

Short Communications

<https://doi.org/10.20546/ijcmas.2018.707.195>

Physico-chemical Properties of Milk and Dairy Products Collected from Allahabad City, India

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A B S T R A C T

Keywords

Buffalo milk, Cow milk, Curd, Goat milk, Paneer, Physico-chemical

Article Info

Accepted: 10 June 2018

Available Online: 10 July 2018

Samples of milk from buffalo, cow, goat milk, samples of dairy products from paneer and curd were used for analysis of physico-chemical parameters viz fat, protein, moisture, ash, T.S., S.N.F. and lactose. Maximum fat percentage among milk product samples was observed in paneer which ranged 14.67 ± 0.421 followed by cow milk 6.421 ± 0.0107 . The maximum protein percentage was observed in paneer 12.978 ± 0.244 . Moisture content among milk samples was observed highest in goat milk 92.421 ± 0.082 . Maximum lactose content among milk samples was found in buffalo milk 5.636 ± 0.011 while minimum ash percentage was found in cow milk 0.692 ± 0.007 .

Introduction

Milk and dairy products are part of a healthy diet which, besides cow's milk, sheep's, goats and buffalo's milk are involved (Hinrichs, 2004). Milk is a complex colloidal dispersion containing fat globules, casei micelles and whey proteins in an aqueous solution of lactose, minerals and a few other minor compounds. Its physical and chemical properties depend on intrinsic compositional and structural factors, extrinsic factors such as temperature and post-milking treatments. An understanding of these properties is important in the technological and engineering design and operation of milk processes and

processing equipment, the design of modern methods of milk analysis, the determination of milk microstructures and the elucidation of complex chemical reactions that occur in milk.

Measurement of some of the physico-chemical properties is used to assess milk quality. Milk is an important source of all basic nutrients required for mammals including human beings. Milk from various mammals such as cow, buffalo, goat, sheep, camel, etc. is used for different nutritional purposes, e.g., feeding to young ones and preparation of some nutritional products such as milk cream, butter, yogurt, ghee, sour milk, etc. (Webb *et al.*, 1974; Hassan, 2005). Nutritionally

enriched milk and its products with enhanced biological potential and without health risks are generally demanded (Khan and Zeb, 2007; Baloch *et al.*, 2006). The major chemical components of milk include water, fats, proteins, carbohydrates, minerals, organic acids, enzymes and vitamins.

The best buffaloes of the world are found in the Indian subcontinent, and India is the leading buffalo country, which produces 96 million tons of milk annually. Buffalo milk (BM) is ranked second after cow milk (CM) in the world as the BM produced is more than 12% of the world's milk production. About 70% of the total BM is produced by India. World milk production has doubled in the last decade, with BM production ranking second after bovine milk. Various compositional and functional properties render the BM eminently suitable for manufacture of dairy products such as ultra-high temperature (UHT) cream, dried ice cream mixes, dairy whiteners, edible casein, and caseinates. However, from a technological point of view, BM is often not considered an ideal fluid for manufacture of several types of cheeses, milkpowders, evaporated and condensed milk, and infant formulas (Khedkar *et al.*, 2016)

Buffaloes are the second largest source of milk supply in the world. In India, nearly half of the milk processed by the organized dairies comes from buffaloes. The BM is richer in fat than milk from cattle. Generally, it has also higher levels of proteins, lactose, and ash, although these differences are not as high in fat.

Goat's milk contains vitamins, minerals, trace elements, electrolytes, enzymes, proteins, and fatty acids that are easily assimilated by the body. Goat's milk has a similarity to human milk that is unmatched in cow milk and also has several medicinal values (Kumar *et al.*, 2012).

Dahi is a fermented dairy product of major importance in Indian subcontinent. Since time immemorial it is being used for its nutritive and therapeutic values (Aneja *et al.*, 2002). The chemical composition of curd has been reported as fat content ranging from 5-8 %, protein 3.3 – 3.4%, lactose 3.5 to 4.5 and 0.5 – 1.1% lactic acidity.

Paneer is non-fermentative, non-rennet, non-melting and unripened type of cheese similar to the white cheese (Chandan, 2007). According to the FSSAI (2011), Paneer shall not contain more than 70.0 per cent moisture and the milk fat content shall not be less than 50.0 per cent of the dry matter.

The physico-chemical properties of milk fat show some natural variations depending upon factors like method of manufacture, age and condition of the sample, species, breed, individuality of animal, stage of lactation, number of lactation (age of animal), season of the year, region of the country, feed of the animal etc. (De, 2005; Aneja *et al.*, 2002). The focus of the present study is to highlight the comparative study of the detailed composition and properties of buffalo, cow, goat milk and dairy products like curd and paneer collected from different regions of Allahabad city.

