Comparative Study of Buffalo Milk and Cow Milk Samples Containing Reducing Sugar and Solid Not Fat

Dadasaheb Navale[1], Shelley Gupta[2]

[1]*Sinhgad Jr. College Vadgaon. Pune.*

[2]*Parvatibai Genba Moze Engineering College Wagholi. Pune.*

***Abstract*: Milk has been a good source of various nutrients including different chemicals. In this paper quality of milk and comparative study of above chemicals present in the milk was done. Various milk samples was analyzed and found that solid not fat was low as compared to reducing sugar in the milk. Buffalo milk sample gave higher result as compeered to Cow milk sample. All these results compared to its World Health Origin value, reducing sugar and solid not fat were negligible.**

***Keywords*: Spectrophotometer, Polarimeter, preparation of solutions, End point, Nutrition, Fats, Milk products and different types of Cow and Buffalo milk samples etc.**

I. INTRODUCTION

Milk is important part of human life. It contains minerals those play a vital role in milk uses human consumption. Since milk is generally viewed as nutritious food with lots of vitamins, minerals and fats, proteins etc thus used for drinking. It contains minerals those play prophylactic role in cancer, autoimmune diseases, heart diseases etc .Minerals play a vital role in milk used for human consumption. Since milk is generally viewed as nutritious food with lots of vitamins, minerals, fats, proteins etc thus used for drinking purpose. There are different sources of milk samples available, however sufficient information regarding their mineral present, especially protein, fat etc. Milk is processed into a variety of dairy products such as cream, butter, yogurt, kefir, ice cream, and cheese. Modern industrial processes use milk to produce casein, whey protein, lactose, condensed milk, powdered milk, and many other food-additives and industrial products. Comparative study between the different types of milk is not available much so present study was carried out to compare the Buffalo milk and Cow milk samples containing reducing sugar, solid not fat and to check the quality of milk.

II. MATERIALS AND METHODS

For this Buffalo and Cow milk samples were used (each type four samples).All these samples were collected from Anandnagar, Dhyari, Hadapsar, Katraj around Pune in Maharashtra. The samples were kept refrigerated at 4°C and transported to the laboratory within 24 hours, prior to refrigeration. All the milk samples were stored at -20°C until analysis.

1. Determination of Reducing Sugar in the Milk

A. Determination of Cane Sugar in the Milk:

Procedure:

Take 1 ml of milk in a test tube. Add 1 ml of Resorcinol Solution and mix. Place the tube in boiling water bath for 5 min. Withdraw the tube and observe the colour. Appearance of deep red colour indicates presence of sucrose, or a ketose sugar. In pure milk samples no such red color is developed and sample remains white in nature. The limit of detection of method is 0.1%.

B. Determination of Lactose in the Milk:

Procedure:

Take two graduated flasks, one of 100 ml and the other of 200 ml capacity. Weigh accurately 65·8 g of the prepared sample into each flask. Add to each flask 20 ml of acid mercuric nitrate solution or 30 ml of mercuric iodide solution. To the 1oo ml flask, add phosphotungstic acid solution to the mark, and to the 200 ml, flask, add 15 ml of phosphotungstic acid solution and dilute to the mark with water. Shake both the flasks frequently during 15 minutes, filter through dry filter paper, and polarize. (It is preferable to read solution from 200 ml flask in 400 mm tube to reduce error of reading. Solution from the 100 ml flask may be read in 200 mm tube.)

Calculation:

Calculate percentage of lactose in the sample as follows,

a) Subtract reading of solution from the 200 ml flask (using 400 mm tube) from reading of solution from the 100 ml flask (using 200 mm tube).
b) Multiply difference by 2.
c) Subtract result from reading of solution from the l00 ml flask; and

d) Divide result by 2.

C. Determination of Sucrose in the Milk:

Procedure:

Place the filtrate from lactose determination in a 250-ml flask, add 34 ml of hydrochloric acid and place the flask immediately in a vigorously boiling water-bath.(The contents shall be at such a temperature as will show a temperature of 21 ° ± 2°C after the addition of acid.) Leave in the bath for exactly 5 minutes, remove and cool rapidly to room temperature. Neutralize with sodium hydroxide solution. taking care not to have either a local or a general excess of alkali in the warm solution lest some of the sugar be destroyed. Cool to room temperature, make up to the mark, shake well and determine the reducing sugar by the Munson and Walker gravimetric method using a.5o-ml aliquot Filter through a tared Gooch filter, wash four or five times with hot water and once with alcohol and dry for 30 minutes at 98 to 100°C.Weigh the dry precipitate of cuprousoxide.

