

Preliminary Studies on the Preparation of Fluid Yoghurt from Cow Milk

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Abstract

In the present research work, attempts were made to determine the physical and chemical characteristics of raw cow milk in the preparation of fluid yoghurt. In this research, unsweetened and sweetened fluid yoghurt processing contained pasteurization, homogenization, cooling to incubation temperature, fermentation, cooling and packaging, including the addition of sugar before fermentation for sweetened fluid yoghurt. In the preparation of unsweetened fluid yoghurt, processing was carried out with different weights of sample culture (2, 3, 4, 5, 6, % by weight), with different incubation temperatures (42°C, 43°C, 44°C) and with different incubation times (5, 10, 15, 20, 25, 30 minutes), respectively. The processing of sweetened fluid yoghurt was also conducted with different weight percentages of sugar (5, 6, 7, 8, 9 % by weight). From these research works, for both processes, the suitable dosage of sample culture 5% (by weight) and suitable dosage of sugar 6% (by weight) were selected as it produced a good quality yoghurt and the suitable incubation temperature 43°C and the suitable incubation time 25 minutes were also chosen because the coagulum was formed within 3 hours for fermentation time, respectively. The physical and chemical characteristics such as pH, specific gravity, water content, fat content, total solid content, solid not fat content, protein content, lactic acid content, lactose content and microbiological examination for both prepared fluid yoghurts were also determined.

Key words: Unsweetened, Sweetened, Yoghurts, Pasteurization, Fermentation

Introduction

Milk is fundamental raw material in dairy product. It has white colour, possesses a fine delicate flavor and fresh taste. Among animals milk, cow milk is more essentially used in dairy product. Milk is a complex mixture of liquid. It contains lipids, carbohydrates, protein, many other organic compounds and dissolved organic salts, dispersed in water. Cow milk contains water 87.2%, fat 3.7%, protein 3.5%, lactose 4.9% and other mineral 0.7%. Thus, total solid in milk is 12.8% and solid–non–fat 9.1%. The life of milk is at least 4 hours in normal condition (NIIR).

Many fermented or cultured products are produced from milk. These fermentations require the use of bacteria that ferment lactose or milk sugar. These bacteria are of two general categories, homofermentative, that produce only lactic acid from lactose and heterofermentative, those that produce acetic acid, ethyl alcohol, and

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carbon dioxide, in addition to lactic acid from lactose and a flavor precursor, acetoin, from citric acid. The culturing process makes yoghurt more digestible than milk. The live active cultures create lactose, the enzyme lactose-intolerant people lack (Eckles).

Yoghurt originates from Bulgaria, where it is known as "Yaourt". Many other countries have their own names for yoghurt. The consistency, taste and aroma vary from one district to the next. In certain areas, yoghurt is produced in the form of a highly viscous liquid, whereas in other countries it is in the form of a softer gel. Yoghurt is also produced in frozen form as a dessert, or as a drink. The taste and aroma of yoghurt differ from those of other acidulated products, and the volatile aromatic substances include small quantities of acetic acid and acetaldehyde (www.fshn.hs.lstate.edu/grad).

Thus, the objectives of this study are to study the standardized techniques and control the procedures for manufacturing fermented milk products (Yoghurt), to compare the properties of the unsweetened and sweetened fluid yoghurts and to promote the health and ensure the long life by using yoghurt.

Materials and Methods

Materials

Fresh cow milk was collected from cow farm at Htantaw Village, Amarapura Township, Mandalay Region. Refined sugar and plain yoghurt as sample culture were purchased from Ocean Supermarket, Mahar Aung Myay Township, Mandalay Region.

Methods

Preparation of Unsweetened Fluid Yoghurt

100g of raw cow milk was placed in a sterilized stainless steel pot, stirred and heated at 90°C, and held for 5 minutes for pasteurization. It was then immediately cooled in water-bath, until it reached the required incubation temperature of 43°C for yoghurt culture growth. 5g of sample culture (plain yoghurt) was added to the above pasteurized milk and held at constant temperature 43°C and incubated for 25 minutes. Then the product was poured carefully into a previously sterilized container and capped tightly and undisturbed until the fluid yoghurt was formed. After 3 hours, the curd was obtained and stored in the refrigerator.