Materials and Methods

The present investigation was undertaken at Department of Dairy Microbiology, SHUATS, Allahabad during 2015-16 and 2017-18 to physico-chemical properties of milk and dairy products collected from Allahabad city. The experiment was laid out in completely randomized design replicated thrice.

Sample collection

Fresh buffalo, cow and goat milk samples were collected from different regions of

Allahabad city. Also, fresh dahi and paneer samples were collected from the vendors/shopkeepers and were brought to the University campus in ice box. It was ensured that the temperature variation was not remarkable in the product.

Three samples from each location were collected. The samples were analyzed in the laboratory of the Department of Food Engineering, SHUATS, Allahabad.

Physico-Chemical analysis

For moisture content 5 g (Mo) of the milk was placed in petri dishes and kept in the Gallenkamp oven at 130°C for 1 h. The dried samples were then cooled in a desiccator and weighed (M1). The average mass of the three masses was used to calculate the moisture content of the samples. The moisture content expressed as a percentage was calculated as follows:

Moisture content (%) $\frac{1}{4} \text{ Mo}_\text{M1}/\text{Mo}_\text{100}$ (AOAC, 2000).

Chemical composition Total solids content was determined by gravimetric method, Kjeldahl technique was utilized to estimate the protein content, Gerber method was employed to determine the lipid content whereas, ash content was quantified using muffle furnace at 550°C(AOAC, 2012).

The aforementioned analyses were performed in triplicate on the final products.

Statistical analysis

Results were expressed as mean \pm SD of three separate determinations. The significant differences between means were calculated by a one-way analysis of variance (ANOVA) using Duncan's multiple-range test at $P<0.05$.

Results and Discussion

Samples of milk from buffalo, cow, goat milk and of dairy products paneer and curd were used for analysis of physicochemical parameters viz fat, protein, moisture, ash, T.S., S.N.F. and lactose. The various physical-chemical parameters of milk and milk products are presented in table 1.

Physico-chemical properties of raw milk

In the present study, the mean fat content in buffalo, cow and goat milk was reported 6.421 ± 0.0107 , 4.06 ± 0.007 and 3.599 ± 0.084 respectively which showed that highest fat% is present in buffalo milk as compared to cow and goat milk. Similar findings were reported by Dubey *et al.*, (1997) (6.80), Sodi *et al.*, (2008) (7.7 ± 1.0) fat% in buffalo milk. Misra *et al.*, 2008 conducted study on different breeds of Indian buffaloes and reported the highest fat% in Murrah (7.53 ± 0.19) and lowest fat% in Surti (6.17 ± 0.02). Similarly highest protein% was found in buffalo milk ie., 3.85 ± 0.01 than to cow and goat milk which is very much in accordance with the finding of Patino and Stefani 2005. The total solid content of buffalo's milk being 10.921 %, was markedly higher than that of cow milk (8.528 %). Lactose is also known as milk sugar and is composed of galactose and glucose. Among all the tested milk samples, the buffalo milk contained the highest amount of lactose. These results were in agreement with those reported by Spanghero and Susmel (1996) and Ahmed *et al.*, (2008). In goat milk the content of carbohydrate was in range of 4.35 ± 0.105 , fat 3.599 ± 0.084 , protein 3.258 ± 0.009 , moisture 92.421 ± 0.082 and S.N.F. 3.974 ± 0.010 . Similar findings were also reported by Hamad and Baiomy (2008) and Imran *et al.*, (2010). The statistical analysis showed insignificant difference.

Physico-chemical properties of milk products

The maximum fat, protein, ash, T.S., S.N.F. and lactose content among milk product samples was observed in paneer but less moisture as compared to curd. The protein and fat % observed in paneer was 12.978 ± 0.244 and 20.67 ± 0.421 respectively. In curd the values recorded for protein was 2.881 ± 0.110 , fat (2.536 ± 0.105) and T.S. (6.154 ± 0.148). Similar results were presented by Obi and Ikenebomeh (2007); Younus *et al.*, (2002) and El-Bakri and El-Zubeir (2009).

In conclusion among the milk products studied Paneer contained higher fat, protein, ash, T.S. and S.N.F contents and less moisture and carbohydrate content than curd.. Buffaloes are the second largest source of milk supply in the world. In India, nearly half of the milk processed by the organized dairies comes from buffaloes. The BM is richer in fat than milk from cattle. Generally, it has also higher levels of proteins, lactose, and ash, although these differences are not as high in fat.

Acknowledgements

The first author acknowledges the Institute fellowship from Maulana Azad National Fellowship and infrastructural facilities received from the Department of Dairy Microbiology, SHUATS, Allahabad.

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How to cite this article:

Nivedita Prasad, Sangeeta Shukla and Ramteke, P.W. 2018. Physico-chemical Properties of Milk and Dairy Products Collected from Allahabad City, India. *Int.J.Curr.Microbiol.App.Sci*. 7(07): 1662-1666. doi: <https://doi.org/10.20546/ijcmas.2018.707.195>