

COMPARATIVE STUDY REGARDING NUTRITIVE VALUE, BACTERIAL LOAD, AND PHYSIOCHEMICAL PROPERTIES OF FRESH AND ULTRA-HEATED (UHT) MILK IN DISTRICT PESHAWAR

Riaz Gul¹, Nighat Mussa², Sofia Kabir³

ABSTRACT

Objective: To compare fresh milk with ultra-heated (UHT) with respect to its nutritive value, bacterial load, and its physiochemical properties in district Peshawar.

Methodology: it was a cross sectional analytical study conducted for duration of four months, i.e. from June 2013 to September 2013. The study was conducted at all four towns of district Peshawar. Multistage cluster sampling technique was adopted to collect milk samples from milk selling points / shops. Total of 200 samples 100 each of UHT and fresh milk were collected using separate aseptic glass bottle. Three samples of 15 ml from each point were taken for nutritive value, bacterial load and physiochemical properties. Milk with known low fat, high calcium, and expired milk samples were excluded from the study. Required tests were carried out at the Centre of microbiology and bacteriology and animal nutrition veterinary research institute Peshawar, Khyber Pakhtunkhwa by using standard protocol recommended by WHO. Results were tabulated and analyzed by using SPSS version 16.

Results: results of our study shows that in the samples we collected, fresh milk was differ significantly from UHT milk only with respect to its PH and bacterial load with p value less than .005 ($p < .005$), while no significant difference was observed in nutritive value (fat, proteins, lactose etc.)

Conclusion: the available fresh and ultra-heated milk in district Peshawar were same in their nutritive value while the bacterial load and Ph. of the ultra-heated milk was better than the fresh milk for the health.

Keyword: ultra-heated milk, condensed milk, pasteurization, homogenization.

INTRODUCTION

Milk is a white liquid produced by the mammary gland of mammals. It is the primary source of nutrition for young mammals before they are able to digest other types of food. Early-lactation milk contains colostrum which carries the mother's antibodies to the baby and can reduce the risk of many diseases in the baby by providing them with immunity.¹

Milk from various mammals such as cow, buffalo, goat, sheep, camel, etc. is used for different nutritional purposes, e.g., feeding to young ones and preparation of some nutritional products such as milk cream, butter, yogurt, ghee, sour milk, etc.

Milk is an emulsion or colloid of butterfat globules within a water-based fluid that contains dissolved carbohydrates and protein aggregates with minerals.

Department of Community Medicine Kabir Medical College Peshawar Pakistan

Address for correspondence:

Dr. Sofia Kabir

Assistant Professor Community Medicine, Kabir Medical College Peshawar

E-mail: shehzadakbar@aof.com

Cell: 0345-9222232

Because it is produced as a food source for a neonate, all of its contents provide benefits to the growing young. The principle requirements of the neonate are energy (lipids, lactose, and protein), biosynthesis of non-essential amino acids supplied by proteins (essential amino acids and amino groups), essential fatty acids, vitamins and inorganic elements, and water.²

Milk as a raw material has a relatively short shelf life but it can be prolonged by heat treatment, which is an essential step adopted by the dairy industry heat treatment of milk during commercial processing operations not only inactivates the microorganisms but also results in a number of physio-chemical changes in the milk constituents.³

An ultra-high temperature pasteurized liquid (UHT) milk concentrate provides a reconstituted milk beverage that tastes like fresh milk. A direct steam injection process is used to form the UHT milk concentrate having at least about 30% by weight, preferably 35% to 45% by weight, nonfat milk solids having a shelf stability of at least 30 days. The UHT milk concentrate is homogenized and aseptically packaged for subsequent mixing in conventional beverage dispensers with water at volume ratios of about 3:1 to 4:1 of water to concentrate to make a beverage that tastes like fresh milk.⁴

Raw milk is milk that has not been pasteurized

or homogenized; Humans may consume it because they are unable or unwilling to treat it. Health food proponents tout the benefits of raw milk and the ills of pasteurization and homogenization. The medical community warns of the dangers of not pasteurizing milk.

