Original Article

International Journal of Forensic Science
Volume 2 Number 2, July - December 2019

Proximate Composition and Rampantly Adulteration in Local Milk Samples Collected from Various Part of Kanpur Nagar

Anuradha Tiwari[1], Neelam Pal[2], Nand Lal[3], Kiran Singh[4]

How to cite this article:

Anuradha Tiwari, Neelam Pal, Nand Lal et al. Proximate Composition and Rampantly Adulteration in Local Milk Samples Collected from Various Part of Kanpur Nagar. International Journal of Forensic Science. 2019;2(2):41-45.

Abstract

Milk plays an important role in a diet of children, younger and old people due to its high nutrient and mineral content. In this study different milk samples were collected from different area of Kanpur and analyzed. Proximate composition of different samples was determined by using 1S-166 (Indian Standard specification of milk). In these samples fat content- 2.8–6.1%, protein content- 3.0–6.1% the total solid content ranged between 10.8–14.75% and ash content 0.61–0.71% were observed. Due to liquid food milk is adulterated easily as neutralizer, fertilizers/additives, thickening agent, preservative were analyzed in all samples.

Keywords: Ash; Fat; Proteins; milk samples.

Introduction

Milk and variety of dairy products are known worldwide. It is a best diet containing all types of nutrition. It provides fat, protein and vitamins. Milk can provide wide range of nutrients to maintain health and normal growth of body. Milk and milk products are important components in human food; since milk is one of the basic primary sources of nutrients in diets for growing childrens.[1] Milk is excellent sources of Calcium, Vitamin D, Riboflavin, phosphorus, good source of Protein, Potassium, Vitamin A, and Vitamin B12.[2] Constitutes of Milk made up of 86.4% water, 11.2% milk solid and 3.0% fat. The milk solid not fat contain Protein (3.4%), Lactose (4.8%), and minerals (0.7%).[3] India is the largest producer of milk in world but majority of milk is marketed through unorganized channel.[4] Consumer is the largest economic group and central point of all marketing activities. With the rise in the income of people, the quality, the quantity and the sophistication of the consumer goods has also increased.[5] Milk products are very important components of the diets. The high nutritional value of milk has led to its high consumption worldwide, but increased demand has also made it prone to fraudulent activity.[6] Adulteration is rampant in India and its main intention to earn huge profits and the main driver of this phenomenon is the absence of vigilance by food safety authorities.[7] Various type of adulteration in milk are found, sometimes synthetic milk is supplied in market in replacement of pure milk.[8] Because of high demand and less productivity milk is easily adulterate. Water is use to increase a volume of milk which serve malnutrition especially in children. Neutralizers like lime water, sodium bicarbonate, sodium carbonate, sodium hydroxide are added to

Author's Affiliation: [1,2,4]Assistant Professor, [3]Associate Professor, Department of Chemistry,Vikramajit Singh Sanatan Dharma College, Nawabganj, Kanpur, Uttar Pradesh 208002, India.

Correspondence and Reprint Requests: Nand Lal, Associate Professor, Department of Chemistry Vikramajit Singh Sanatan Dharma College, Nawabganj, Kanpur, Uttar Pradesh 208002, India.

