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Effect Of Milk Fortified With Zinc On Physico-Chemical Properties Of Matsun

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ABSTRACT

Milk along with its products are essentially the most significant resources of vitamins and minerals to obtain humans diet plans by their daily life, however they are inadequate in several various other elements significantly, Iron and Zinc. Zinc fortification of those dairy products might cause problems in several products as well as disposers into the potential customers. The objectives of this study is to investigate the effect of fortification matsun with some zinc salts on matsun physical and chemical properties. Cow milk (3.2% of fat) was obtained from private farms of Abovyan region (Armenia). Fresh cow milk was standardized to 85ºC for 10 minutes. The milk was divided in to 2 portions. The first portion was not fortified with zinc and regarded as a control. The remaining portion was fortified with zinc salt. Matsun samples were chemically examined when fresh and after 1, 3, 5 days of refrigerating at 5˚C.our study show: Zn-fortify has significant effect on acidity. Zn-enrichment has no significant effect on Total solids, Fat and Protein.

Keywords: milk, zinc salt, fortification, matsun.

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INTRODUCTION

Zinc

Zinc has an atomic weight of 65.37 and is classified as a group IIB post-transition metal. In biological systems, zinc exists as Zn2+. It is a Lewis acid and acts as an electron acceptor which typically binds to proteins, amino acids, peptides, and nucleotides and permits both catalytic and structural functions [Institute of Medicine, Food and Nutrition Board, 2001; 1]. The unique chemical properties make zinc important in a wide variety of biological processes. Though, zinc is in the divalent state (Zn2+), it does not cause oxidative damage in respect that it does not exhibit redox chemistry in living organisms [1].

Metabolic Function The adult human contains 2–3 g of zinc [2] and zinc is the second most abundant trace mineral after iron in human body. Choroid of the eye and prostatic fluid include most of zinc as well as other zinc including tissues such as blood, bone and teeth [1; 3;4].

Over 300 zinc enzymes, which have structural, regulatory or catalytic roles, have been discovered covering all six classes of enzymes [2; 3 ;5; 6]. Additionally, numerous physiological functions require zinc such as mitosis, DNA synthesis, neurogenesis, synaptogenesis, neuronal growth, neurotransmission, protein and regulation of gene expression as well as bone mineralization, collagen synthesis. Zinc also maintains the configuration of a number of non-enzymatic proteins such as pre-secretory granules of insulin [2; 7; 12].

The essentiality of zinc for the growth was first recognized in the 1860s with plants. Additionally, zinc deficiency was first demonstrated in a swine as a cause of disease called parakeratosis. In human, its requirement was better understood after Prasad and colleagues, 1961 described syndrome of hypogonadism and dwarfism since zinc supplementation restored growth and sexual maturation [1;3]. Zinc deficiency, however, alters protein synthesis besides the nature of RNA polymerase and may affect gene expression. Thus, the growth, cellular immunity, fertility, hair growth, wound healing and plasma protein levels are suppressed in the absence of zinc [3].

Zinc Fortification

Food fortification is one of the approaches to prevent or correct a demonstrated deficiency of nutrient in the populations with addition of one or more essential nutrients to particular foods (food vehicle) whether or not it is normally contained in the food [10]. The food fortification is also one of the most-cost effective and long term strategies. Nevertheless, this strategy is difficult to adapt in developing countries as it requires a strong food processing [11]. For a successful fortification, target population, appropriate level of fortification, good bioavailability of the nutrient, processing and preparation methods of the food vehicle, cost, impact of the nutrient on food quality, inhibitory components that affect bioavailability of the fortified nutrient, estimated zinc requirement and finally consumer acceptability have to be taken into consideration [10; 12]. Additionally, the food vehicle and the fortifying agent or fortificant selected for fortification have to be chosen carefully [9].
The food vehicle must be technologically and economically fortifiable, has wide and regular consumption, appropriate serving size to meet a significant part of daily dietary requirement of the fortificant added. On the other hand, the fortificant must be resistant to dietary inhibitors, has a good bioavailability during normal shelf life of the fortified product, and should not affect quality of the food that is to be fortified [9;11; 12].

However, some information is needed to design fortification programs, namely; distribution of nutrient intakes in populations, whether intakes will be adequate and safe with a specific level of fortification . It is also important that the fortified food to be consumed less than the UL by consumers.

Milk and dairy products are frequently consumed by populations and are considered as the ideal carriers in food fortification programs. However, these products are low in zinc. Therefore, it is estimated that fortification of these foods with a proper zinc salt is an effective and economic strategy to prevent zinc deficiencies [8].

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MATERIAL AND METHOD

Matsun (It is very similar to yogurt and it is made from cow's milk (mostly), goat's milk, sheep's milk, buffalo milk, or a mix of them and a culture from previous productions)is in fact one of the most common dairy products eaten in Armenia it is a popular fermented milk product and is actually one of the drinks they have actually frequently daily.

Cow milk (3.2% of fat) was in fact obtained from private farms of Abovyan region. Then the real concentration of zinc salt was determined using GOST 269228-86. Ferrous sulphate was obtained from Scharlau Company (Spain).

