Computer vision based Comparative Studies on the Physicochemical Analysis and Bacterial Biota in Different Milk Samples

Karthikeyan V1*, Gokul Priyan K1, Rajesh Siva1, Gopirajan PV2

1Department of Biotechnology, KarpagaVinayaga College of Engineering and Technology, G.S.T road, Padalam, Chengalpattu, Tamil Nadu-603308, India
2Department of Computer science and Engineering, Saveetha Engineering College, Tamil Nadu, India

Article History:
Received on: 28 Mar 2020
Revised on: 23 Apr 2020
Accepted on: 29 Apr 2020

Keywords:
Physicochemical analysis, Pasteurized milk, Raw Milk and Chemical analysis

ABSTRACT
Milk is a complete food with high nutritional value. Milk is an important culture medium for the growth and reproduction of microorganisms. This study focuses on the samples collected from the different milk distribution areas in Maduranthagam Taluk, South India. Fifty pasteurized milk samples of ten different brands were collected and physicochemical, microbiological analysis were carried out in both raw milk and pasteurized milk samples. The milk samples were subjected to physicochemical analysis such as Fat content, Clearance, Lactometric Reading, Clot on Boiling Test, Solid Non Fat and Acidity were calculated. The milk sample were also subjected to the chemical analysis for the Nitrogen content, crude protein content, Lactose content, ash content were also calculated Methylene blue reduction test has been used to test quality of the milk samples. These findings may be helpful to monitor the quality of the milk products in the market. It can provide an interest in examine the organic and inorganic content in milk. It is reported that all samples added with urea and few samples have sulphate. Raw milk showed inferior quality, processed milk have Low load of bacterial population.

INTRODUCTION
Milk is a supplement rich, white fluid nourishment created by the mammary organs of well evolved creatures. It is the essential wellspring of sustenance for new born child warm blooded animals before they can process different kinds of nourishment (Haug et al., 2007). Early-lactation milk contains colostrum, which conveys the mother’s antibodies to its young and can lessen the danger of numerous maladies. It contains numerous different supplements including protein and lactose. Inter-species utilization of milk isn’t extraordinary, especially among people, huge numbers of whom expend the milk of different warm blooded animals. Such balanced diet milk becomes contaminated with several types of microorganisms which originate from the soil, water (Braun and Fehlhaber, 2002) or skin and the hair of the animals or utensils or from the milk handlers (Rahman and Ahmed, 1988). Raw milk quality and determination of adulterants at the collection point also a major concern of this study. Raw milk is pasteurized before packing to destroy the microorganisms (Bramley and Mckinnon, 1990; Hahn, 1996). It gets contaminated and spoiled very easily. The balanced diet milk becomes contaminated with the microorganisms which originate from the soil, water etc. i.e., psychotrophs. Milk get contaminated by proteases and lipases released by microbes at low temperature (Aslam
The quality and hygienic aspects were affected by the presence of microorganisms in the milk. The psychrotrophs are readily killed by HTST pasteurization (Abdou et al., 2001; Canigova and Benczova, 2001). Hence, this present study is focussed on the physicochemical analysis and bacterial load of raw and pasteurised milk collected from Chengalpattu region.

MATERIALS AND METHODS

Sample collection

In this present study, fifty raw milk samples from cow (n=50), ten from Buffalo (n=10), ten from Goat (n=10) were collected from Chengalpattu region in a sterile screw cap bottles under aseptic conditions.

Physiochemical analysis

The following methods including Methylene Blue Reduction Test, Lactometric Reading, Clot on Boiling Test, Phosphatase test, Solid Non Fat and Acidity test were carried out (Ammara Hassan et al., 2009).

Chemical analysis of milk sample

AOAC 2000 methods were followed to test the presence of Sulphate, Urea, Sodium Chloride and Nitrogen content in raw and pasteurised milk samples

Physical analysis

The physical characteristics of assorted milk samples were determined shortly after they were delivered to the laboratory. All determinations were administered consistent with AOAC (2000)’s methods, (Mahmood and Sumaira usman, 2010). Briefly, moisture content was determined by the difference between the known weight of milk sample and therefore the determined weight of the entire solid after evaporating the liquid component of the milk sample on a hot plate. The pH measurement was made employing a digital pH-meter (HI 8314, Hanna Instruments, Italy) calibrated with pH 4 and seven buffers. Titratable acidity was measured by titrimetric method, and expressed as percent of carboxylic acid. Relative density, conductivity and viscosity were determined by the quality methods.

