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Expiry Date of Set Yoghurt under Sudanese Conditions

Kamal Eldin Eltayeb Yassin[1], Tagog Mohamed Tahier Gilany[2]
[1,2]*Department of Chemical Engineering, Faculty of Engineering. University of Khartoum Khartoum, Sudan*

ABSTRACT
The objective of this research is to study the stability of set yoghurt during its shelf life in different storage and distribution conditions of temperature and time span. Yoghurt samples were collected starting from factory gates though distribution and storage locations for period of 21 days. Titratable acidity, pH, temperature, wheying off and microbiological characteristics of the set yoghurt samples were investigated using standard method set by Sudanese standard and metrology organization and other internationally recognized methods. The results showed that the pH- values decreased progressively (4.50 – 4.29) and the titratable acidity significantly increased (0.97%– 1.37%) during the specified period of 21 days. There was a significant increase in wheying off of the set yoghurt samples at the end of storage period especially for the off road transported samples and it reaches 5.78ml/400gm which could be attributed mainly to shaking and heat during transportation. The E.coli, yeast and mold recorded no growth in all samples of set yoghurt under the specified storage conditions except in the 21st day in samples collected from small groceries and long distance transported samples. It could be concluded that storage and distribution conditions had significant effects on all set yoghurt properties at the end of their storage period. The study recommended that processing , distribution and storage conditions stipulated by Sudanese standard and metrology organization are to be strictly followed to allow the shelf life to be extended far after the specified period of 10 days recommended by the same organization. It is also recommended to conduct further studies on the issue and to disseminate the culture of preserving food products at their optimal conditions of storage and distribution.

I. INTRODUCTION

The expiry date is the point in time when a product is no longer within an acceptable condition to be considered effective. The product reaches the end of its 'shelf life depending on the product, the expiry date may be set as a fixed time, after manufacture, after dispensing and after opening of the manufacturer's container. The expiry dates on Food/Medicine/Drugs and other Consumable Products is often etched on the container or printed in very small letters and/or often in a form which is unreadable or undetectable. This can be hazardous to health if such products are consumed or used in any manner after its expiry date.

The shelf life Is a guide for the consumer of the period of time that food can be kept before it starts to deteriorate, provided any stated storage conditions have been followed. The shelf life of a product begins from the time the food is prepared or manufactured. Its length is dependent on many factors including the types of ingredients, manufacturing process, type of packaging and how the food is stored. It is indicated by labeling the product with a date mark.

For this research yoghurt was selected as a case study for that Set yoghurt (Zabadi) is one of the most important fermented milk products of considerable economic and dietary importance to most people of Sudan. It is involved in daily meals.

In Sudan it's made from fresh cow milk and recombined milk.

The most important raw material used in yoghurt manufacture is milk, Milk, in addition to being a nutritious medium, presents a favorable physical environment for the multiplication of microorganisms and being an animal product is subjected to widely differing production, handling and processing methods, results in its contamination by a broad spectrum of microbial types, chemical residues and cellular material (Gilmour & Rowe, 1990).

Set yoghurt produced by a number of dairy products factories in Khartoum area and other small producers elsewhere. In Sudan yoghurt, although a traditional fermented product, but recently it gains extra popularity since many techniques are used to fulfill the Sudanese demands for better quality and different flavor.

Objectives of The research:

1. Determine the physical, chemical, microbiological and sensory properties of some samples of set yoghurt.
2. Follow those properties through distribution and storage.
3. Determine the stability of set yoghurt during its specified shelf life.
4. Extend the storage beyond the specified expiration period and check stability.
5.

II. MATERIALS AND METHODS

2.1 MATERIALS

The materials employed for this research include cow milk , Starter Culture and yoghurt samples as detailed below:

Cow milk

Brought from the milk collection centers (MCC) after being collected from dairy farms.

Starter Culture

Starter culture on bulk was obtained from Blue Nile Dairy Products Company. 1:1 Lactobacillus bulgaricus and Streptococcus thermophilus**.**

Yoghurt samples

Samples were classified as follows:

A: Large supermarkets its refrigerators have high quality such as open refrigerators.

