*INT. J. BIOL. BIOTECH.*, 11 (1): 107-110, 2014.

# QUALITY ASSESSMENT OF TETRA PACK MILK AND TEA WHITENERS IN RELATION TO STRENGTH OF MACROMINERALS AND MICROBIAL ACTIVITY

**Rubina Perween[1*], Qamar-Ul-Haque[2], Anila Anwar[1], Kousar Yasmeen[1], Hina Zafar[3], Humera Anwar[1] and Talat Tarique[1]**

[1]*Department of Chemistry, Federal Urdu University of Arts, Science and Technology, Karachi-75300, Pakistan.*
[2]*Faculty of Eastern Medicine, Hamdard University, Karachi, Pakistan.*
[3]*Department of Botany, Federal Urdu University of Arts, Science and Technology, Karachi-75300, Pakistan.*
*Corresponding Author: e-mail: r_perween1@yahoo.com

**ABSTACT**

Epidemiological studies have proven the threats associated with the food commodities either as raw or packed after processing. Tetra pack milk (TM) and tea whiteners (TT) are increasingly used in the last decade in all social circles due to ready to drink or use in Pakistan. This bifocal investigation has provided a clue regarding imbalance in the levels of sodium and potassium. The study of microbial activity based on the colony forming unit CFU/mL of fungi and bacteria have been measured in the ranges of 4 – 28 and 68 $x10^4$ - 322 $x10^4$, respectively, whereas 36 % Tetra pack milk and 25 % tea whiteners showed the presence of Gram negative bacteria.

**Key-words:** Electrolytes, fungi, bacteria, processed milk, processed tea whiteners

## INTRODUCTION

Minerals contribute to the buffering capacity of milk, the maintenance of milk pH, the ionic strength and milk's osmotic potential (Perween *et al*., 2011). Minerals are inorganic elements that maintain their structure throughout the processes of digestion, absorption, and metabolism. They play critical roles in virtually all aspects of human health and function. Sodium, potassium, magnesium, calcium and phosphorus are required by the body in amounts greater than 100mg/day (Murray *et al.,* 2000). The primary functions of potassium and sodium are fluid balance, transmission of nerve impulses and muscle contraction. The deficiency of potassium is characterized by muscles weakness, paralysis, neuronal inhibition and increased cardiac contractility and excitability, whereas sodium deficiency causes muscle activation, anesthesia, fatigue, nausea, vomiting and neuronal inhibition, while its toxic effects are characterized by the water retention, high blood pressure and loss of calcium. (Klaassen, 2001; Thompson and Manore, 2009).

Milk in the udder of healthy animals is sterile. However, during its collection, storage and transport, milk can be contaminated with different pathogens. Most of these pathogens come from the hide of animals, bedding material, manure, feed, milking equipment, and /or milk handlers ((Oyarzabal and Backert, 2012). It is also well established that milk quality is greatly influenced by three main extrinsic factors: quality of raw material, the packaging system, the binomial temperature/ pasteurization time (Cromie, 1991). Pasteurization is a process applied to a product with the objective of minimizing possible health hazards arising from pathogenic microorganisms associated with the product (milk) which is consistent with minimal chemical, physical and organoleptic changes in the product (IDF, 1986). However, some fungal spores and bacterial strain can be resistant to pasteurization. Equivalent pasteurization processes for milk may be accomplished using three processes: low temperature, long-time (LTLT); high-temperature, short-time (HTST); and ultrahigh temperature (UHT). LTLT is commonly done in batch processing in a vat where milk is heated to 62.7 $^{o}$C (145 $^{o}$F) for 30 min. HTST requires a processing temperature of 71.7 $^{o}$C (161$^{o}$ F) for 15 s, and UHT pasteurization occurs at 140-150 $^{o}$C (280-300$^{o}$ F) for 1-2 s. (Oyarzabal and Backert, 2012). Some gram-positive bacteria are capable of producing spores that are surrounded by two layers: the inner made up of peptidoglycan whereas outer coat is composed of proteins. The spores have low water content, which supports the survival during heat treatments (Setlow, 1995).

There have been a number of food-borne illnesses due to the presence of microorganisms resulting from the ingestion of poorly pasteurized raw milk or dairy products, tetra packs or even in sterile milk (CAST, 2003). The existence of bacteria and yeast in the pasteurized milk is an indication of recontamination or improper processing (Hui, 1992; Salmeron *et al*., 2002). Therefore, in the USA aseptic techniques have been developed for the safe collection of milk. Scarlet fever, tuberculosis and typhoid fever have been widely controlled by the pasteurization of liquid milk (Oyarzabal and Backert, 2012).

In this regard present study was designed to focus on the quantitative investigation of electrolytes and microbial activity in terms of CFU count of bacteria as well as fungi in homogenized ultra heat treated (UHT) pasteurized milk

and tea whitener available not only Karachi city but throughout the country.

