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PHYSICO-CHEMICAL PROPERTIES OF OSMANABADI GOAT MILK

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ABSTRACT
The objective of the investigation was to study the physic-chemical properties of Osmanabadi goat milk. All these properties were analyzed using standard methods. The values of physico-chemical properties of Osmanabadi goat milk *viz*., moisture content, solids not fat, fat, protein, lactose, ash, pH, titrarable acidity, colour (L^*, a^* and b^*) and water activity were 87.20 ±0.66%, 9.18 ±0.30%, 4.12 ±0.35%, 3.98 ±0.19%, 4.35 ±0.22%, 0.85 ±0.03%, 6.75 ±0.07, 0.15 ±0.01%, 86.43 ±1.04 (L^*), -2.88 ±0.46 (a^*), 9.03 ±0.46 (b^*) and 0.95 ±0.01, respectively. The results of all these properties were good consistent with many studies.

KEYWORDS: Colour, Goat milk, Osmanabadi goat, proximate composition, Water activity

INTRODUCTION

Goats are recognized as the most effective livestock for promoting health and economy of poor people in the developing countries of the world (Mandal *et al.*, 2005). A family with just two goats can have sufficient milk throughout the year. It is estimated that there are 102 descript breeds and types of goats in the world, 95% of them are in developing countries (Banerjee, 2006). In India, there are 20 breeds of goats (Banerjee, 2006) although, 70% of their population are non-descript and meat type, however, some of the Indian breeds such as Jamunapari, Barbari, Beetal, Surti and Jarkhana produce fair amount of milk in India (Pal *et al.*, 2011). Dairy production from goats has become a more commercialized in some regions such as Europe, Oceania, North and South America (Silanikove *et al*., 2010). The major constituents of milk are: water, fat, protein, lactose and ash or mineral matter. Composition of goat milk is almost similar to cow milk. The yield and composition of goat milk vary widely; this variation is attributed to breed, parity, stage of lactation and milking time (Jenness, 1980; Pal *et al*., 2011), diet, health, age, geographical location, season and management of goat (Park, 2000). Some physico-chemical properties of goat milk such as smaller fat globules, higher percent of short and medium chain fatty acids and softer curd formation of its proteins are advantageous for higher digestibility and healthier lipid metabolism relative to cow milk (Park, 1994). Vitamin A and Niacin content is more in goat milk than cow milk and similar to human milk whereas folic acid is very deficient in goat milk compared to cow milk and human milk (Pal *et al*., 2011).

Goat milk is very useful for people suffering from problems such as acidity, eczema, asthma, migraine, colitis, stomach ulcer, digestive disorder, liver and gallbladder diseases and stress-related symptoms such as insomnia, constipation and neurotic indigestion (Babayan, 1981). Patients suffering from these diseases may turn in future to goat milk and its products to solve their problems. Recently a high volume of cosmetic products are produced from goat milk, including soaps, creams, body lotions, shampoos, hair conditioners and after shave lotions, which are marketed in countries such as USA and Switzerland (Ribeiro and Ribeiro, 2010).

The name Osmanabadi breed is derived from their distribution in Osmanabad area in Maharashtra. It covers the major part of Southern Maharashtra, especially Osmanabad, Beed, Sholapur, Latur, Parbani and Ahmed Nagar districts, Western Andhra Pradesh and North Eastern part of Karnataka *i.e.*, Hyderabad-Karnataka region as reported by Reddy *et al*., 2014. According to these authors, Osmanabadi goats are mostly medium size animals usually black in colour, but in some areas of Maharashtra and Western Andhra Pradesh brown or spotted ones can also be seen. The major breeding season of Osmanabadi goats is from May to July, followed by August to October and a small number of Osmanabadi goats also breed from October to March. This breed is considered useful both for meat and milk. Average daily milk yield varies from 0.5 to 1.5 kg for a lactation period of about 4 months (Banerjee, 2006). The aim of the present investigation was to study the physico-chemical properties of Osmanabadi goat milk.

