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EFFECTS OF PRESERVATION METHODS ON THE NUTRITIONAL QUALITIES OF MILK AND SOME MILK PRODUCTS

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Target Audience: Food scientists, policy makers, household consumers, milk processing industries

ABSTRACT

Proximate compostion, bacterial load and organoleptic testing of milk products preserved through pasteurization, fermentation and chemical treatment were determined. Unpasteurized fresh milk (UFM), Pasteurized fresh milk (PFM), Yogurt (YGT) and chemically preserved milk (CPM) contained 2.72, 2,74, 2.45, 2.75% crude protein, 3.51, 3.50, 3.51, 3.52% Fat, 0.72, 0.72, 0.77, 0.68% ash respectively, which were not significantly differnt (P>0.05). Bacterial load recorded were 7.0×10^7, 7.0×10^6 and 2.4×10^7 cell/ml for UFM, PFM and YGT respectively, while corresponding shelf-lives were 2, 7, 14 days and pH were 6.5, 6.7 and 4.5. Various concentrations of benzoic acid, sodium benzoate, sugar and common salt used revealed that 0.25% of sugar induced the longest shelf-life (20 days) for Yogurt stored at 4^0C. Salt, benzoic acid and sodium benzoate at concentrations (0.25, 0.10, and 0.10% induced shelf-lives of 16.14 and 16 days respectively. Significant (P>0.05) difference was observed between the flavour and taste of UFM, PFM and YGT. NO significant (P>0.05) difference was observed between the appearance. It can be concluded that milk can be pasteurized at 62.8^0C for 30 minutes, fermented and chemically treated at low concentrations with no adverse effect on its chemical and nutritional qualities.

Keywords: Milk products, preservation methods, qualities.

DESCRIPTION OF PROBLEM

Milks as defined by (1) and (2) is the white liquid produced by the female of the warm vlooded animals for the feeding of her young. It can be consumed directly or converted to other products through various preservative methods which include pasteurization, fermentation and chemical treatment increase its shelf-life. The foremost concern in preserving milk and milk products is the control of microorganisms that causes spoilage and illnesses, many of which had been reported by other researchers (2,3,4). Other reasons for preservation of milk

and milk products are to ensure constant supply during the period of low production, the neccessity of transporting from the producing areas where it is required and the need for provision of an abundant and safe products for consumption.

The use of chemical preservatives such as benzoic acid, sodium benzoate, sugar and common salt at recommend level have been approved by Food and Drug Organisation (FDO) of Nigeria for food preservation (5).

The experiment was therefore conducted to check at what level or concentration the chemicals can be effective as spoilage control alone or in combination with pasteurization treatment. The effect of the preservation methods on the qualities of fresh milk and milk products in terms of microbial load, improved shelf life, proximate composition and organoleptic qualities were also evaluated.

MATERIAL AND METHODS

Sample Collection

Milk samples were collected from a Fulani herd (White fulani breed) behind YelwaMakaranta, Bauchi in April. The cows were being extensively managed by the Fulani herdsmen, only the feed of the lactating dams were supplemented with cotton seed cake.Milking of the dams was done by hand once a day, in the morning. The undiluted milk was collected into sterile containers as it was being extracted from the cows. Samples wee collected five times every other day and taken to the laboratory for immediate processing and preservation.

Sampling Technique

Undiluted fresh milk was collected from a single source throughout the study peroid. Milk products studied were randomly selected, one or two method of preservation were applied to each product.

pH Determine

pH values of fresh milk, starter culture and Yogurt samples were measured using Griffim pH meter model pH J251-499W .

Pasteurization of Milk

The milk was clarified, pasteurized, homogenized and cooled to room temperature. Pasteurization was done at 62.8°C for 30 minute (Holder's method) Homogenization was achieved by stirring vigorously with a sterlized rod for about 5 minutes and then left cool to room temperature by leaving it closed on the table.