Everyone in the world has drunk milk at some point in his or her life. Indeed milk is the food which exclusively sustains us during the first few months of life. All mammals produce milk to nurture their young and the composition of different milks reflect the growth and development patterns of the different mammalian species. For almost all people "milk" is synonymous with milk from a cow and that is what is meant in this article unless stated otherwise.⁵

The yield of milk from the domestic cow, *Bos Taurus*, has increase drastically over the last century due to dairy cattle breeding and production. Most dairies today are high-tech operations. The time between leaving the dairy and arriving in the supermarket is generally very short, the same day in many cases.⁶

Consumption of milk and dairy products varies from country to country and from person to person. In the UK and northern Europe people tend to consume milk quite regularly, even as adults. For most tea drinkers in Britain, a cup of tea is not a cup of tea without milk in it, but in other parts of Europe milk is not generally added to tea. Yet in some parts of Scandinavia, milk is a mealtime drink for many adults. But in many parts of the world, consumption of milk is very low.⁷

Different researchers have carried out studies in different parts of the world to analyze the differences between the fresh milk and UHT milk with respect to its nutritive values, bacterial contents and other physiochemical properties.

Pathak et al worked on physiochemical and microbial quality of 1800 samples of boiled milk from Jabalpure. Their results were alarming for the public when many strains of microbial were detected in the sample.⁸

He, J.(2012) compare the flavor of ultra-high temperature processed milk with fresh milk heated by conventional method. Their results showed marked difference in the flavor of both types and their acceptance by the public for difference purposes.⁹

Hussein et al (2011) studied the chemical and microbiological quality assessment of raw and processed liquid milks of Bangladesh. Results revealed that most of the raw and pasteurized milk were substandard in both chemical and sanitary quality whereas the quality of UHT treated milk was excellent.¹⁰

Rizwan et al (2011) studied about the bacterial quality of raw and packed milk. Results provided evidence that contamination of raw milk is originated during milking, transportation and storage.¹¹

No such study has been carried out before in Khyber Pukhtunkhwa to assess the quality of both fresh milk and UHT milk samples available at markets and to compare them for their nutritive value, physiochemical properties and bacterial load. This study is an attempt to carry out a comparative analysis of both types of milk available at market and to create awareness in general public regarding its proper use to get maximum benefits out of it and to avoid diseases caused by its improper use.

Methodology: it was a cross sectional analytical study conducted for duration of four months, i.e. from June 20013 to September 20013. the study was conducted at all four towns of district Peshawar. Multistage cluster sampling technique was adopted to collect milk samples from milk selling points / shops. Peshawar is divided into four towns. Out of four towns 25 union councils were selected randomly. Out of each union council 8 samples were taken four each of fresh milk and four of UHT milk. Total of 200 samples 100 each of UHT and fresh milk were collected using separate aseptic glass bottle and standard procedure. Three samples of 15 ml from each point were taken for nutritive value, bacterial load and physiochemical properties. Milk with known low fat, high calcium, and expired milk samples were excluded from the study. Required tests were carried out at the Centre of microbiology and bacteriology and animal nutrition veterinary research institute Peshawar, Khyber Pakhtunkhwa by using standard protocol recommended by WHO. Results were tabulated and analyzed by using SPSS version 16.

RESULTS

Out of 200 milk samples included in the study, 100 were of UHT milk and 100 of fresh milk. In physiochemical properties density, added water, PH and conductivity was observed and measured and compared. PH of UHT milk was found significantly within normal range as compared with fresh milk; p value was less than 0.005. 94 samples of UHT milk (94%) were having normal PH, while 70% of fresh milk was of normal PH. There was no significant difference of conductivity, added water and density of both fresh and UHT. Majority of fresh and UHT milk were having abnormal values of these. (Table#1)

In nutritive value fats, protein, lactose, solids not fats and solids were compared between UHT milk and fresh milk. There was no significant difference observed for the above mentioned nutrients among both types of milk. 2% of fresh milk was having normal fats and only 10% of UHT milk was having normal fats values. Protein content in UHT milk was 100% normal and 98% of fresh milk were having normal protein values. 100% of UHT milk was having normal lactose level while 94% were having normal lactose values. 98% of UHT milk had normal solids levels while 94% of fresh milk had normal solids levels. (Table #2)

Bacterial load of both fresh and UHT milk were

Table 1: Comparison of the physicochemical properties of fresh and UHT milk

Properties		FRESH MILK	UHT MILK	TOTAL	CHI SQUARE	DEGREE OF FREEDOM	P VALUE
Density	Normal	4	0	4	2.041	1	0.495
	Abnormal	96	100	196			
Added Water	Normal	32	36	68	.123	1	.833
	Abnormal	68	64	132			
pH	Normal	70	94	164	9.78	1	0.003
	Abnormal	30	6	36			
Conductivity	Normal	12	16	28	0.332	1	0.774
	Abnormal	88	84	172			