Calculation:

Sucrose, percent by weight=M/5
Where,
M=number of mg of sucrose equivalent to cuprous oxide precipitate.

D. Determination of Added Glucose in the Milk:

Procedure:

To 1 ml of milk sample or 1 ml of reconstituted milk powder in a test tube add equal volume of acetate buffer and filter. To 0.2 ml of filtrate add 2.8 ml water and 2 ml of modified Barford's reagent. Heat the tube in boiling water for 4 minutes. After cooling for 2 minutes add 3 ml of phosphomolybdic acid and mix the contents. Development of deep blue colour indicates the presence of glucose.

Filter the contents of the tube through Whatman No 42 filter paper. Collect the filtrate in a colorimetric tube, after discarding first 1 ml. Measure the absorbance in a photoelectric colorimeter, using red filter or determine absorption maxima in a spectrophotometer between 620-780 um against blank prepared identically from a pure milk sample. The concentration of glucose in the sample can be determined with the help of a standard curve prepared from milk samples containing known amounts of added glucose i.e., 0.5, 1.0, 2.0, 5.0 percent glucose in milk.

2. Determination of Total Solids in the Milk (Gravimetric Method)

Procedure:

Weigh accurately the clean, dry empty dish with the lid. Pipette into the dish about 5 ml of the prepared sample of milk and weigh quickly, with the lid on the dish. Place the dish, uncovered, on a boiling water bath. Keep the base of the dish horizontal to promote uni-form drying and protect it from direct contact with the metal of the water-bath. After at least30 minutes, remove the dish, wipe the bottom and transfer to a well-ventilated oven at 98 to 100°C, placing the lid by the dish.

The bulb of the oven control thermometer shall be imrnediately above the shelf carrying the dish. The dish shall not be placed near the walls of the oven, and shall be insulated from the shelf, for example, by a silica or glass triangle. The shelf used shall be near the middle of the oven. After three hours, cover the dish and immediately transfer it to a desiccator. Allow to cool for about 30 minutes and weigh. Return the dish, uncovered and the lid to the oven and heat for one hour. Remove to the desiccator, cool and weigh, as before. Repeat, jf necessary, until the loss of weight between successive weighings does not exceed 0-5mg.Note the lowest weight.

Calculation:

Total solids, percent by weight=100w/W
Where,
w=Weight in g of the residue after drying, and
W=weight in g of the prepared sample taken for the test.

III. OBSERVATION TABLE

Sample Description	B_1	B_2	B_3	B_4	C_1	C_2	C_3	C_4
Reducing Sugar %	5.20	5.15	5.30	5.25	4.90	4.80	4.95	4.85
Solid not Fat %	10.19	10.70	11.28	10.19	7.86	7.67	7.60	7.61

NOTE:

1) Buffalo milk samples-B_1, B_2, B_3, B_4 and Cow milk samples-C_1, C_2, C_3, and C_4.
2) Chemical Analysis was done per 100 gm.
3) Reducing sugar and solid not fat were negligible.

IV. RESULTS AND DISCUSSION

Present study found that the milk samples had low average fat , SNF and TS as compared to standards of FSSA .Similar results were found in study conducted in Pakistan by Javaid et al where the milk samples collected from milk vendors had average fat content of 5.20%, SNF of 8.25% and TS of 13.45%.

Study conducted by the Food Safety and Standards Authority of India (2011) throughout the country on 1791 milk samples found that the total non-conforming samples to the FSSA standards were 1226 (68.4%)

A study conducted by Menon in Hyderabad city of Pakistan also found that chemical quality of milk samples were inferior

and did not even meet the minimum legal requirement All the samples from the canteens of different hospitals were found skimmed and adulterated with water. Similar results were also found in studies conducted in Izmir (Turkey) ,Tirupati (India),Faisalabad (Pakistan).