## MATERIAL AND MTHODS

### Sampling:

Samples of homogenized and UHT milk samples and tea whitener samples packed in aluminum-laminated paperboard cartons or tetra pack of various brands were purchased from wholesale or retail shops of different local markets. All samples were analyzed before the expiry date.

### Electrolytes Evaluation:

Electrolytes including Sodium (Na) and Potassium (K) were evaluated through Atomic Absorption Spectrophotometer. For this purpose samples were digested through $HNO_3$ by applying the procedure As given by Mahmood *et al*. (2004). Electrolytes were measured using a Perkin Elmer A Analyst 700 Atomic Absorption Spectrophotometer while standard burner and air-acetylene was applied as fuel. For radiation source of respective metal standard hollow cathode lamps were used.

### Microbial Assessment:

Media containing Potato Dextrose Agar (PDA) and Nutrient Agar (NA) were prepared for growing the fungal and bacterial colonies, respectively. For the observation of colony forming unit of mycobiota, aliquot of 1 ml of sample was inoculate in triplicates of Petri plates containing PDA and incubated at 30º C for five to seven days. While for the bacterial colonies, serial dilution up to $10^{-4}$ of each sample was prepared with sterile distilled water. An aliquot of 1ml of diluted sample was inoculated on triplicates Petri plates containing NA and incubated at 35º C for 24 h. Colonies were counted by colony counter. Gram staining was also performed.

## RESULTS AND DISCUSSION

Mean concentration with standard error (SE) of electrolytes in UHT pasteurized tetra pack milk (TM) samples and tetra packs tea whitener (TT) samples of several brands are depicted in Table 2. Sodium was estimated in TMs 289.16 - 413.354 mg/L whereas, the range of concentration in TTs was found as 255.29 - 290.774 mg/L. The level of sodium in all TMs was higher as compared to reported level by Imran *et al.*, (2008), but lower than the standard value given by AAP (2004) of cow milk (499 mg/L). Samples of TT showed also similar trend in contrast to literature value (80 mg/l) as reported by Imran *et al*.(2008).

The range of average concentration of Potassium in TMs and TTs was found to be 290.066 – 418.390 mg/l and 173.362 – 252.160 mg/L respectively. The observed concentration of Potassium in all samples including TMs and TTs was comparatively higher than the reported concentration (115 mg/L) by Imran *et al*. (2008). The FDA suggested that diets containing foods that are good sources of potassium and low in sodium may reduce the risk of high blood pressure and stroke. To justify this claim, a food must contain at least 350 mg potassium and must have ≤ 140 mg sodium (Gropper *et al*., 2005). About 18 % brands showed lesser level of potassium as compared to sodium, by contrast 100 % TTs exhibited elevated level of sodium than potassium.

The microbial activity in samples of various brands including TMs and TTs was presented in Table 2 in terms of CFU's (colony forming units) count. The range of bacterial count in the TMs and TTs was recorded as $68X10^4$ - $322X10^4$ CFU's $mL^{-1}$. The least count was shown by TM5, while highest in TM1. The infectious dose of food borne bacterial pathogens may vary from 10 to 1000 bacterial cells. Among the bacterial pathogens, 10 species are most commonly associated with food borne outbreaks: *Listeria monocytogenes, Escherichia coli* O157:H7, *Salmonella* spp., *Campylobacter jejuni, Bacillus, Staphylococcus, Yersinia, Shigella, Clostridium* and *Vibrio* (Foley *et al*., 2009; Gerner-Smidt *et al*., 2006).

Approximately 36 % TMs and 25 % TTs showed Gram negative bacteria. The CFU of fungal count was recorded in the range of 4 – 28 colonies $mL^{-1}$ among all brands. The lowest fungal CFU count recorded in TM2 where as highest was found in TM11.

### Conclusion

Briefly it can be concluded that all processed milk and tea whiteners have imbalance in concentrations of electrolytes (Na & K) whereas, bacteria in the range $68X10^4$ - $322X10^4$ CFU's $mL^{-1}$ and fungi in the range 4 – 28 CFU's $mL^{-1}$.

Table 1. Mean concentration (mg/L ± SE) of electrolytes in processed milk samples and milk analogue samples. (n = 5)

| Serial no. | Company code | Na mg $L^{-1}$ | K mg $L^{-1}$ |
|---|---|---|---|
| 1 | TM1 | 377.870 ± 0.003 | 390.246 ± 1.208 |
| 2 | TM2 | 335.934 ± 0.012 | 338.840 ± 1.040 |
| 3 | TM3 | 358.516 ± 0.140 | 336.588 ± 0.009 |
| 4 | TM4 | 413.354 ± 1.202 | 418.390 ± 1.002 |
| 5 | TM5 | 395.612 ± 0.171 | 393.624 ± 1.840 |
| 6 | TM6 | 375.621 ± 1.60 | 411.235 ± 0.008 |
| 7 | TM7 | 284.204 ± 0.005 | 399.113 ± 1.078 |
| 8 | TM10 | 363.354 ± 2.000 | 381.616 ± 1.605 |
| 9 | TM8 | 327.870 ± 1.004 | 335.462 ± 0.324 |
| 10 | TM9 | 289.16 ± 1.342 | 290.066 ± 0.003 |
| 11 | TM11 | 294.000 ± 1.450 | 330.584 ± 0.007 |
| 12 | TT1 | 261.278 ± 0.006 | 186.153 ± 1.610 |
| 13 | TT2 | 255.290 ± 0.063 | 173.362 ± 1.342 |
| 14 | TT3 | 284.322 ± 0.001 | 250.284 ± 0.229 |
| 15 | TT4 | 290.774 ± 0.008 | 252.160 ± 1.009 |
| | Reference* | 55 – 67 | 115 |

Reference*: Imran *et al*. (2008).