Table 2: Comparison of nutritive value of fresh and UHT milk

Properties		FRESH MILK	UHT MILK	TOTAL	CHI SQUARE	DEGREE OF FREEDOM	P VALUE
(Fats)	Normal	2	10	12	2.837	1	0.204
	Abnormal	98	90	188			
(Protein)	Normal	96	100	196	2.041	1	0.495
	Abnormal	4	0	4			
(Lactose)	Normal	94	100	194	3.093	1	0.242
	Abnormal	6	0	6			
(Solid Not Fat)	Normal	92	96	188	3.001	1	0.201
	Abnormal	8	4	13			
Solids	Normal	94	98	192	1.99	1	0.387
	Abnormal	6	2	8			

Table 3: Bacterial load of both fresh and UHT milk

	Type of milk			Total	Chi square	Degree of freedom	P value
	Fresh milk	UHT milk					
Normal Bacterial Load	2	38		40	20.250		Less than 0.001
Abnormal Bacterial Load	98	62		160			
TOTAL	100	100		200			

also compared in samples.38% of UHT milk were having normal bacterial load while only 2% of fresh milk were having normal bacterial load, rest of the samples from fresh milk were having high bacterial count than normal. (p value less than 0.005).(table #3).

DISCUSSION

One the basis of our study result we have different observation found between fresh milk and UHT milk regarding bacterial load, nutritive value and physico-chemical properties.

BACTERIAL LOAD

Bacterial load of both fresh and UHT milk were shown in table 1. Only two fresh milk samples out of hundred have normal bacterial load while the remaining 98 samples have higher bacterial count than normal. 38 samples were found normal for bacterial load while 62 samples have higher bacterial load out of 100 UHT samples. 38% of UHT milk were having normal bacterial load while only 2% of fresh milk were having normal bacterial load. The results of the present study are contrary with Al-Shamary and N.I.Abdal Ali find out that only 14% milk samples were contaminated with many types of bacteria.¹² This higher contamination in the present study may be due to the status and inadequate hygiene and improper monitoring of milk by the

government. Another study done in Peshawar by Abid Hamida regarding Microbial Quality Assessment Study of Branded and Unbranded Milk showed that coliforms, Salmonella, yeast and mould were isolated from all raw milk samples while the UHT milk Produced by modern dairies showed a very high quality of microbial standard with a very delicate flavor.¹³ A study done by Ammara Hassan showed Microbial counts for coliforms (e.g., E.coli), Bacillus cereus, Bacillus subtilis and heat resistant spores forming bacteria were zero. This may be due to more developed city and good monitoring system of UHT milk.¹⁴

NUTRITIVE VALUE OF FRESH AND UHT MILK

Data about the normality of nutritive value of fresh and UHT milk is shown in table2. Only two samples were found normal while 98 samples were abnormal out of 100 samples of fresh milk for the fat contents. The result for fat contents was almost the same in UHT milk as fresh milk. Forty eight (98) samples have normal protein value while only two samples have abnormal protein value for fresh milk. The lactose content of the fresh milk was found normal for 94 samples while abnormal for 6 samples. 92 samples were found normal while 8 samples were abnormal for solid not fat content of the fresh milk. The total solids of 92 samples were normal while 8 samples were not normal in fresh milk. Ten samples were found normal while 90 samples were abnormal for UHT milk. All the 100 samples of the UHT milk were found normal in term of protein and lactose content. 96 samples were found normal while 4 samples were abnormal for solid not fat content of the UHT milk. The total solids of 98 samples were normal while 2 samples were not normal in UHT milk. No significance difference in nutritive value was found between fresh and UHT milk. The results of the present study were supported by many researchers. Rizwan et al reported that the microbial contamination of raw milk decrease the nutritive value because at room temperature microbial activity is more.¹¹

PHYSIOCHEMICAL PROPERTIES OF FRESH AND UHT MILK

Data regarding physiochemical properties of fresh and UHT milk are shown in table3. 96 samples have higher or lower density than normal while 4 samples have normal density in fresh milk sample. The value of added water in fresh milk is not normal in 68 samples while normal in 32 samples. Normal PH and conductivity samples were 70 and 12 respectively for fresh milk. The number of samples normal for density, added water, PH and conductivity were 0, 36, 94,16 respectively for UHT milk while abnormal samples for density, added water, PH and conductivity were 100, 64, 06, 84 respectively.

These results are supported by Imran et al who reported that the physicochemical properties of the UHT

milk in Pakistan are better than fresh milk. The reason may be the higher bacterial load, improper storage, contaminated utensils etc. of fresh milk that may affect the physicochemical properties.