Enumeration of microorganisms

Determination of total viable count

By using the sterile peptone water different dilution of milk sample ranging from $10^1$ to $10^6$ Each dilution inoculated using a sterile pipette on nutrient agar. The diluted sample was sprayed as quickly as possible on the surface of the plate and kept in incubator at 37°C for 24-48 hrs.30 to 300 colonies have been found after incubating the plates. The average number of Colonies in a particular dilution was multiplied by dilution factor to obtain the total viable count (Bhattacharyya, 1986).

RESULTS AND DISCUSSION

As shown in Figure 1, the MBRT results for raw and pasteurised Cow milk samples showed 60% poor 40% fair and good in raw milk, 24% fair,76% good
### Table 1: Bacterial load of pasteurised milk

| Sample  | Sulphate | Urea | Sodium Chloride | Starch |
|---------|----------|------|-----------------|--------|
| Cow     | -        | +    | -               | -      |
| Buffalo | -        | +    | -               | -      |
| Goat    | -        | +    | -               | -      |

### Table 2: Micro flora of rawmilk

| Milk sample | TVC/ml |
|-------------|--------|
| R1          | 2.7x10^7 |
| R2          | 2.9 x10^7 |
| R3          | 3.2 x10^7 |
| R4          | 2.6 x10^7 |
| R5          | 3.7 x10^7 |
| R6          | 2.5 x10^7 |
| R7          | 3.8 x10^7 |
| R8          | 2.1 x10^7 |
| R9          | 2.9 x10^7 |
| R10         | 3.1 x10^7 |

### Table 3: Chemical components of various milk samples

| Milk samples | Total protein (%) | Casein (%) | Lactose (%) | Ash (%) | Na (mg/L) | K (mg/L) | Ca (mg/L) | Mg (mg/L) |
|--------------|------------------|------------|-------------|---------|-----------|----------|-----------|-----------|
| Buffalo      | 4.34             | 4.38       | 2.46        | 0.88    | 16        | 145      | 702       | 193       |
| Cow          | 3.28             | 5.34       | 4.18        | 0.64    | 20        | 152      | 680       | 205       |
| Goat         | 2.95             | 4.18       | 3.36        | 1.04    | 27        | 113      | 644       | 139       |
| Pasteurised milk | 4.48       | 5.15       | 3.49        | 0.78    | 55        | 128      | 823       | 160       |

### Table 4: Chemical Analysis of Raw Milk

| Sample | Sulphate | Urea | Sodium Chloride | Starch |
|--------|----------|------|-----------------|--------|
| 1      | +        | +    | -               | -      |
| 2      | -        | +    | -               | -      |
| 3      | +        | +    | -               | -      |
| 4      | -        | +    | -               | -      |
| 5      | +        | +    | -               | -      |
| 6      | -        | +    | -               | -      |
| 7      | -        | +    | -               | -      |
| 8      | -        | +    | -               | -      |
| 9      | -        | +    | -               | -      |
| 10     | -        | +    | -               | -      |
Table 5: Physical characteristics of various milk samples

| Milk samples  | Moisture (%) | Total solids (%) | Conductivity (mS) | Specific gravity (mS) | pH | Viscosity (cP) | Titratable acidity (% lactic acid) | accladric | dicadric |
|---------------|--------------|------------------|-------------------|----------------------|----|---------------|-----------------------------------|---------|---------|
| Buffalo       | 79.7         | 15.7             | 1.09              | 6.73                 | 6.57 | 1.52          | 1.23                              |         |         |
| Cow           | 86.5         | 12.4             | 1.03              | 6.97                 | 9.5  | 1.38          | 2.87                              |         |         |
| Goat          | 76.8         | 13.4             | 1.07              | 6.63                 | 9.4  | 1.44          | 1.56                              |         |         |
| Pasteurised milk | 89.9     | 14.5             | 1.05              | 6.87                 | 8.78 | 1.69          | 1.76                              |         |         |

result in pasteurised milk respetively. The raw and pasteurised milk samples of goat showed 80% good quality in pasteurised sample 50% fair quality in raw milk respectively. MBRT results of buffalo milk showed 50% good and fair quality in raw milk samples, 90% good and 10% fair in pasteurised milk samples. Reported excellent quality milk both in raw and pasteurised samples. There are no chances of excellent quality milk in case of raw samples because of the environmental conditions and the cattle feed. In this work, no such excellent quality milk was determined.