B: Medium Supermarkets use normal refrigerators and have suitable external environment.

C: Small grocery usually in remote areas with a harsh environment.

Transport: Take product in distribution vehicle to end of day working and then studied effect of the road and vehicle condition of the product.

2.2 Methods

The methods employed for this purpose include determination of major chemical, physical and properties of yoghurt normally pH, temperature and titrable acidity and microbiological analysis in addition to sensory evaluation. Standard analytical methods are used as detailed below:

2.2.1Chemical analysis

pH

The pH was determined according to Association of Official Analytical Chemists AOAC (2000), by using a ph-meter (mode HI 8521 microprocessor bench pH/MV/°C°meter).

Temperature

The temperature was measured by a testo 926 Digital Thermometer, calibrated by the South African Bureau of Standards (SABS).

Titrable acidity (T.A)

The titrable acidity was determined according to the method described by AOAC (2000). Five grams of the samples were weighed accurately (each samples in triplicates) dissolved water by stirring for 15 minutes, then filtered using Whatman filter paper and then transferred to 100ml volumetric flask to complete the volume up to the mark. Ten ml of the prepared solution were titrated against 0.1N sodium hydroxide using phenolphthalein as an indicator. The titrable acidity was calculated as lactic acid (%) of an equivalent weight of 90 mg. (1 ml NAOH 0.1 N≡0.09 g lactic acid)

2.2.2 Microbiological analysis

Preparation of diluents & serial dilutions:

2 tablets of ¼ strength Ringers solution (Provided by LAB M Limited) were dissolved in 1000 ml of deionised water, then transferred 9ml to test tubes and sealed by plastic rubber. The tube were then sterilized by an autoclave (121 C° , at 15 minutes) as described by Food and Agriculture Organization FAO (2000).

Yeasts and moulds

A volume of 1 ml of the sample was added to YGC agar, then the sample was distributed all over the plate. The plates were incubated at 25°C – 28°C for 72 hours, then colonies forming unites (CFU) were counted (FAO, 2000)

Detection of Coli form bacteria

The medium used was VRB agar. One milliliter of diluted sample was transferred into each of the VRB agar plates were then incubated for 24 – 48 hours at 37°C. Positive results were indicated by presence of red colonies (FAO, 2000).

III. RESULTS AND DISCUSSION

3.1 RESULTS

The effect of storage periods on physicochemical properties of set yoghurt are shown in the following tables:

Table1: Effect of storage period on pH-value of set yoghurt obtained from different sources

Storage period (days)	Source of set yoghurt (classes)			Transport
	A	B	C	
0	4.50	4.50	4.50	4.50
5	4.38	4.33	4.34	4.32
10	4.45	4.42	4.37	4.38
15	4.42	4.41	4.33	4.37
21	4.41	4.37	4.29	4.35

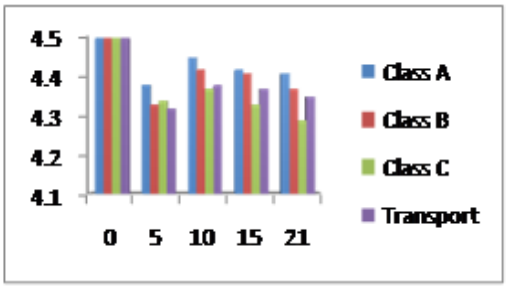

Figure1: pH-value of set yoghurt obtained from different sources as affected by storage period

Table 2: Storage temperature (°C) of set yoghurt obtained from different sources

Storage period (days)	Source of set yoghurt (classes)			Transport
	A	B	C	
0	22.40	22.40	22.40	22.40
5	8.90	8.00	9.20	10.00
10	8.30	8.90	10.10	8.20
15	8.90	8.60	9.90	9.90
21	10.20	9.00	14.00	10.00

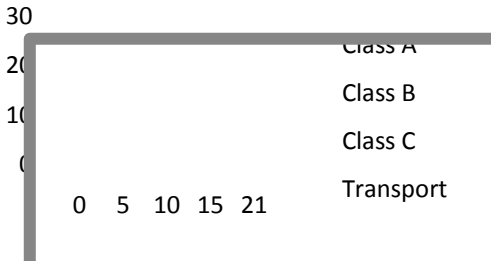

Figure2: Temperature of set yoghurt obtained from different sources as affected by storage period