Amara et al reported that the physicochemical properties of the UHT milk changes. There is an increase in sedimentation value with the ice mixing or dilution before processing which disturbed the salt balance, protein charges and natural emulsion. There was increase in acidity and sedimentation of milk but pH, % of fat contents, SNF (solids non fats) and proteins decreased during storage. The negative changes occurred in color, aroma and flavor with reference to these physicochemical changes.¹⁴

CONCLUSIONS:

Keeping in view the results of study following conclusions are made,

In physiochemical properties, only PH of UHT milk was significantly found normal compare to fresh milk while there was no significant difference between fresh and UHT milk in conductivity, density and added water.

Nutritive value of both fresh and UHT milk were good. There was no significant difference in both fresh and UHT milk.

The bacterial load of majority of fresh milk samples were more than normal range as compare to UHT milk.

RECOMMENDATION

On the basis of result of my project, I suggest the following recommendations for government and general public for their health benefit and provision of healthy, nutritive and of normal bacterial range of milk.

UHT milk should be preferred over fresh milk as fresh milk has more chances of high bacterial range.

It is highly recommended to drink fresh milk after proper pasteurization or boiling due to its high bacterial load as it is dangerous for health.

Public awareness should be created not to consume fresh milk which is in open containers and drums.

Government should make monitoring policy for check and balance over both fresh and UHT milk especially.

REFERENCES

1. Aneja, R.P. World survey of traditional milk products. India and neighboring countries including the Himalayan region. FAO Manuscript. 1989;vol 6.p.123-126.
2. Toor F.D. &Kazmi. A.R. Recombination in Pakistan in recombination of milk and milk products. Milk pack limited, Pakistan 2009; vol 10 pp28.

3. 3. Milk Processing Guide Series, Project, Training Programme for Small Scale Dairy Sector and Dairy Training Institute – Naivasha. 1999; Volume 1 by FAO/TCP/KEN/6611.
4. 4. Amit, A, Awasthi, V, Dua A, Ganguly S, Garg V, Marwaha S. Microbiological profile of milk: Impact of household practice. 2012; vol 56, p 88-94.
5. 5. Abdalla M.O.M; Comparison of Chemical and Microbiological Parameters of Charcoal versus Gas and Solar Energy Treated Milk. Advance J. Food Sci. and Tech. 2010; vol 2: p 286-290.
6. 6. Wndie C., Smout, C.L.V. Annm., H.E. Marac., Form Time Temperature Integrator kinetics to Time Temperature Integrator Tolerance Levels: Heat-Treated Milk. American Institute of Chemical Engineers (AIChE). 2004; 2, p 11-12.
7. 7. Claeys. W. L. C. smout. A. Loey, V. Hendrickx M... Time temperature integrator kinetics to time temperature integrator tolerance levels: heat-treated milk. American Institute of Chemical Engineers. 2008; vol 20, p 1-12.
8. 8. PatsyS., Goossens K. Rodriguez M.D. Pil A. Goris J. Herman L. De Vos P. N, M. Hendricks. Paenibacillus lactis sp., isolated from raw and heat-treated milk Nov., Inter. J. SGM 2004; vol. 54; p 885-891.
9. 9. David S.L. and Schmidt K. UHT processing and aseptic filling of dairy foods. Thesis, Food sci, Graduate Program College, Kansas state university Manhattan, Kansas. 2008; vol 3, p 45-49.
10. 10. Scheldeman P. Pil A. Hermam. L.P.D. Vos and Hendricks. M. Incidence and Diversity of Potentially Highly Heat-Resistant Spores Isolated at Dairy Farms. Appl Environ Microbial. 2005 March; vol 3, p 1480-1494.
11. 11. Rizwan Muhammad et al. bacterial quality of raw milk and packed milk. Canadian. J. Sci. Industrial Res Vol.2, p 11-14.
12. 12. Al-Shamary, A. H. A. Abdalali N. I., Detection of microbial load in imported UHT milk in Baghdad Markets. Al-Anbar J. Vet. Sci. 2011; Vol4, p 21-24.
13. 13. AbidHamida, Ali Javed et al. Microbial Quality Assessment Study of Branded and Unbranded Milk Sold in Peshawar City, Pakistan. Pakistan Journal of Nutrition 01/2009; vol3, p 32-37.
14. 14. Ammara. H. et al. Microbiological and physico-chemical analysis of different UHT milk available in a local market, As, J. food Ag-Ind. 2009, vol 2, p 434-447.

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