Effect of Different Amount of Sample Culture on Fermentation Time of Prepared Unsweetened Fluid Yoghurt

The same procedure was carried out by using the different weight percentages of sample cultures (2, 3, 4 and 6% weight) respectively and their respective data are shown in Table (2).

Effect of Different Incubation Temperature on Fermentation Time of Prepared Unsweetened Fluid Yoghurt

The same procedure was conducted at different incubation temperature (42, and 44°C) respectively and their respective data are shown in Table (3).

Effect of Different Incubation Time on Fermentation Time of Prepared Unsweetened Fluid Yoghurt

The same procedure was carried out for various incubation times (5, 10, 15, 20, and 30 minutes) respectively and their respective data are shown in Table (4).

Preparation of Sweetened Fluid Yoghurt

100 g of raw milk was placed in a sterilized stainless steel pot, stirred and heated at 90 °C, and held for 5 minutes for pasteurization. It was then immediately cooled in water-bath, until it reached the required incubation temperature of 43°C for yoghurt culture growth. 5g of sample culture and 6g of refined sugar were added to the above pasteurized milk and held at constant temperature 43°C and incubated for 25 minutes. Then the product was poured carefully into a previously sterilized container and capped tightly and undisturbed until the fluid yoghurt was formed. After 3 hours, the curd was obtained and store in the refrigerator.

Effect of Different Amount of Sugar Content on the Shelf –life of Prepared Sweetened Fluid Yoghurt

The same procedure was carried out by using the different weight percentages of sugar contents (5, 7, 8 and 9%) respectively and their respective data are shown in Table (5).

Results and Discussion

The physico-chemical characteristics of raw cow milk are shown in Table (1). It was observed that the physico-chemical characteristics of raw cow milk were within the range of literature values. The effect of different amount of sample culture on fermentation time of prepared unsweetened fluid yoghurt is shown in Table (2). It was found that the suitable amount of sample culture was 5g with the minimum fermentation time.

The effect of different incubation temperature on fermentation time of prepared unsweetened fluid yoghurt is shown in Table (3). It occurred that the suitable incubation temperature was found at 43°C for minimum fermentation time. The effect of different incubation time on fermentation time of prepared unsweetened fluid yoghurt is indicated in Table (4). It was found that the suitable incubation time for unsweetened fluid yoghurt was 25 minutes associated with the minimum fermentation time (3 hr). The effect of different amount of sugar content on the shelf-life of prepared sweetened fluid yoghurt

is shown in Table (5). It was shown that the suitable amount of sugar for sweetened fluid yoghurt was 6g because it gave the longest shelf life of sweetened fluid yoghurt.

The comparison of physico-chemical characteristics of prepared unsweetened and sweetened fluid yoghurts are shown in Table (6). It was found that the pH value of sweetened fluid yoghurt was slightly higher and water content of sweetened fluid yoghurt was slightly lower than the unsweetened fluid yoghurt because of the addition of sugar in the preparation of sweetened fluid yoghurt. It was also clearly observed that the total solid and solid-not-fat contents of sweetened fluid yoghurt were greatly higher than that of unsweetened fluid yoghurt due to the sugar used.

The effects of shelf-life on pH of prepared unsweetened and sweetened fluid yoghurt under room temperature are shown in Table (7). It was observed that the shelf-life of prepared unsweetened fluid yoghurt was 4 days and that of prepared sweetened fluid yoghurt was 6 days. The longer the shelf-life, the lower the pH values giving sour taste to yoghurt. The effect of shelf-life on pH of prepared unsweetened and sweetened fluid yoghurt under refrigerator is shown in Table (8). It was observed that the shelf-life of prepared unsweetened fluid yoghurt was 9 days and that of prepared sweetened fluid yoghurt was 12 days. From Table (7) and (8), it is clearly seen that the shelf-life of both prepared yoghurts stored in refrigerator was longer than that stored in room temperature. The shelf-life of sweetened fluid yoghurt was longer than that of unsweetened fluid yoghurt because of the sugar used in sweetened fluid yoghurt. Sugar has the preservative property. The shelf-life of sweetened fluid yoghurt stored in refrigerator was longer than that stored in room temperature because storage in refrigerator retarded the fermentation reaction of yoghurt.