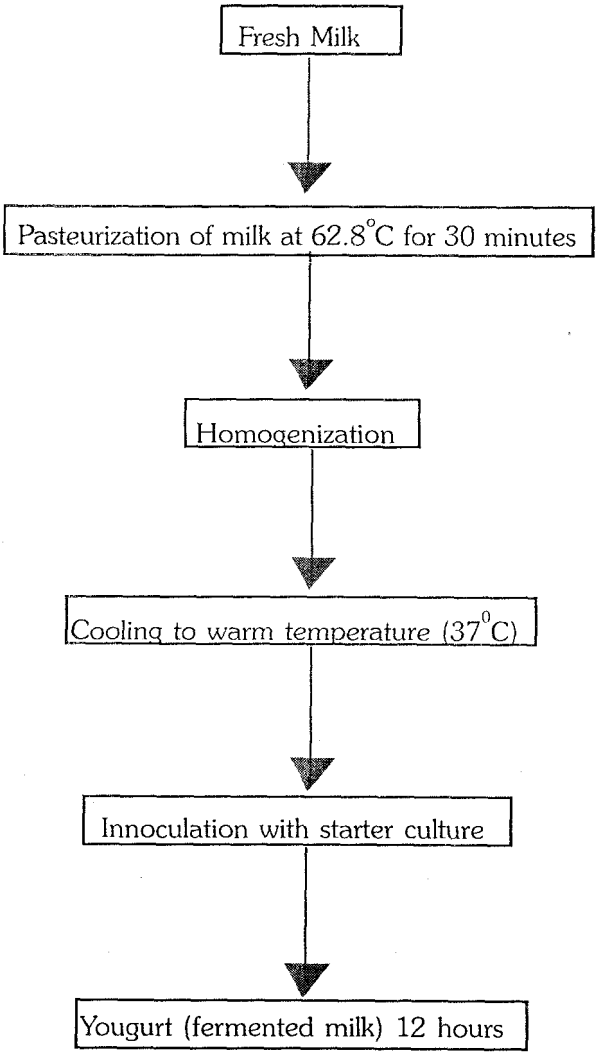
Collection and weighing of preservative

The preservatives used were sodiun chloride, sugar, sodium benzoate and benzoic acid. The latteer two preservatives were collected from the Chemistry laboratory of Abubaker Tafawa Balewa University, Bauchi while the first two

were purchased from the market. A highly sensitive weighting balance was used in detemining the actual amount of preservatives required.

Laboratory preparation of Yogurt

Yogurt was aseptically produced in the laboratory as shown in the following chart (5,6)



Addition of perservatives and storage

Chemical preservatives were added to the yogurt sample according to specification. The maximum concentration allowed for each preservative was calcualted in grams and four values below the maximum concentration were

added into 100ml of yogurt aseptically using a sterile spatula.

All samples were covered properly and stored at refrigeration temperature (4^0C) with their corresponding control at room temperature (25^0C).

Analytical procedures

The fresh unpasteurized, fresh pasteurized and chemically preserved milk and yogurt were analysed for proximate composition (%), microbial load (cell/ml) and organoleptic qualities.

Proximate Analysis

Proximate values of the samples were determined according to AOAC methods (6) and presented in simple percentage (Table1). Percentage total solids (% TS) were determimed by dehydrating the sample. By simple difference, the amount

Table 1: Proximate compostion (%) of milk products

Product/components	TS	CP	ASH	FAT	SNF	MC
Unpasteurized fresh milk	12.74	2.74	0.74	3.51	9.56	87.15
Pasteurized fresh milk	13.76	2.74	0.75	3.50	9.87	85.85
Untreated yougurt	11.33	2.45	0.77	3.51	8.34	86.75
Treated yogurt	16.97	2.75	0.68	3.52	13.4	83.04
S. E.	0.42	0.02	0.01	0.01	0.38	0.34
LSD (P>0.05)	NS	NS	NS	NS	NS	NS

of moisture was known, hence, that of total solids which was fuirther divided by sample weight and multiplied by 100. Percentage crude protein (%CP) was determined using the Kjeldahls method which first of all, determines the amount of nitrogen in the sample. The amonunt of Nitrogen so determined is then multiplied by a factor (6.25) to give the crude protein. Percentage ash (% Ash) was determined by ashing percentage fat and solids-non-fat by Babcok method and difference respectively.

One way of analyisis of variance (7) was used to test for any difference in the effect of the three preservation methods on the quality of the food products, while signnificant difference between mean values were compared by Dunca's Multiple Range test.