MATERIALS & METHODS

Selection of Osmanabadi goat milk

Raw goat milk was procured from the surrounding region of Raichur. Prior to milking, the teats of all milking goats were washed with clean water and dried with single service paper towels. After discarding the first few strippings, a representative milk sample was collected. Milk samples from ten goats (randomly selected) were collected in the morning hours. The milk was stored at 5±1°C before analysis.

Determination of physico-chemical properties of Osmanabadi goat milk

The physico-chemical composition of fresh milk samples, namely moisture content, fat, SNF, protein, ash, titratable acidity, lactose, colour and water activity were determined as follows; The moisture content of goat milk was determined by hot air oven (Make: Swastik Electric and Scientific works, Ambalcant) method (No. 990.20; AOAC, 2005). Fat in Osmanabadi goat milk was determined by the Gerber method (Method No. 2000.18) given in AOAC (2005). Solids-not-fat in Osmanabadi goat milk was calculated by method (No.990.21) given in AOAC (2005). Percent fat is subtracted from percent total solids to obtain solids-not-fat. The nitrogen content in milk sample was estimated by using Kjeltech instrument (Model: D-40599, Behr Labor Technik GmbH, Germany) by Kjeldahl's method (991.20) of AOAC (2005). The total ash content of Osmanabadi goat milk was determined at 550 °C for 5 h by muffle furnace (Make: MAC; model: MSW-251) method (AOAC, 2005; Method No.925.23). Acidity in goat milk sample was determined by the method (No. 947.05) given in AOAC (2005). The lactose content in Osmanabadi goat milk was determined by difference method**.** The lactose content was computed using the following equation;

Lactose (%) = 100 - (moisture content + fat + protein + ash) (1)

The pH of Osmanabadi goat milk was measured using Systronic μ digital pH meter 361. Buffer solution of pH 4 and 7 were used to calibrate the pH meter before determination of pH of milk. Hunter lab colourimeter (Model: Colour Flex EZ) was used for the measurement of colour of fresh goat milk. The 3-dimensional scale L^*, a^* and b^* was used. The L^* is the lightness coefficient, ranging from 0 (black) to 100 (white), a^* represents greenness and redness (+100 for red and -80 for green) while b^* represents yellowness and blueness (+70 for yellow and -80 for blue). The instrument was standardized before placing the sample by placing black tile and white tile provided with the instrument. The water activity of fresh Osmanabadi goat milk was measured by Rotronic Hygrolab 3 water activity analyzer (Model: a_w-HP23) at a room temperature. Before measuring the water activity, the instrument was calibrated for its accuracy by measuring the water activity of distilled water.

RESULTS & DISCUSSION

Physico-chemical properties of Osmanabadi goat milk

The physico-chemical properties of Osmanabadi goat milk are presented in Table 1. The average moisture content of Osmanabadi goat milk obtained from the present investigation was found to be 87.20% (w.b.). Similar values were reported by Hassan *et al.* (2010) for Jamunapari goat milk and Agnihotri and Pal (1996) for Babari goat milk.

TABLE 1. Physico-chemical properties of Osmanabadi goat milk

Sl. No.	Composition		Range	Mean ±SD	CV	SEm ±
1	Moisture (% w.b.) [a]		86.55 - 88.14	87.20±0.66	0.01	0.27
2	Solids Not Fat (%)[a]		8.79-9.60	9.18±0.30	0.03	0.12
3	Fat (%)[a]		3.80- 4.70	4.12±0.35	0.08	0.14
4	Protein (%)[a]		3.82 – 4.32	3.98±0.19	0.05	0.08
5	Lactose (%)[a]		4.15-4.65	4.35±0.22	0.05	0.09
6	Ash (%)[a]		0.80-0.90	0.85±0.03	0.04	0.01
7	pH[a]		6.68 - 6.85	6.75±0.07	0.01	0.03
8	Titratableacidity[a]		0.14-0.16	0.15±0.01	0.07	0.004
		L^*	84.86-87.53	86.43±1.04	0.01	0.42
9	Colour[a]	a^*	(-2.34)-(-3.46)	-2.88±0.46	-0.16	0.19
		b^*	8.36-9.54	9.03±0.46	0.05	0.19
10	Water activity[a]		0.93-0.96	0.95±0.01	0.01	0.004