Table 3: Effect of storage period on titratable acidity (%) of set yoghurt obtained from different source

Storage period (days)	Source of set yoghurt (classes)			Transport
	A	B	C	
0	0.83	0.83	0.83	0.83
5	0.97	0.96	0.95	0.99
10	0.95	0.99	1.03	0.97
15	0.97	0.99	1.02	1.01
21	0.99	0.92	0.96	1.06

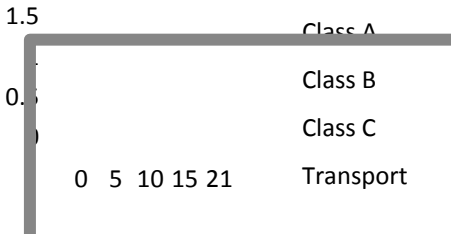

Figure3: Titratable acidity of set yoghurt obtained from different sources as affected by storage period

Table 4: Effect of storage period on wheying off (ml) of set yoghurt obtained from different sources

Storage period (days)	Source of set yoghurt (classes)			Transport
	A	B	C	
0	0.00	0.00	0.00	0.00
5	0.00	0.31	0.00	0.19
10	0.25	0.52	0.20	0.41
15	0.79	3.93	0.68	0.55
21	1.18	0.54	0.79	5.87

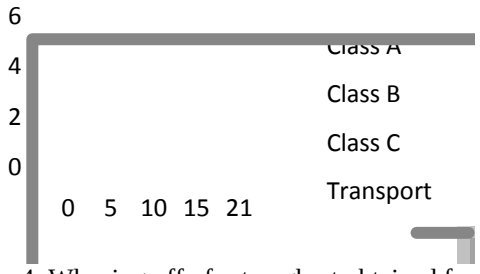

Figure 4: Wheying off of set yoghurt obtained from different sources as affected by storage period

Table 5: Effect of storage period on E coli Most Probable Number (microbiology method) (MPN/ml) set yoghurt obtained from different source

Storage period (days)	Source of set yoghurt (classes)			Transport
	A	B	C	
0	Nil	Nil	Nil	Nil
5	Nil	Nil	Nil	Nil
10	Nil	Nil	Nil	Nil
15	Nil	Nil	Nil	Nil
21	Nil	Nil	Nil	nil

Table 6: Effect of storage period on yeasts and moulds Most Probable Number (MPN/ml) of set yoghurt obtained from different sources

Storage period (days)	Source of set yoghurt (classes)			Transport
	A	B	C	
0	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00
21	0.00	0.00	10.00	10.00

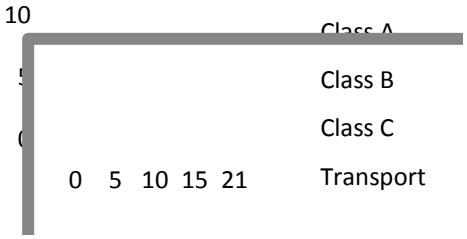

Figure5: Yeast and moulds of set yoghurt obtained from different sources as affected by storage period

3.2 DISCUSSION

The effect of storage periods on physicochemical properties of set yoghurt

pH-value

Table 1 and fig.1 show the effect of storage period on pH-value of set yoghurt obtained from different sources. The highest value was obtained at the beginning of the storage period (4.50) this result is lower than the values (4.61) observed by Ranathunga (2013) *pH*. Max 4.5, and same value (4.5) stipulated by Sudanese standard and metrology organization, while the lowest (4.29) was obtained at the end. The pH-values were decreased

progressively due to excessive sugar fermentation and presence of lactic acid (Galal et al., 2004 and Gouda et al.,2004). Mohammed (2008) reported that, the pH-values gradually decrease during the storage period indicating that yoghurt culture was still alive and lowering the pH due to production of lactic acid.

Temperature

The results in table 2 and fig.2 show the storage temperature of set yoghurt obtained from different sources.