E-mail: drnandlal71@rediffmail.com

Recevied on 23.11.2019, **Accpeted on** 26.12.2019

developed acidity are effect vomiting severe cases can cause burns on the lips, tongue, and harms the mucosa of the esophagus.[9] Fertilizer (additive) urea, ammonium sulphate, potassium nitrate salt are used to increase the protein content create toxic poisonings in kidney stones, hypertension, acute renal failure, bladder cancer and severe cases have led to death.[10] Preservatives boric acid, borates, formaldehyde, benzoic acid, salicylic acid, etc. reduced electricity costs by extending the shelf-life of milk so it can be preserved for a very long time at room temperature responsible for vomiting, diarrhea, decreased body temperature, dermatitis, mood and balance alterations, abdominal pain, liver and kidney damages.[11] Thickening agent starch, cane sugar, gelatin, cellulose are increased profits by increasing the lactometer reading to mask adulteration with water, Can pose a risk for diabetics, patients who might be consuming excess sugar will raise their blood sugar levels.[12] Skimmed milk powder-increased profits by increasing the total solids-nonfat content of diluted milk While the protein and lactose content is similar to whole milk, skim milk contains low levels of fat and fat soluble vitamins, which might impair growth and development in childrens.[13] Detergent Increased profits by adding to diluted milk to enhance cosmetic nature. Its effect accidental contamination through low maintenance of milk tanks. Gastro-intestinal complications that is abdominal pain and vomiting, hypotension, respiratory irritation, cancers gastroenteritis responsible for many kidney disease. Limited information is available on detergent and sanitizer toxicology which occurrence in food, therefore proper safety assessments are difficult.[14] Ammonia in milk develops regression loss of acquired speech and sensory disturbance.[15] Chloride in milk disturbs the acid base balance in the body and also blood pH.[16] The H_2O_2 disturb the antioxidants in body disturbing the natural immunity hence increasing aging.[17,19] Carbonate in milk produce gastrointestinal problems including gastric, ulcer, diarrhea, and colon ulcer and electrolytes disturbance.[18,20] This work is aimed to carrying out a comparative study of proximate composition of different milk samples, and also the level of adulteration to aware the people about its nutrition and harmful effect in human body.[21]

Materials and Methods

Samples were collected in clean, dry and sterilized glass bottles. The milk samples were tested for the following adulterants such as formalin, urea, starch, neutralizers, detergents, sodium chloride, skim milk powder, sucrose, glucose/dextrose, hydrogen peroxide.[22]

This study was carried out in "Analytical research laboratory" in V.S.S.D College, Kanpur, U.P, India. The samples were collected from different area of Kanpur (X1, X2, X3, X4, X5, X6, X7-Rawatpur, Civil Lines, Ashok Nagar, Barra II, Ratanlal Nagar, Panki, and P. Road). The samples were packed in the cleaned plastic containers and quickly transported and stored in ice cold packed.

Analysis

Proximate parameter moisture, fat, protein, ash were determined using AOAC (2000).

Fat: Fat was determined by acid digestion method (Werner schmith method). In this method milk protein is digest with concentrated HCl. Librated fat was extracted with alcohol, ethyl ether and petroleum ether. Ether is evaporated and residue left behind is weighted to calculate the fat content.

Fat: % $w/w = 100 (w_1-w_2)/w_3$

w_1 = weight in gram of metal dish before removal of fat

w_2 = weight in gram of metal dish after removal of fat

w_3 = weight in gram of material taken for test.

Protein: This protein have important role for building block of bones, muscles cartilage, skin and blood. Protein is determined by kjeldahl method.

Total solid: Total solid determined by gravimetric method. The calculation of total solid content is calculated by following formula.

M2 - M0 / M1- M0 * 100

M0- Mass in g of dish+ lid

M1- Mass in g of dish+ lid and portion

M2- Mass in g of dish+ lid and dried test portion

For the above formula total solid content is determine in all milk samples.

Ash: Ash content was determine by gravimetric methods, using Muffle Furance. ash content in milk replacer has recently become a subject of much discussion. Ash is fixed for the formula depending on the ash content of the various ingredients.