Total solids content were determined based on GOST 3626- 90 and fat to GOST 5867-90 .The pH values have been determined by Jenway pH meter (Jenway limited. England). Moisture contend was determined at 105 ºC (GOST 3626- 90) Titrable acidity and pH value were determined according to the methods GOST 36 24- 92

Total and soluble nitrogen contents were really determined in accordance with GOST 23327- 98. Fat content was measured according to GOST 5867-90. Yogurt making Procedure: Fresh cow milk was standardized to 85ºC for 10 min. The milk was divided in to 2 portions. The first portion was not fortified with zinc and regarded as a control. The remaining portion was fortified with zinc. The milk was cooled to 42˚C. Inoculated with matsun culture and titled in to 500 ml plastic cups. Covered and incubated at 42˚C until a firm curd was formed. Matsun samples were chemically examined when fresh and after 1, 3, and 5 days of refrigerating at 5˚C.Data in Tables 1 show Effect of zinc Salt Fortification on Dry matters, fat, pH and Protein % of Matsun during Storage respectively.

Table. 1. Effect of zinc Salt Fortification on Dry matters, fat, pH and Protein % of Matsun during Storage respectively

Indicator	Control samples			Samples with Zn		
	1st day	3rd day	5th day	1st day	3rd day	5th day
Dry matters %	13.1	13.1	13.1	13.2	13.22	13.22
Fat %	1.8	1.8	1.8	1.75	1.8	1.8
pH	4.4	4.3	3.8	4.3	4.2	3.6
Protein %	3.1	3	3.1	3.0	3.1	3

Statistical Analysis: The obtained data were subjected to analysis of Paired **Samples Test**. [15].

Hypothesises and Analysis:

First hypothesis:

H_0 Hypothesis: There is no significant difference for acidity before and after enrichment by zinc.

Hypothesis: H_1 there are significant differences for acidity before and after enrichment by zinc.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Acidity.z1	1.2150	4	.03317	.01658
	Acidity.z2	1.0925	4	.04992	.02496

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Acidity.z1 & Acidity.z2	4	.815	.185

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Table1) Paired Samples Test

	Paired Differences			
				95% Confidence Interval of the Difference
	Mean	Std. Deviation	Std. Error Mean	Lower
Pair 1 Acidity.z1 - Acidity.z2	.12250	.02986	.01493	.07498

Paired Samples Test

	Paired Differences			
	95% Confidence Interval of the Difference			
	Upper	t	df	Sig. (2-tailed)
Pair 1 Acidity.z1 - Acidity.z2	.17002	8.205	3	**.004**

Therefore, the significance level is 0.004 that is smaller than α (error value), which is 0.05. Thus null hypothesis is rejected as well as the equal-means hypothesis and it means that there is a difference between acidity after fortify by zinc (interfering agent) and before that. It implies that there are significant mean differences and consequently there are significant differences between acidity after and before fortify by Zn. Zn-fortify has significant effect on acidity.

Second hypothesis:

H_0 Hypothesis: There is no significant difference for total solids before and after enrichment by zinc.

Hypothesis: H_1 there are significant differences for total solids before and after enrichment by zinc.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Total.solids.z1	15.8475	4	.48836	.24418
	Total.solids.z2	16.0850	4	.29366	.14683

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Total.solids.z1 & Total.solids.z2	4	.729	.271

Table3) Paired Samples Test

	Paired Differences			
				95% Confidence Interval of the Difference
	Mean	Std. Deviation	Std. Error Mean	Lower
Pair 1 Total.solids.z1 - Total.solids.z2	-.23750	.33994	.16997	-.77842

Paired Samples Test

	Paired Differences			
	95% Confidence Interval of the Difference			
	Upper	t	df	Sig. (2-tailed)
Pair 1 Total.solids.z1 - Total.solids.z2	.30342	-1.397	3	**.257**

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Therefore, the significance level is 0.257 that is more than α (error value), which is 0.05. Thus null hypothesis is accepted as well as the equal-means hypothesis and it means that total solids are the same before and after enrichment by Zn (interfering agent). It implies that there is no significant mean difference and consequently there is no significant difference between Total solids after and before enrichment by Zn.
Zn-enrichment has no significant effect on Total solids.

Third hypothesis:

H_0 Hypothesis: There is no significant difference for Fat before and after enrichment by zinc.

Hypothesis: H_1 there are significant differences for Fat before and after enrichment by zinc.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Fat.z1	5.3850	4	.09574	.04787
	Fat.z2	5.3875	4	.10012	.05006

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Fat.z1 & Fat.z2	4	1.000	.000

Table5) Paired Samples Test

		Paired Differences				
					95% Confidence Interval of the Difference	
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper
Pair 1	Fat.z1 - Fat.z2	-.00250	.00500	.00250	-.01046	.00546

Paired Samples Test

		t	df	Sig. (2-tailed)
Pair 1	Fat.z1 - Fat.z2	-1.000	3	**.391**

Therefore, the significance level is 0.391 that is more than α (error value), which is 0.05. Thus null hypothesis is accepted as well as the equal-means hypothesis and it means that Fat is the same before and after enrichment by Zn (interfering agent). It implies that there is no significant mean difference and consequently there is no significant difference between Fat after and before enrichment by Zn.
Zn-enrichment has no significant effect on Fat.