The microbiological examination of prepared fluid yoghurts is shown in Table (9). E.coli, coliform, staphylococcus, streptococcus and non-lactose fermentation organism were not found in the prepared yoghurt samples. Therefore, it was confirmed that the prepared yoghurt samples were safe and adaptable for human health. from the determination of standard plate count, unsweetened fluid yoghurt was found with the count of 2000×10^2 and sweetened fluid yoghurt occurred with the count of 1600×10^2 . These microbes may be beneficial microbes such as *Lactoba-cillusbulgaricus* and *Streptococcus thermophilus* needed for human.

Table (1) Physico-chemical Characteristics of Raw Cow Milk

Sr. No.	Characteristics	Raw Cow Milk	Literature Values
1.	pH	6.7	6.6
2.	Specific Gravity	1.029	1.027-1.033
3.	Water (%w/w)	87.4	87.0
4.	Fat (%w/w)	3.0	4.0

5.	Total Solid (%w/w)	12.6	13.0
6.	Solid-not-Fat (% w/w)	9.6	9.0
7.	Protein(%w/w)	2.5	3.4
8.	Lactic Acid (%w/w)	0.11	0.10-0.18
9.	Lactose(%w/w)	3.2	4.8

Table (2) Effect of Sample Culture on Fermentation Time of Prepared Unsweetened Fluid Yoghurt

Sr. No.	Milk(g)	Sample Culture (g)	Incubation Temperature(°C)	Incubation Time (min)	Fermentation Time (hr)
1.	100	2	43	30	4.0
2.	100	3	43	30	4.0
3.	100	4	43	30	3.5
4.	100	5 *	43	30	3.0
5.	100	6	43	30	3.0

*Suitable amount of sample culture = 5g

Table (3) Effect of Incubation Temperature on Fermentation Time of Prepared Unsweetened Fluid Yoghurt

Sr. No.	Milk (g)	Sample Culture (g)	Incubation Temperature (°C)	Incubation Time (min)	Fermentation Time (hr)
1.	100	5	42	30	3.5
2.	100	5	43*	30	3.0
3.	100	5	44	30	3.0

* Suitable Incubation Temperature = 43 °C

Table (4) Effect of Incubation Time on Fermentation Time of Prepared Unsweetened Fluid Yoghurt

Sr. No.	Milk (g)	Sample Culture(g)	Incubation Temperature(°C)	Incubation Time(min)	Fermentation Time(hr)
1.	100	5	43	5	6.5
2.	100	5	43	10	6.5
3.	100	5	43	15	6.0
4.	100	5	43	20	4.0
5.	100	5	43	25*	3.0
6.	100	5	43	30	3.0

* Suitable Incubation Time = 25 minutes

Table (5) Effect of Sugar Content on the Shelf-life of Prepared Sweetened Fluid Yoghurt

Incubation Temperature = 43 °C, Incubation Time = 25 minutes

Sr. No.	Milk (g)	Sample culture (g)	Sugar Content (g)	Fermentation time (hr)	Shelf-Life (day)
1.	100	5	5	3.0	2
2.	100	5	6*	3.0	5
3.	100	5	7	3.0	5
4.	100	5	8	3.0	3
5.	100	5	9	3.0	3

Suitable Amount of Sugar Content=6g

Table (6) Comparison of Physico-chemical Characteristics of Prepared Unsweetened and Sweetened Fluid Yoghurt