The reason for this could be due to the fact that milk vendors want to maximize their profit and moreover, even if caught, there are no stringent provisions under the current legislation, which further motivate them to do so. According to FSSA, 2006 and its rule 2011, any person who sells to the purchaser's prejudice any food which is not in compliance with the provisions of this Act or the regulations shall be liable for punishment of six months and fine.

The total number of samples examined under FSSA,2006 in India from 2006-2008 were 325500 out of which only 11% were found to be adulterated or misbranded, out of which, only 13.6% were convicted.

This shows the lax implementation of rules of the Act and vendors take advantage of that to maximize their margins. Dairy: All fluid milk products are considered part of this food group. Foods made from milk also are part of this group if they retain their calcium content. Foods made from milk that have little to no calcium, such as cream cheese, cream, and butter, are not. Calcium-fortified soymilk (soy beverage) is also part of the dairy group. Fat-free or low-fat milk Cheese Yogurt Calcium-fortified soy beverages Whole and flavored milk Sweetened yogurts.

The availability of plant foods, such as potatoes, root vegetables and cereals, decreased in response to policy initiatives after the Second World War. Data from FAO during the period 1950ñ1989 illustrate a 25% decrease on average in the availability of potatoes, root vegetables and cereals, and a 50% increase in the production of meat and meat products and milk and dairy products (Fig. 2). In 1991 the average quantity of meat and meat products was 225 g per person per day, ranging from around 50 g in Albania to over 250 g in Germany and Denmark.

The CINDI pyramid assists in the selection of the food groups required for healthy nutrition. It makes use of the colour scheme of traffic lights: green for proceeding, orange for caution and red for stopping to consider before consuming. The CINDI pyramid appears on the cover of this document, and posters are available on request from the WHO Regional Office for Europe. The poster also shows four active individual figures. Annex 1 provides some principles to aid the development of pictorial food models such as the pyramid.

The CINDI pyramid helps to illustrate both the variety and the proportions of foods needed for a healthy diet. The more physically active a person is, the more servings are needed. Food energy was traditionally measured in calories, or kilocalories (kcal), but now the metric form, the joule, is almost universally used (1 kcal = 4.2 kJ). Adults normally require around 6500ñ14 000 kJ per day, depending on gender, age, body size and level of physical activity. WHO recommends that more than half the daily energy should come from a mixture of foods from the two green layers at the base of the pyramid, the lower of which includes bread, grains, pasta, rice and potatoes? This means that, in a diet comprising 6000 kJ, at least half of total energy (3000 kJ) should come from this group.

From the upper green layer, WHO recommends the intake of at least 400 g of vegetables (in addition to potatoes), and fruit per day which translates into around 5ñ6 portions daily. One portion is equivalent to one fruit, such as an apple or pear, or one serving of vegetables, around 80 g in weight.

Eat bread, grains, pasta, rice or potatoes several times per day. Bread, grains, pasta, rice or potatoes should form the foundation of all meals, as shown in the base of the food pyramid. WHO recommends that more than half of daily energy come from this food group because it is low in fat and rich in both nutrients and non-nutrients. The nutritional benefits of these foods, especially their role in disease prevention, should be publicized.

Unfortunately, many people mistakenly believe that bread and potatoes are more fattening than other foods. The energy content of starch is actually much lower than that of either fat or alcohol. Starch provides only 16 kJ energy per gram; the corresponding figures for fat and alcohol are 38 kJ and 29 kJ respectively. An energy-dense diet (one containing a lot of fat, refined sugar and alcohol, combined with few micronutrients and non-nutrients) promotes overconsumption of food, leading eventually to obesity, possibly combined with nutrient deficiencies. As do grains and potatoes, all types of bread contain different types of dietary fibre (especially whole grain varieties, but even white bread contributes significant amounts of fibre, particularly a fibre-related substance called resistant starch). In addition, different fibre types are present in legumes, beans, vegetables and fruit. Eating a variety of fibre-containing foods is important for preventing constipation, diverticular disease and haemorrhoids.

Council recommendations) appears to have no effect on protein content of milk. However, feeding extra energy to high producing cows may increase the SNF by about 0.2 percentage units. For example, when four increasing levels of concentrate (0, 2, 4, 6#/gal milk) were fed, SNF increased from 8.3 to 8.6%. Also, reducing the energy-fed to high-producing cows below requirements may decrease SNF as much as 0.2 - 0.5 percentage units. Response to pasture exposure depends upon the feeding status prior to turnout. If cows are receiving 100% or less of their energy recommendation prior to turnout, an increase in SNF can occur; however; if cows are on full feed or are receiving 130% of energy recommendations, a decrease in SNF will usually be observed upon exposure to pasture.

