. Hasan. 1988. Fortification of low fat plain yogurt with calcium gluconate. *Cultured Dairy Product J.* 23(1): 5-9.
- Forsyth, W.G.C. 1980. Banana and plantain. In: *Tropical and Sub-Tropical Fruits*. S. Nagy and P.E. Shaw (Eds.) pp. 258-278. AVI Publishing, Westport, Conn.
- Hafeez, K. 2002. Preparation and evaluation of apple based stirred yogurt. M.Sc. (Hons.) Thesis, Dept. Food Tech. Univ. of Agri., Faisalabad.
- Hursit, K. and H. Temiz. 1999. Comparison of manufacturing methods of fruit flavoured yogurt. *Ondokuzmayis Universitesi, Ziraat Fakultesi Dergisi*. 14(3): 151-165.
- ICARDA, 2006. Simple changes to yogurt making add value in northern Syria in Annual Report International Centre for Agricultural research in the dry areas. Aleppo, Syria, p. 71-72.
- Khan, M.R. 2001. Studies on banana fruit yogurt. M.Sc. Thesis, Dept. of Food Sci. & Tech., Univ. Agri., Faisalabad.
- Land, D.G. and R. Shepherd. 1988. Scaling and ranking methods. In: *Sensory Analysis of Foods* by J.R. Piggott (Ed.): Elsevier Applied Science, New York, pp. 155-185.
- Loones, A. 1989. Transformation of milk components during yogurt fermentation. In: *Yogurt: Nutritional and Health Properties* by Chandan R.C. (Ed.) McLean.
- Peri, C., M. Lucisano and E. Donati. 1985. Studies on coagulation of milk ultrafiltration retentates-II Kinetics of whey syneresis. *Milchwissenschaft*, 40(11): 650-652. (*FSTA*, 18(10): 99, 1986).
- Steel, R.G.D., J.H. Torrie and D.A. Dieky. 1997. *Principles and Procedures of Statistics*. 3rd Ed. McGraw Hill Book Co Inc., New York, USA.