Determination of total ash calculation

Ash content (%) =Z-X/Y-X*100

Weight of empty crucible - X g

Weight of crucible + sample - Y g

After complete ash, Weight of crucible + ash - Z g

Adulteration

Preservative

- *Test for detection of hydrogen peroxide:* 5 ml milk in a test tube and then add 5 drops of paraphenylenediamine and shake it well. Change of the colour of milk white to blue confirms that the milk is added with hydrogen peroxide.
- *Test for detection of formalin Formalin:* (40%) is poisonous though it can preserve milk for a long time. 10 ml of milk in test tube and 5 ml of conc. sulphuric acid is added on the sides of the test tube without shaking. If a violet or blue ring appears at the intersection of the two layers, then it shows the presence of formalin.
- *Detection of benzoic and salicylic acid in milk:* 5 ml of milk is taken in a test tube and acidified with concentrated sulphuric acid. 0.5% ferric chloride solution is added drop by drop and mixed well. Development of buff colour indicates presence of benzoic acid and violet colour indicates salicylic acid.
- *Detection of borax and boric acid in milk:* 5 ml of milk is taken in a test tube to which 1 ml of concentrated hydrochloric acid is added and mixed well. Tip of a turmeric paper is dipped into the acidified milk and it is dried in a watch glass at 100°C or over a small flame. If the turmeric paper turns red, it indicates the presence of borax or boric acid. Confirmation can be made by adding a drop of ammonia solution on the turmeric paper and if the red colour changes to green, it shows the presence of boric acid.

Fertilizer/Additives

- *Test for detection of urea:* Urea is generally added in the preparation of synthetic milk to raise the SNF value. 5 ml of milk is mixed well with 5 ml paradimethyl amino benzaldehyde (16%). If the solution turns yellow in colour, then the given sample of milk is added with urea. 5 ml of milk in a test tube and add 0.2 ml of urease (20 mg/ml). Shake well at room temperature and then add 0.1 ml of bromothymol blue solution (0.5%). Appearance of blue colour after 10–15 min indicates the adulteration milk with urea.
- *Test for detection of ammonium sulphate:* The presence of sulphate in milk increases the lactometer reading. 5 ml of hot milk is taken in a test tube and added with a suitable acid for e.g. citric acid and the whey thus separated is filtered. Collect the whey in another test tube and add 0.5 ml of 5% barium chloride. Appearance of precipitate indicates the presence of ammonium sulphate in milk.

Neutralizer's

- *Rosalic acid test (Soda Test):* In milk neutralizers like hydrated lime, sodium hydroxide, sodium carbonate or sodium bicarbonate are added which are generally prohibited. 5 ml of milk in a test tube and add 5 ml alcohol followed by 4–5 drops of rosalic acid. If the colour of milk changes to pinkish red, then it is inferred that the milk is adulterated with sodium carbonate / sodium bicarbonate and hence unfit for human consumption. This test will be effective only if the neutralizers are present in milk.

Thickening agents

- *Test for detection of sugar in milk:* Generally sugar is mixed in the milk to increase the solids not fat content of milk i.e. to increase the lactometer reading of milk, which was already diluted with water.10 ml of milk in a test tube and add 5 ml of hydrochloric acid along with 0.1 g of resorcinol. Then shake the test tube well and place the test tube in a boiling water bath for 5 min. Appearance of red colour indicates the presence of added sugar in milk.
- *Test for detection of starch:* Addition of starch also increases the SNF content of milk. Apart from the starch, wheat flour, arrowroot, rice flour are also added. 3 ml milk in a test tube and boil it thoroughly. Then milk is cooled to room temperature and added with 2 to 3 drops of 1% iodine solution. Change of colour white to blue indicates that the milk is adulterated with starch.
- *Test for detection of glucose:* Usually poor quality glucose is added to milk to increase the lactometer reading. There are two tests available to detect the adulteration of milk with glucose.
- *Phosphomolybdic or Barford:* Test 3 ml of milk in a test tube and add 3 ml Barford's reagent and mix it thoroughly. Then keep it in a boiling water bath for 3 min and then cool it for 2 min by immersing in tap water without disturbance. Then add 1 ml of

phosphomolybdic acid and shake. If blue colour is visible, then glucose is present in the milk sample.