Fourth hypothesis:

H_0 Hypothesis: There is no significant difference for Protein before and after enrichment by zinc.

Hypothesis: H_1 there are significant differences for Protein before and after enrichment by zinc.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Protein.z1	4.7950	4	.02082	.01041
	Protein.z2	4.7750	4	.01732	.00866

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Protein.z1 & Protein.z2	4	-.370	.630

Table7) Paired Samples Test

		Paired Differences			
					95% Confidence Interval of the Difference
		Mean	Std. Deviation	Std. Error Mean	Lower
Pair 1	Protein.z1 - Protein.z2	.02000	.03162	.01581	-.03032

Paired Samples Test

		Paired Differences			
		95% Confidence Interval of the Difference			
		Upper	t	df	Sig. (2-tailed)
Pair 1	Protein.z1 - Protein.z2	.07032	1.265	3	**.295**

Therefore, the significance level is 0.295 that is more than α (error value), which is 0.05. Thus null hypothesis is accepted as well as the equal-means hypothesis and it means that Protein is the same before and after enrichment by Zn (interfering agent). It implies that there is no significant mean difference and consequently there is no significant difference between Protein after and before enrichment by Zn.
Zn-enrichment has no significant effect on Protein.

RESULTS

There are significant differences between acidity after and before fortify by Zn. Zn-fortify has significant effect on acidity. There is no significant difference between Total solids after and before enrichment by Zn. Zn-enrichment has no significant effect on Total solids. There is no significant mean difference and consequently there is no significant difference between Fat after and before enrichment by Zn. Zn-enrichment has no significant effect on Fat. There is no significant mean difference and consequently there is no significant difference between Protein after and before enrichment by Zn. Zn-enrichment has no significant effect on Protein.

REFERENCES

[1] Shrimpton, R. and Shankar, A.H. 2008. Nutrition and Health in Developing Countries 2nd ed. Chapter 15: Zinc Deficiency R. D. Semba and M. W. Bloem (Ed.) Humana Press, Totowa, NJ

[2] Maret, W., and Sandstead, H. H. 2006. Zinc requirements and the risks and benefits of zinc supplementation. J. Trace Elem. Med. Biol., 20:3-18.

[3] Jeejeebhoy, K. 2009. Zinc: An essential trace element for parenteral nutrition. Gastroenterology 137:S7-S12.

[4] Song Y., Elias V., Loban, A., Scrimgeour, A.G., Ho, E. 2009. Marginal zinc deficiency increases oxidative DNA damage in the prostate after chronic exercise. Free Radic Biol Med, 48:82-88

[5] Saper, R.B., and Rash R. 2009. Zinc: An Essential Micronutrient. American Family Physician 79:768-772.

[6] Qin, Y.A., Melse-Boonstra Shi, Z., Pan, X., Yuan, B., Dai, Y., Zhao, J., and Zimmermann, M.B. 2009. Dietary intake of zinc in the population of Jiangsu Province, China. Asia Pac J Clin Nutr 18:193-199.

[7] Walingo, M.K. 2009. Indigenous food processing methods that improve zinc absorption and bioavailability of plant diets consumed by the Kenyan population. AJFAND 9(1):523-535.

[8] Salgueiro, M.J., Zubillaga, M., Lysionek, A., Sarabia, I., Caro, R., De Paoli, T., Hager, A., Ettlin, E., Weill, R., Boccio, R.J. 2000a. Bioavailability, biodistribution and toxicity of Bio-Zn-AAS: a new zinc source. Comparative Studies in rats. Nutrition 16:762-6.

[9] Salgueiro, M.J., Zubillaga, M.B., Lysionek, A.E., Caro, R.A., Weill, R., and Boccio, J.R. 2002. Fortification strategies to combat zinc and iron deficiency. Nutrition Reviews, 60, 52-58.

[10] Hess, S.Y., and Brown, K.H. 2009. Impact of zinc fortification on zinc nutrition. Food Nutr Bull, 30:79-107

[11] Gómez-Galera, S., Rojas, E., Sudhakar, D., Zhu, Ch., Pelacho, A.M., Capell, T., Christou, P. 2010. Critical evaluation of strategies for mineral fortification of staple food crops. Transgenic Research 19:165-180.

[12] Brown, K.H, Wessells, K.R., Hess, S.Y. 2007. Zinc bioavailability from zinc-fortified foods. Int J Vitam Nutr Res, 77(3):174-81

[13] Drago, S.R. and Valencia, M.E. 2002. Effect of fermentation on iron, zinc, and calcium availability from iron-fortified dairy products. J Food Sci, 67(8):3130-3134.

[14] Struhl, K. 1989. Helix-turn-helix, zinc-finger and leucine-zipper motifs for eukaryotic transcriptional regulatory proteins. Trends Biochem Sci 14: 137-140.

[15] Mee, R. W., & Chua, T. C. (1991). Regression toward the mean and the paired sample t test. *The American Statistician*, *45*(1), 39-42.