Use milk and dairy products (kefir, sour milk, yoghurt and cheese) that are low in both fat and salt. Only moderate amounts of food should be selected from the milk and dairy

products group (illustrated in the left side of the orange layer of the food pyramid) on a regular basis. Different types of cream and sour cream can be safely avoided, since these contain a lot of saturated fat and very little protein or other essential micronutrients. In some countries people add soured cream (smetana) to vegetables and other cooked dishes. This habit should be discouraged, and low-fat yoghurt or other low-fat products substituted.

Most other milk and dairy products provide many different nutrients, especially protein and calcium. Women, children and adolescents, especially girls, need to eat foods that contain a lot of calcium. Calcium is needed to ensure the development of healthy teeth and bones, and plays an important role in cell metabolism. Calcium recommendations vary widely from country to country, from around 500 mg to 1000 mg, or more, per day for adults. Given this wide variation, larger amounts of calcium-rich foods are needed to satisfy the high recommendations in some countries.

The current scientific consensus is that the evidence seems insufficient to support the need for very high intake levels of calcium, so most countries recommend an intake of around 700 mg per day for most adults, with possibly higher levels for groups with increased requirements Fortunately, most people can obtain enough calcium, while still maintaining a low fat intake, by selecting the recommended low-fat or skimmed milk and low-fat dairy products in moderate amounts. The calcium is present in the main body of the milk, not in the cream or fat that is removed. People who do not eat foods from this group should try to get their calcium from other foods; canned fish, such as sardines, anchovies and salmon, contain small bones that contribute calcium to the diet. Dark green leafy vegetables and cereals, whole-grain or fortified, also provide a small amount of calcium.

The salt content of dairy products such as cheese may be high, so low-salt varieties should be encouraged where possible. The producer should state the amount of salt in a food product on its label. In addition, salt should be iodized, especially in areas where iodine deficiency is endemic; where animal fodder for cows contains iodine, this will automatically be transferred to the population via milk and dairy products.

REFERENCES

[1]. Adams, I. K. (2011). What is Nutrient Density? Families, Food and Fitness Home. http://www.extension.org/pages/55447/what-is-nutrient-density.Academy of Nutrition and Dietetics. Practice paper of the American Dietetic Association: Nutrient density: Meeting nutrient goals within calorie needs. Journal of the American Dietetic Association. Academy of Nutrition and Dietetics. What is Nutrient Density? Accessed January 31, 2012 from http://www.eatright.org/Public/content.aspx?id=6442464242. Centers for Disease Control and Prevention. Healthy Weight – It's not a Diet, It's a Lifestyle! Rethink Your Drink. Accessed January 31, 2012 from http://www.cdc.gov/healthyweight/healthy_eating/drinks.html.

[2]. USDA Food Composition. Nu-trient Data Laboratory. Accessed January 31, 2011 from http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=1&tax_subject=279. Carbohydrates in human nutrition: report of a Joint FAO/WHO Expert Consultation, Rome, 14ñ18 April 1997. Rome, Food and Nutrition Organization of the United Nations, 1998 (FAO Food and Nutrition Paper 66).

[3]. CINDI nutrition action plan. Copenhagen, WHO Regional Office for Europe, 1998 (draft document). Comparative analysis of implementation of the Innocenti Declaration. Copenhagen, WHO Regional Office for Europe, 1998 (document EUR/ICP/LVNG 01 01 02). Comparative analysis of nutrition policies in the WHO European Region. Copenhagen, WHO Regional Office for Europe, 1998 (document EUR/ICP/LVNG 01 02 01). Contaminated soil in gardens: how to avoid the harmful effects. Copenhagen, WHO Regional Office for Europe, 1999 (document EUR/ICP/LVNG 03 01 02(A)).

[4]. Craig, W.J. Phytochemicals: guardians of our health. Journal of the American Dietetic Association, 10(Suppl. 2): S199ñS204 (1997).

[5]. Delange, F. et al., ed. Elimination of iodine deficiency disorders (IDD) in central and eastern Europe, the Commonwealth of Independent States, and the Baltic states: Proceedings of a conference held in Munich, Germany, 3–6 September 1997.