- *Diacetic test:* A strip of diacetic strips and dips it in the milk for 30 sec to 1 min. If the strip changes colour, then it shows that the sample of milk contains glucose. If there is no change in the colour of the strip, then glucose is absent. In this method the presence of glucose in milk can be quantified by comparing the colour developed with the chart strip.

Results and Discussion

Fat: Milk fat is easily digested, because it completely dispersed in milk and it gives 50% calories of the total calories value of the milk. Fig. 1 observe that maximum fat was obtained 5.9% in sample X7 and minimum value of fat obtained 2.5%sample no. X1 while 7.45% is standered fat contained is reported in buffalo milk.[20] Thus this is poor condition of milk in kanpur city areas regarding the fat amount and such difference in fat content is due to management practices. The unorganized milk market is responsible for this type of rampant.

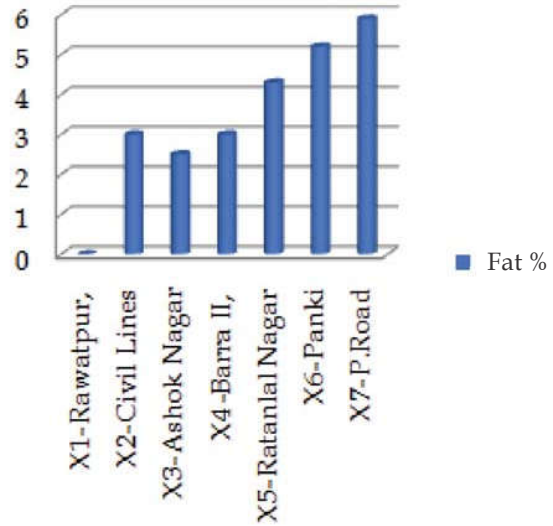

Fig: 1. Percentage of fat in different milk samples

Protein: 17th edu, 2000 official method (casein nitrogen content of milk). Proteins also used to make enzyme, hormones and other essential body chemicals. Form the observation Fig: 2. It shows that the maximum protein content was obtained 4.9% in X6 milk sample and minimum protein content was obtained 2.9% in X1 milk sample. Thus miner difference is observed in milk samples because slandered protein content is 3.4%.

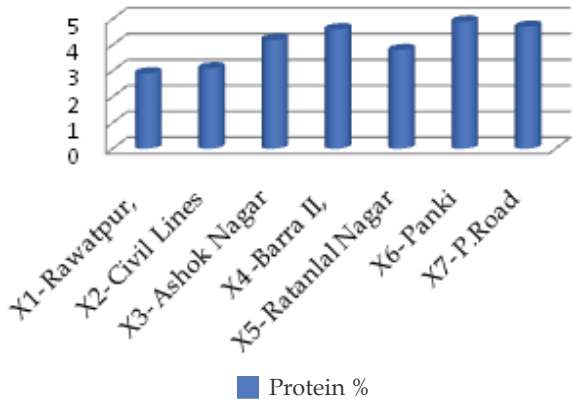

Fig: 2. Percentage of protein in different milk samples

Total Solid Content: From the observation in Fig: 3 it was found that maximum solid content present 14.1% in X4 sample and minimum 10.52% in X2 sample. While the standard value of total solid is 12.6%. Thus the amount of total solid content observed in milk samples similar to the reported value of solid present in milk. Total solid content is determine in all milk samples x1-2.9%, x2-3.1%, x3- 4.2%, x4-4.6%, x5-3.8% , x6-4.9% , x7-4.7%.