[a]No of replications = 6; SD= Standard Deviation; CV= Coefficient of Variation; SEm = Standard Error of the Mean; L^*- Brightness; a^*- Redness; b^*- Yellowness

The average SNF in Osmanabadi goat milk was obtained from the present study was found to be 9.18%. These values were in good agreement with Hassan *et al.* (2010) who reported the SNF in Jamunapari goat milk as 10.7 ±0.8%. Park *et al.* (2007) also reported the SNF value of 7.90%. The average fat content of Osmanabadi goat milk obtained from the present investigation was found to be 4.12%. According to Hassan *et al.* (2010) the fat in Jamunapari goat milk (5.60±1.30%) was more than the Osmanabadi goat milk, but Agnihotri and Rajkumar (2007) also reported that the fat content of Jakhrana goat milk (4.39%) was comparable with Jamunapari goat milk (4.38%) but lower than Barbari goat milk (4.82%) breed.

From Table 1, it was observed that the average protein content in Osmanabadi goat milk as 3.98%. Jenness (1980) reported that the protein in Barbari and Jamunapari goat milk were 3.76% and 3.74%, respectively and Hassan *et al.* (2010) also studied the protein in Jamunapari goat milk as 4.0 ±0.30%. The results of lactose content in Osmanabadi goat milk were similar to those stated by Jenness (1980) who reported the lactose content in Barbari and Jamunapari goat milk were 4.80% and 4.72%, respectively. Lactose content in goat milk during seasonal variation *i.e.,* spring, summer, autumn and winter seasons were 4.36 ±0.02%, 4.39 ±0.03%, 4.42 ±0.02% and 4.30 ±0.02%, respectively as reported by Ramona (2010). There was not much variation in lactose content in all

seasons. The ash content of Osmanabadi goat milk was found to be 0.85%. Similar results were reported by Helmut and Gregor (2012) who investigated the ash content in goat milk as 0.81% and Park *et al.* (2007) also reported the ash content in goat milk as 0.90%. The average pH of Osmanabadi goat milk obtained from the present investigation was found to be 6.75. These values were similar to those stated by Chornobai *et al.* (1999) who analysed the pH in Saanen goats as 6.69±0.20. Ramona (2010) reported the seasonal variation of pH in goat milk during spring, summer, autumn and winter seasons were 6.31±0.02, 6.71 ±0.02, 6.50 ±0.02 and 6.32±0.02, respectively. The results of titratable acidity of Osmanabadi goat milk was found to be in the range of 0.14-0.16. These results are good confirmation with Park *et al.* (2007) who reported the acidity in goat milk as in the range of 0.14-0.23.

The mean colour values *viz.*, *L**, *a** and *b** of the Osmanabadi goat milk were found to be 86.43 (L^*), -2.88 (a^*) and 9.03 (b^*). These values were comparable with Guler and Park (2009) who reported that the colour values of the goat milk L^*, $a^*$and b^*were 85.2, -3.38 and 7.76, respectively. The white colour of goat milk is caused by the lack of β-carotene. β-carotene is the precursor of vitamin A. In goat milk all β-carotene is converted and the content of vitamin A is therefore higher than in bovine milk (Park *et al*. 2007). Jandal (1996) also reported that the goat milk was white in colour compared with cow milk, which was yellowish because of the presence of carotene in the fat. The average water activity of fresh Osmanabadi goat milk was found to be 0.95.

CONCLUSION

As cited in many research articles, goat milk can be used an important source in the manufacture of a wide range of food products such as chocolate and confectionery, health and personal care products, pharmaceuticals and cosmetics products. The proximate composition of Osmanabadi goat milk is more or less similar to other Indian goat breeds. So that, milk from Osmanabadi goat can also be used to manufacture the high quality indigenous dairy products. Furthermore, it is recommended to standardize the milk before any processing to reach the acceptable level.

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