[6]. Geneva, World Health Organization, 1998 (document WHO/EURO/NUT/98.1). Department of Health. Nutritional aspects of the development of cancer: report of the Working Group on Diet and Cancer of the Committee on Medical Aspects of Food and Nutrition Policy. London, The Stationery Office, 1998 (Report on Health and Social Subjects 48). Diet, nutrition, and the prevention of chronic diseases: report of a WHO Study Group. Geneva, World Health Organization, 1990 (WHO Technical Report Series, No. 797).

[7]. Prevention in primary care: recommendations for good practice. Copenhagen, WHO Regional Office for Europe, 1994 (document EUR/ICP/CIND 94 01/PB01). Eight guidelines for a healthy diet. A guide for nutrition educators. London, Health Education Authority, 1994. Energy and protein requirements: report of a Joint FAO/WHO/UNU Expert Consultation. Geneva, World Health Organization, 1985 (WHO Technical Report Series, No. 724).

[8]. Fats and oils in human nutrition: report of a joint expert consultation. Rome, Food and Nutrition Organization of the United Nations, 1994 (FAO Food and Nutrition Paper 57). Food, nutrition, and the prevention of cancer: a global perspective. Washington, DC, American Institute for Cancer Research, 1997.

[9]. Heinig, J.M. & Dewey, K.G. Health effects of breastfeeding for mothers: a critical review. Nutrition research reviews, 10: 35ñ56 (1997).

[10]. James, W.P.T. et al. Healthy nutrition: preventing nutrition-related disease in Europe. Copenhagen, WHO Regional Office for Europe, 1988 (WHO Regional Publications, European Series, No. 24).

[11]. John, T. & Romeo, J.T., ed. Functionality of food phytochemicals. New York, Plenum Press, 1997. (Recent Advances in Phytochemistry, Vol. 31).

[12]. Shah, S. K. and S. A. Khan. Factors influencing the protein level in milk.Progressive Farming.1982; 2(6): 10-13.

[13]. Indian dairy industry seen at Rs. 5 lakh cr. Indian Express [Internet] 2011, Nov 18.Acessed from http://www.indianexpress.com/news/on Feb 5, 2012.

[14]. Aneja RP. Processing and distribution of buffalo milk. Proc. XXIII Int. Dairy Cong. held in October 8-12, 1990 in Montreal, Canada. 1: 383-396.

[15]. Milk adulteration: HC issues notices to Maha govt, Centre. Food safety news. 2012 Jan 11.Acessed from http://www.foodsafetynews.com/on Feb 6, 2012.

[16]. AOAC, 1997. Official Methods of Analysis. Association of Official Analytical Chemists, Washington DC, USA.

[17]. James C S. 1995. Determination of the fat content of dairy products by the Gerber Method. Analytical. Chemistry of Food. Blackie Academic and Professionals, an imprint of Chapman and Hall, Glasgow, UK, pp: 93–95.