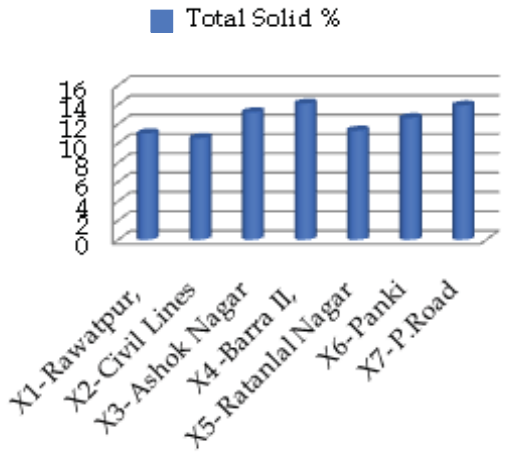

Fig. 3. Percentage of Total Solid Content in different milk samples

Ash: From the observation in Fig: 4 it was found that maximum ash content present 0.7% in X5 sample and minimum 0.58% in X1 sample. Thus this is poor condition of milk in kanpur city areas regarding the ash content and such difference in ash content is due to management practices.

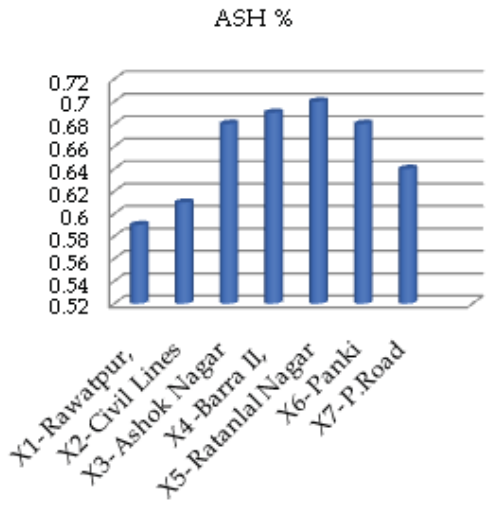

Fig. 4: Percentage of Ash Content in different milk samples

Proximate composition (fat, protein, total solid, ash) are compared by the Fig. 5.[20]

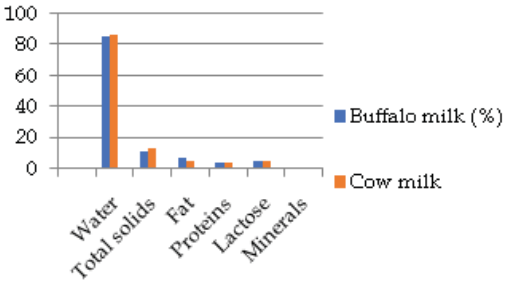

Fig. 5: Reported Value of Buffalo And Cow Milk[20]

The percentage of adulterants present in different samples collected in different area of Kanpur showed in Fig. 6

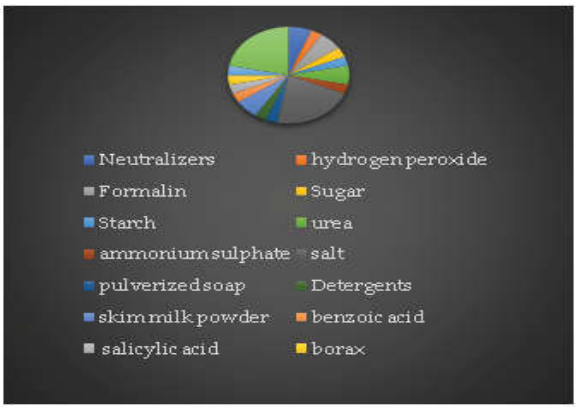

Fig. 6: Different types of Adulterants present in different samples

Conclusion

The analytical study showed that the poor condition of all milk samples collected from different area of Kanpur city. All milk samples were free from different adulterarent i.e hydrogen peroxide, ammonium sulphate, soap, benzoic acid, salicylic acid and borax. There is formalin, starch, sugar, detergent, urea, salt, skim milk powder etc are present in collected samples. The prevention of adulteration and contamination of milk is a matter of vital importance from both an economic and hygienic standpoint. Children, who are so largely dependent upon milk, do not well tolerate its adulteration, and milk is so much used as a raw food perhaps more than any other one article of diet. That its careful inspection in regard to contamination by disease germs or adulterants is imperative, and the continuous vigilance of the health authorities of large cities is required to protect the public from imposition.