Microbial Load Analysis

Ten folds serial dilution of each sample was made as from 10^{-1} to 10^{-6}. The nutrient agar plate was streaked with 1ml of the sample of a particular dilution and incubated at 37^0C for 24 hours. The number of collonies were then counted using the digital illuminated colony counter (Gallenhemp England). The counts were converted to microbial load using the following formula

ML =N/V x R

Where:

ML = microbial load

N = Number oif colonies

V = Value of dilution

R = Dilution factor and expressed in cell/ ml.

Organoleptic quality analysis

Men panel of judges were used in assessing the orgnaoleptic qualities of the products. Qualities evaluated include flavour, taste and appearance/ colour.

Hedonic preference test was used in testing for a significant difference in each of the parameters mentioned above.

Effects of different concerntration of preservatives on shelf-life of Yogurt

Four different preservation were used at four different level of concentration each. The samples were stored at 25^0C and 4^0C. Recommended concentrations for benzoic acid and sodium benzoate ranged from 0.02 to 0.106 while that for sugar and common salt ranged from 0.05 to 0.25%. The samples were observed for deterioration by combined use of organoleptic test and microbial count.

RESULTS AND DISSCUSION.

Milk for the experiment was collected from a single source, hence no variation was introduced, this may be responsible for the fact that proximate analysis of unpasteurized fresh milk, pasteurized fresh milk, treated yogurt and untreated yogurt showed a fairly constant compostion in all the samples. The mean total solids (TS) of the four samples are 12, 74, 13, 76, 16.97 and 11.35 percent respectively. (Table1). Crude protein contents are 2.74, 2.74, 2.75 and 2.45 percent respectively. Fat contents are 3.51, 3.50; 3.52 and 3.51% in the same order while Ash content are 0.74, 0.75, 0.68 and 0.77 respectively. This result is in accordance with the findings of (8). The findings by (9) slightly vary from this result. Variation in proxiamte value of milk may be as a result of geographical location of where analyses were carried out it may also be due to seasonal variation. While (9) analysis was carried out in Jos, Plateau State (a relatively used environment) during the rainy season, analysis of this particular studies took place in Bauchi (a relatively cool environment) during the dry season. The water content of the milk analysed in Jos during rainy season is expected to be higher and therefore, the total solid results were lower than obtained result in this study. State of Lactation may also be a source of variation to proximate value of obtained milk.

Pasteurization at 62.80°C for 30 minutes does not affect the proximate composition of milk, neither do fermentation and addition of chemical preservatives.

Table 2: Baterial load (ceell / ml) shelf-life (days) and pHof unpasteurized fresh milk and some milk products.

Products	Bactrial load (cell/ml)	Shelf-life (days)	pH
Unpasteurized fresh milk	$7.0x10^{7(a)}$	2	6.5
Pasteurized fresh milk	$7.4x10^{6(b)}$	7	6.7
Yogurt	$2.4x10^{7(c)}$	14	4.5

LSD (P>0.05)
a= significanly differnet from b and c
b= significantly different from a and c
c= significantly different from a and b.

Fresh milk shows a high ($7.0x10^7$ cell / ml) microbial load (Table 2). This reduced drastically after pasteurization to $7.4x10^6$ cell / ml. Yogurt shows microbial load of $2.4x10^7$. This result agrees with the findings of (10). They used direct microscopy to determine the bacterial load of fresh milk and the microbial count obtained were in the range obtained for the present analysis. The microbial

Table 3: Effect of different concentrations of preservatives on shelf-life of yogurt stored at 4^0C and 25^0C.

Preservative	Concentration (%)	Shelf-life 4^0Ca	(days) 25^0C[b]
Control (No presrvative) (d)	-	4	1
Benzoic Acid (e)	0.02	5	1
	0.04	7	1
	0.06	9	2
	0.08	13	2
	0.10	14	2
Sodium benzoate (e)	0.02	6	1
	0.04	8	1
	0.06	10	2
	0.08	14	3
	0.10	16	3
Sugar (e)	0.05	8	1
	0.10	10	2
	1.15	12	2
	0.20	15	2
		20	2
Sodium chloride (e)	0.05	7	1
	0.10	8	1
	0.15	10	2
	0.20	12	2
	0.25	16	2

LSD (P>0.05)
a = significantly different from b.
d = significantly different from e.
No significant difference between columns labelled e.

load of milk and milk products analysed in Bauchi fell short of acceptable unit, taking the grading of (10) into consideration. They classified milk to be good if it contains approxmately less than 50,000 ($5.0x10^4$) per millilitre and fairly good if it contains 1.000,000 ($1x10^6$)/ml passable if it contains 4,000,000 ($4x10^6$) to 20,000,000 ($2x10^7$) and bad when it contian over 20,000,000.