[18]. Harding F. Milk quality. Blackie Academic and Professionals, an imprint of Chapman and Hall, Glasgow, UK.1995:157-158.
[19]. Javaid SB, Gadahi JA, Khaskeli M, Bhutto MB, Kumbher S, Panhwar AH. Physical and chemical quality of market milk sold at healthline pISSN 2239-337X / eISSN 2320-1525 Volume 5 Issue 1: January - June 2014 PageTandojam, Pakistan. Pakistan Vet. J. 2009; 29(1): 27-31
[20]. Executive Summary on National Survey on Milk Adulteration. Accessed from www.fssai.gov.in/Portals/0/Pdf/sample_analysed.pdf on10 May, 2012.
[21]. Memon AM., 2000. Physico-chemical and hygienic quality of milk supplied to the canteens of various hospitals in Hyderabad city. MSc Thesis, Sindh Agri. Univ, Tandojam, Pakistan.
[22]. Kesenkas H , Akbulut N , Determination of milk quality produced from middle and large scale dairy farms and informal/street milk quality sold in Izmir J of Ege University Faculty of Agriculture .2010; 47(2): 161-169.
[23]. Sreedhar S., Suresh Babu D. Milk Constituents and Microbial Analysis of Mixed Milk Samples in Rural Areas. Ind J of Vet Research.2009; 18(2):31-36.
[24]. Lateef M, Faraz A, Mustafa MI, P. Akthar P , Bashir MK 2009. Detection of adulterants and chemical composition of milk supplied to canteens of various hospitals in Faisalabad city. Pak J Zool.2009;9: 139-142.
[25]. The Food Safety and Standards Act, 2006 –Accessed from www.drugscontrol.org/ on 19 May, 2012.
[26]. Neumann, C., Harris, D.M. & Rogers, L.M. 2002.
[27]. Contribution of animal source foods in improving diet quality and function in children in the developing world. Nutr. Res.,22: 193–220.
[28]. Neumann, C.G., Bwibo, N.O., Murphy, S.P., Sigman, M., Whaley, S., Allen, L.H., Guthrie, D., Weiss, R.E. & Demment M. 2003.
[29]. Animal source foods improve dietary quality, micronutrient status, growth and cognitive function in Kenyan school children: Background, study design and baseline findings. J. Nutr.,133: 3941S–3949S.
[30]. Nyabila, M. 2010. Unlocking value of smallholder dairy through Hub Model – case of Kenya. Presentation. Available at: http://cgspace.cgiar.org/handle/10568/3004.Accessed 25 October 2012.OECD & FAO.2008.
[31]. The OECD-FAO agricultural outlook 2008–2017[online]. Available at: http://www.oecd.org/trade/agricultural-trade/40715381.pdf. Accessed 24 October 2012.Parker, J. 2011.
[32]. Doing more with less. The Economist, 24 February 2011. Available at: http://www.economist.com/node/18200606. Accessed 25 October 2012.Peacock, C. 2008.
[33]. Dairy goat development in East Africa: a replicable model for Smallholders? Small Ruminant Res., 77(2–3): 225–238.Peduzzi, C.S.1990.
[34]. Home and community gardens assessment: program implementation experience: The tip of the iceberg.VITAL Report No. TA-2. Arlington, VA, USA, Vitamin
[35]. A Field Support Project (VITAL). 45 pp.Pradel, W., Yanggen, D. & Polastri, N. 2006. Trade offs between economic returns and methane greenhouse gas emissions in dairy production systems in Cajamarca, Peru. Livest. Res. Rural Dev.18(3), article #41. Available at: http://www.lrrd.org/ lrrd18/3/prad18041.htm. Accessed 25 October 2012.Rahman,F.H.1995
[36]. The status of rural women in China.Washington, DC, International Food Policy Research Institute. UN.2011.
[37]. World population prospects, the 2010 revision[online]. United Nations, Department of Economics and Social Affairs. Available at: http://esa.un.org/wpp/ index.htm. Accessed 22 November 2012.UNICEF. 1990.
[38]. Strategy for improved nutrition of children and women in developing countries. Policy Review Paper E/ICEF/1990/1.6. New York, USA.UNICEF. 1998.
[39]. The state of the world's children. Oxford, UK, Oxford University Press.Walingo, M. 2006. The role of education in agricultural projects for food security and poverty reduction in Kenya. Int. Rev. Educ. 52(3/4): 287–304.
[40]. Walshe, M.J., Grindle, J., Nell, A. & Bachmann, M. 1991.
[41]. Dairy development in subSaharan Africa: a study of the issues and options. Technical paper 135. Washington, DC, World Bank.WeD. 2007.
[42]. Research statement[online]. Economic and Social Research Council Research Group on Well-being in Developing Countries (WeD). Available at: http://www.welldev.org.uk/research/aims.htm.Accessed 23 October 2012.WHO. 2003.
[43]. Diet, nutrition and prevention of chronic disease.Report of a joint FAO and WHO Expert Consultation, Geneva, 2002.
[44]. WHO Technical Report Series 916. Geneva, World Health Organization.World Bank. 2003.
[45]. World development indicators Washington, DC, World Bank.World Bank. 2005a.
[46]. Agricultural investment sourcebook. Washington, DC, World Bank.World Bank. 2005b.
[47]. Afghanistan: national reconstruction and poverty reduction. The role of women in Afghanistan's future. Washington, DC, World Bank.World Bank. 2007a.
[48]. World development report 2008. Agriculture for development. Washington, DC, World Bank.World Bank.2007b.