References

1. Keria CS and Mao FD. Journal of AOAC International, 2004;87(1):151–56.
2. Dictary guidelines for Americans, us department of agriculture 2005; 6th ed.
3. Chandan R. 1997 Diary Based Ingredients St. Paul, Muimm, Eagan press.
4. HUW and MR murphy. A Meta-Analysis. J. of Dairy SA 2004;87:2222–29.
5. Clare Da, Llatigamani G and Swais He. Good Current Pharmaceutical Design, BanthamSci publishers. 2003;9(16):1239–55.
6. CE Handford, K Campbel. Wiley online library Food Science and Food Safety. 2016;15(1):130–42.
7. Prema Chandra Athukorala, Sisra Jayasuriya, world economy 2003;26(9):1395–1416.
8. Anwar Sadat, Pervez Mustajab, Iqbal A Khan, journal of food engineering 2006;77(3):472–77.
9. Ahiwar RK, Harilal PT, Srihari KA and Pandey MC. Quality changes in milk adulterated with detergent, urea, ammonium sulphate and neutralizers. Asian journal of dairy and food res. 2015;34(4):285–89.
10. Abernethy G, Higgs K. Rapid detection of economic adulterants in fresh milk by liquid chromatography–tandem mass spectrometry. Journal of chromatography. 2013 May;1288(3):10–20.
11. Ali Ibrahim Ali Mansour, Mohamed Mansour, EL-Loly and Ramadan Omar Ahmed. A Preliminary

Detection of Physical and Chemical Properties, Inhibitory Substances and Preservatives in Raw Milk Internet journal of food safety 2012;14:93–103.

12. Chinta Siva Swetha, Bharathy Sukumar, Sudhanthiramani Sudhanthirakodi. The Study on Detection of Adulteration in Milk Samples Supplied by Local Vendors in Tirupathi Region. India International journal of Veterinary Science. 2014 Oct-Dec;2(2):4–11.
13. Edoardo Capuano, Rita Boerrigter-Eenling, Alex Koot, Saskia M Van Ruth. Food Analytical Methods (Springer.com) 2015;8(8):2125–34.
14. Beall DP and Scofield RH. Milk-alkali syndrome associated with calcium carbonate consumption. Report of 7 patients with parathyroid hormone levels and an estimate of prevalence among patients hospitalized with hypercalcemia. Medicine (Baltimore). 1995 Mar;74(2):89-96.
15. Webbetal. Fundamental of Diary chemistry 3ed Chapman and Hall, London new york. 1974.
16. Murlikrishnan, Kamalahasan, Bharathi SV, Prakash Srinivascanc Sathya P, Vijayrgavendiram S. International J of Sci Enviro and tech. 2017;6(1):483–86.
17. WJ Fischer, B Schilter, AM Tritscher, R Hstadler. Contaminates of milk and dariy product contamination resulting from farm and dairy pracstices. Refrence module in food science. elsevier, pp.1-13, uploded page-15 jan 2018.
18. Ghulam Shabir Barham, Muhammad Khaskhali, Aijaz Hussain Soomro, Zaheer Ahmed Nizamanu. Extent of extraneous water and detection of various adulterants in market milk at Mirpurkhas, Pakistan. IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 2014 April;7(3 Ver I):83–89.
19. Ola, F.A Talkam. Milk Adutration: some chemical adultrants of milk Egypt. J. Chem. Enviro. Health. 2015;1:694–703.
20. Hemanth Singuluri, Sukumaran MKJ. Chromatography separate technique. 2014;5:1.
21. Food Safety and Standards Authority of India (statuary regulatoty of india under the mohfw) (online) available from www.fssai.gov.in food safety helpline.
22. Arvind Singh, Gulab Chandra, Anjali Aggarwal and Praven Kumar. Research (RNFU). 2012;5:2250–3668.