Table 2. Mean CFU/mL of bacterial and fungal colonies in processed milk samples and tea whitener samples.

| Brand code | Bacterial count $X10^4$ CFU's m $L^{-1}$ | Gram stain | Fungal count CFU's m $L^{-1}$ |
|---|---|---|---|
| TM1 | 322 | Negative | 09 |
| TM2 | 126 | Positive | 04 |
| TM3 | 96 | Positive | 11 |
| TM4 | 74 | Positive | 08 |
| TM5 | 68 | Negative | 09 |
| TM6 | 128 | Positive | 12 |
| TM7 | 152 | Positive | 16 |
| TM8 | 110 | Negative | 22 |
| TM9 | 186 | Positive | 20 |
| TM10 | 159 | Positive | 15 |
| TM11 | 274 | Negative | 28 |
| TT1 | 100 | Positive | 07 |
| TT2 | 78 | Positive | 16 |
| TT3 | 173 | Positive | 08 |
| TT4 | 212 | Negative | 18 |

**REFERANCES**

AAP, (American Academy of Pediatrics) (2004). *Pediatric Nutrition Handbook.* 5th ed. Elk Grove Village, IL: American Academy of Pediatrics.

CAST, (Council for Agriculture Science and Technology) (2003). Mycotoxins: Risks in plants, animals and human. Task Force Report No. 139. Ames, Lowa, USA.

Cromie, S.J. (1991). Microbiological aspects of extended shelf life products. *Aust. J. Dairy Technol*. 46(2): 101-4.

Foley, S.L., A.M. Lynne and R. Nayak (2009). Molecular typing methodologies for microbial source tracking and epidemiological investigations of Gram-negative bacterial food borne pathogen. *Infection, Genetics and Evolution*, 9: 430-440.

Gerner-Smidt, P., K. Hise, J. Kincaid, S. Hunter, S. Rolando, E. Hyytia-Trees, E.M. Ribot, B. Swaminathan and P. Taskforce (2006). PulseNet USA: afive-year update. Food borne Pathogens and Disease 3: 9-19.

Gropper, S.S., J.L. Smith and J.L. Groff (2005). *Advanced Nutrition and Human Metabolism*. Thomson Wadsworth, 4th ed. Chapter 12, 491, 436, 446 p.

Hui, Y.H. (1992). *Encyclopedia of food science and technology.* John Wiley & Sons Inc. USA. 3: 1798-1799.

IDF, (International Dairy Federation) (1986). Monograph on Pasteurized Milk. Bulletin Number 200.

Imran, M., H. Khan, S.S. Hassan and R. Khan (2008). Physico-chemical characteristics of various milk samples available in Pakistan. *J. Zhejiang Univ. Sci. B.* 9: 546–551.

Klaasen, C,D, (2001), Sasarett and Doill's Toxicology the Basic Science of Poisons. 6th ed. Mc Graw Hill, Medical Publishing Division, USA.

Mahmood, F., S.B. Niazi, A. Raza, and M.Y. Khokhar (2004). Physico-analytical Studies on Commercial Milk Samples. *Journal of Chemical Society of Pakistan.* 26(3): 212-216.

Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell (2000). Harper's Biochemistry. 25th Ed. Mc Graw Hill, Health Profession Division, USA.

Oyarzabal, O.A. and S. Backert (2012). *Food Science Text Series: Microbial Food Safety an Introduction.* Springer Science+Business Media, 40, 191, 195 pp.

Perween, R., M. Mumtaz, Q. Haque and T. Mehmood (2011). Nutritional Values In Aspects Of Essential And Non Essential Elements In Variety Of Milk Samples By AAS And FES. Analytical And Inorganic, *J.Chem.Soc.Pak.*, 33: 313-316.

Salmeron, J., F.J. Perez-Elortondo, M. Albisu and L.J.R. Barron (2002). Effect of pasteurization and seasonal variations in the microflora of ewe's milk for cheese making. *Food Microbiol.*, 19 (2–3): 167–174.

Setlow, P. (1995). Mechanism for the prevention of damage to DNA in spores of *Bacillus* species. *Annual Review of Microbiology* 49: 2-54.

Thompson, J. and M. Manore (2009). *Nutrition – An Applied Approach***,** 2nd Edition, Pearson Benjamin Cummings, New York, 258-9, 632, 643.

(*Accepted for publication November 2013*)