The highest value was obtained at the end of the storage period and the lowest value was obtained at the beginning of the same period. The results of temperature of set yoghurt samples revealed significant difference.

Titratable acidity

As shown in table 3 and fig .3 the effect of storage period on titratable acidity of set yoghurt obtained from different sources was indicated. The highest value was obtained at the end of the storage period (1.06%) while the lowest value (0.83%) was obtained at the beginning of the storage period, this reading is lower than that reported by frank (1970) who found a value of (1.2%) titratable acidity in cow's milk yoghurt and also within range (0.7-1.6%) stipulated by Sudanese standard and metrology organization. Titratable acidity content in all samples increased rapidly during storage period. That may be due to the weak activity of starter culture or could be attributed to the change of organic acids content in yoghurt during fermentation and storage in addition to decrease in pH of yoghurt during storage (Fernandez-Garcia et al. 1994).

These results were in line with (*Galal et al., 2004 and Guod et al., 2004)*, who reported that the increase of titerable acidity was due to an increase in lactic acid by starter culture.

Effect of storage period on Rheological properties of set yoghurt

Wheying – off

Table 4 and Fig.4 Show the effect of storage period on wheying off of set yoghurt obtained from different sources. The highest (5.871ml) was obtained at the end of the storage period and the lowest value (0.00ml) was obtained at the beginning. Ibrahim el al.(1989) reported that, the amount of separated whey from yoghurt samples ranged from 0.5 ml to 2.3 ml, it increased through storage without specific trend in the rate of increase. Excessive wheying- off is certainly an objectionable criteria and may be considered as poor quality yoghurt or lack of freshness.

Effect of storage period on microbiological count of set yoghurt obtained from different sources

4.3.1E. coli

Table 5 shows all yoghurt formulation had negative E. coli bacteria result that indicates good hygienic practice during processing and complying with the Sudanese standard and metrology organization limits Colony forming unit (10 Cfu /g), (2011).

Yeast and Moulds

Table 6 and Fig.5 shows The effect of storage period on yeast and moulds of set yoghurt recorded nil in all samples of set yoghurt under storage except in last day (21) in sample C and transport sample (10 Cfu/g) this result disagree with Arnott et al., (1974) who reported that 26.3% of the yoghurt produced and sold commercially in Ontario, Canada had mould count > 1 Cfu/g and disagree with Yaygin and Kilic, (1980) who found that yoghurt made using only pure culture showed no growth of yeast and mold up to 4th day of storage, and comply with the range (10 Cfu/g) stipulated by Sudanese standards and metrology organization (2011).

IV. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

From the above results and discussions it could be concluded that:

1. Titrarble acidity TA may be seen as one of the major factors determining the shelf life of set yoghurt samples.
2. The pH of yoghurt decreased with storage period, while the titratable acidity increased.
3. Wheying-off and synersis increased progressively during storage period.
4. No viable count observed except during last day of storage period.
5. The storage condition has significant effect on all set yoghurt properties at the end of storage period especially for transported samples.
6. The physical properties of yogurt gels can be qualitatively explained by the interactions that emphasizes a balance between attractive (e.g., hydrophobic attractions, casein cross-links contributed by calcium phosphate nanoclusters, and covalent disulfide cross-links between caseins and denatured whey proteins) and repulsive (e.g., electrostatic or charge repulsions, mostly negative at the start of fermentation) forces.

Recommendations

Taking into consideration the results obtained in this research it is recommended to:

1. Disseminate the culture of awareness among the works in dairy farms with Good Hygienic Practices (GHP), Good manufacturing practices (GMP) and Hazard Analysis Critical Control Point (HACCP)
2. Should be raised and if food safety is to continue, the Sudanese standard for milk products should be enforces strictly.
3. Better understanding of factors contributing to the physical and structural attributes may allow manufactures to improve the quality of yogurt.
4. Exceed the shelf of 10 days by stag at 4 – 7°C.
5. Take Care in yoghurt handling. Distribution and storage.
6. Strictly apply and enforce quality measures by authorities concerning milk products manufacturers.

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