With reference to physicochemical analysis, In raw milk, the acidity is usually between 0.144-0.166, CLR is between 20-30. The pasteurised samples show almost the same acidity values, their CLR values lie between 25-40. There is a variation in SNF value for raw and pasteurised milk samples. (Belalhossain and Dev, 2013) The pasteurised samples show greater SNF value. Urea content present in all Pocket samples whereas Sulphahte is found in few milk samples (De, 2005).

Higher caesin 5.34% content found in cow milk and increased ca (823mg/L) content found in all pasteurised milk samples.

Further, the pasteurised milk samples were subjected to Phosphatase test in order to test the efficiency of pasteurisation. This showed that the pasteurisation was up to the mark but still there was prevalence of microorganism which may be due to the improper handling and unhygienic conditions. As per the results in Tables 4 and 5, the colony forming units in raw and pasteurised samples were maximum at a dilution of 10^-1 and decreased as the dilution increased. The colony forming units in pasteurised milk samples were less compared to that in raw milk samples and some pasteurised milk samples showed no colony forming units (Burdova et al., 2002). As displayed in Table 1, Urea found to be positive for all the samples taken from the three different mammals, where sulphate and starch absent in all milk samples. Table 2 shows total viable count presence of bacterial biota in a raw milk samples. Most prominently, Table 3 reports the level of sugar, protein and macronutrients present in milk. Table 4 shows the presence of sulphate and few urea compositions in milk samples. As a final point, Table 5 showed the moisture and other physical characteristics of Milk. Further, graphs shown in the Figures 2, 3 and 4 were generated with the help of computer for the values depicted in tables.

CONCLUSIONS

Pasteurisation of milk does not alter its physicochemical properties to a great extent with reference to acidity and fat content. The pasteurisation is effective in killing the microbes present in the raw milk samples to a great extent but not completely. The preservation of milk should be given more attention with natural preservatives.

Conflict of Interest

None.

Funding Support

None.

REFERENCES

Abdou, S. M., Dawood, A. H., Montasser, E. A., Ismail, E. E. 2001. Evaluation of UHT milk during storage. pages 149–162, Cairo, Egypt.

Ammara Hassan, Amjad, I., Shahid Mahmood 2009. Microbiological and physicochemical analysis of different UHT milks available in market. African Journal of Food Science, 3(4):100–106.

Aslam, M., Hurley, W. L. 1996. Proteases in Milk. Illinois Dairy Report Home Page.

Bellalhossain, S. R., Dev 2013. Evaluate the physicochemical quality of raw milk sample in selected dairy plant of Bangladesh. International journal of engineering and applied science, 1:3–3.

Bhattacharyya, R. N. 1986. Experiment with Microorganisms. In Emkay publications, pages 366–366.
Bramley, A. J., Mckinnon, C. H. 1990. The Microbiology of Raw Milk. In: Dairy Microbiology, I, (Ed.: Robinson, R.K.). London, New York. Elsevier Applied Science, 171.

Braun, P., Fehlhaber, K. 2002. Combined effect of temperature, aw and PH on enzymatic activity of spoilage causing bacteria. 57:134–136.

Burdova, O., Barahova, M., Laukova, A., Rozanska, H., Rola, J. 2002. Hygiene of pasteurized milk depending on psychrotrophic microorganisms. Bull. Vet. Inst. Pulawy, 46:325–329.

Canigova, M., Benczova, E. 2001. The microflora changes of raw milk during its refrigerated storage. Acta-Fytotechnica-et-zootechnica, 4(4):104–106.

De, S. 2005. Market milk. In Outlines of Dairy Technology. Oxford University Press.

Hahn, G. 1996. Pathogenic bacteria in raw milk situation and significance. Bacteriological quality of raw milk. Brussels (Belgium), Int. Dairy Federation, pages 515–538.

Haug, A., Høstmark, A. T., Harstad, O. M. 2007. Bovine milk in human nutrition – a review. Lipids in Health and Disease, 6(1):25–25.

Mahmood, A., Sumairausman 2010. compare the physicochemical parameters of milk samples of four different species like buffalo, cow, goat and sheep. Pakistan journal of nutrition, 9(12):1192–1197.

Rahman, H. A. A. E., Ahmed, A. A. 1988. Incidence and level of occurrences of proteolytic microorganisms in some selected foods. Assist veterinary medical journal, 19(38):72–78.