Pasteurization and fermentation improve falvour and taste of milk and milk products, thus extending shelf-life. The result of organoleptic evaluation of unpasteurized fresh milk, pasteurized fresh milk and yogurt for flavour, taste and colour is presented in Table 4. Significant ($P<0.05$) difference were observed in flavour and taste due to the effect of pasteurization and fermentation. Earlier report (11) showed that desirable flavours develop during the fermentation of foods such as Cheese, Yogurt and alcoholic beverages.

Table 4: Organoleptic evaluation of pasteurized and fermented milk in contrast to unpasteurized milk.

	Pasteurized	Fermented milk.
Flavour	*	**
Taste	*	**
Colour	NS	NS

* = Significant at 5%
** = Significant at 1%
NS = Not significant

0.1%, 0.1% and 0.25% of Benzoic acid, sodium benzoate, sodium chloride and sugar extended the shelf-life of yogurt stored at 4^0C and 20 days respectively (Table 3). The corresponding shelf-lifes at 25^0C are 2,3,2 and 2 days respectively. This is in agreement with the finding of (2, 12). They reported that Benzoic acid, sodium chloride, sugar and pasteurization at various concentrations extended the shelf-life of milk and milk products to between 15-20 days. In this study, it can be concluded that, milk and milk products can be preserved by pasteurization and chemical preservatives, without any adverse effect on the proximate/nutritional value of the products.

REFRENCES

1. **Bradley, R. L. J. (1989).** Milk. The New Book of knowledge. University of Wisconsin U. S. A. 12:309-310.
2. **Oyawoye, O. M., Oyawoye, E. O., Bamgbose, A. M. and Dimka, S. R. (1997).** Effect of Chemical Preservatives on the Shelf-Life of "nono". Applied Tropical Agriculture 2:63-66.

3. **Feresu, S. (1992).** Fermented products in Zimbabwe. Application of Biotechnology to traditional fermented foods. National Academy Press, U. S. A. 80-84.
4. **Fashakin, J. B. and Unokiwedi, C. C. (1992).** Chemical analysis of 'warankasi' prepared from cow milk partially substituted with melon milk. Nigeria Food Journal 10, 103-109.
5. **Ihekoronye, A. I. and Ngoddy, P. O. (1985).** Integrated Food Science and Technology for the tropics. macmillian London.
6. **AOAC (1984).** Assocaition of Official Analytical Chemist, Official Methods of Analysisi, 14th edition, Wahsington Dc, USA.
7. **Steel, R. G. D. and Torrie, J. H. (1980).** Principles and procedure of Statistics. A biometrical approach (2nd ed.) M. Graw Hill International Edition, Singapore.
8. **Ibeawuchi, J. A. and Dalyop, D. M. (1995).** Compositon and quality of milk. Nigeria Journal of Animal Production. 23(1):81-84.
9. **Rangaswami, G and Bagy Arat, D. I. (1993).** Food preservation. Agricultural Microbiology. 2nd Edition. Prentice Hall of India Private Ltd., New Delhi, 330-346.
10. **Robinson, R. K. (1990).** The microbiology of milk products. Diary microbiology 2: 2nd Edtion. Barking U. K. 75-80.
11. **Fenwema, O. (1985).** Chemical Changes in Food during processing Avi Publishing Company, Inc. West Port Connecticest, 1-13.
12. **Oyawoye, O. M. Oyawoye, E. O. Tahir, F. Yusuf, I. Z. and Buhari, H. (1998).** Effects of preservatives on the shelf life of locally produced cottage cheese. Science Forum: J. Pure and aAppl. Sci. Accepted.