Sr. No.	Characteristics	Unsweetened Fluid Yoghurt	Sweetened Fluid Yoghurt	Literature Value
1.	pH	4.1	5.0	4.1-4.3
2.	Water(%w/w)	87.79	78.85	88.8
3.	Texture	Liquid	Liquid	Liquid
4.	Taste	Sour(mild)	Sour(mild)	Sour(mild)
5.	Fat(%w/w)	4.2	4.8	3.0
6.	Total Solid(%w/w)	12.21	21.15	11.2
7.	Solid-not-Fat (% w/w)	8.01	16.35	8.2
8.	Protein(% w/w)	3.48	2.95	3.8
9.	Lactic Acid(% w/w)	1.12	0.72	1.1-1.8

Table (7) Effect of Shelf-Life on pH of Prepared Unsweetened and Sweetened Fluid Yoghurt under Room Temperature

Sr. No.	Shelf-Life (day)	pH	
		Prepared Unsweetened Fluid Yoghurt	Prepared Sweetened Fluid Yoghurt
1.	-	5.9	5.9
2.	1	5.4	5.7
3.	2	4.7	5.2
4.	3	4.3	4.7
5.	4*	3.9	4.4
6.	5	3.5	4.2
7.	6**	3.3	4.0
8.	7	3.1	3.8

Literature value of pH = 3.9

* The Shelf-life of prepared unsweetened fluid yoghurt was only 4 days.

** The shelf-life of prepared sweetened fluid yoghurt was only 6 days.

Table (8) Effect of Shelf-Life on pH of Prepared Unsweetened Fluid Yoghurt and Sweetened Fluid Yoghurt under Refrigerator

Sr. No.	Shelf-Life (day)	pH	
		Prepared Unsweetened Fluid Yoghurt	Prepared Sweetened Fluid Yoghurt
1.	-	5.9	5.9
2.	1	5.7	5.8
3.	2	5.5	5.6
4.	3	5.4	5.4
5.	4	5.1	5.2
6.	5	4.9	4.8
7.	6	4.7	4.6
8.	7	4.5	4.5
9.	8	4.3	4.3
10.	9*	4.2	4.2
11.	10	3.8	4.1
12.	11	3.5	4.0
13.	12**	-	3.9
14.	13	-	3.8

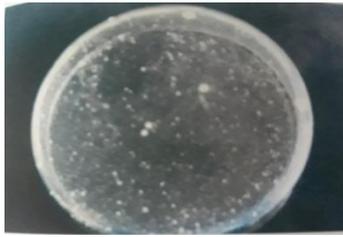
Literature value of pH = 3.9

* The shelf-life of prepared unsweetened fluid yoghurt was only 9 days.

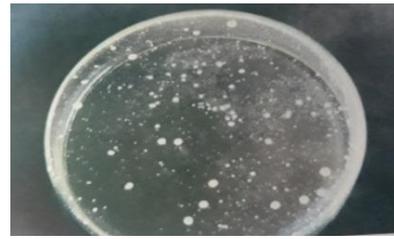
** The shelf-life of prepared sweetened fluid yoghurt was only 12 days.

Table (9) Microbiological Examination of Prepared Fluid Yoghurts

Sr. No.	Sample	Standard Plate Count	E.coli	Coliform	Staphylo-coccus	Strepto-coccus	Non Lactose Fermentation organism
1.	Unsweetened Fluid Yoghurt	2000 x 10 ²	Nil	Nil	Nil	Nil	Nil
2.	Sweetened Fluid Yoghurt	1600 x 10 ²	Nil	Nil	Nil	Nil	Nil



(a)



(b)

**Figure 8 (a) Standard Plate Count for Unsweetened Fluid Yoghurt
(b) Standard Plate Count for Sweetened Fluid Yoghurt**

Conclusion

Yoghurt is a fermented dairy product. It has several health benefits. Yoghurt acts as good supplement of carbohydrate and it has high digestibility power. To achieve the finished product–fluid yoghurt, it is not only depended on good quality raw materials used but also depended on the sophisticated techniques. The quality of fluid yoghurt was based on the quality of milk such as fat, protein, total solid, specific gravity, pH and free from pathogens. Moreover, acceptable ranges of microbiological parameters ensure the safety of prepared fluid yoghurts. It was concluded that all of the prepared yoghurt samples were suitable for consumption.

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