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Analysis of Pantja goat milk for gross composition

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Abstract
Goat is earliest domesticated animal. Goat is a versatile animal having short generation interval with lower investment cost and higher prolificacy. Milk is the complete and first food of mammals which provides energy and nutrients needed for the proper growth and development. Goat milk is superior in nutrients and is having better digestibility, alkalinity, buffering capacity and certain therapeutic values. The present study was carried out at Goat farm, LPM, GBPUAT, Pantnagar. During the entire study the fresh milk samples of Pantja goats were analyzed for physico-chemical properties. The colour of Pantja goat milk was perfect white and overall average composition of Pantja goat milk i.e. water, fats, protein, carbohydrates, total solids, solids not fat, ash, titratable acidity, specific gravity and pH was 85.27, 4.96, 3.82, 5.09, 14.73, 10.06, 0.78, 0.130 per cent, 1.036 g/ml and 6.44, respectively.

Keywords: Pantja goat, milk, composition

1. Introduction
Goat is considered as an animal with multipurpose utility which not only provides meat and milk but also hide, hair and manure. It is a well-known fact that goat industry has provided significant improvement to the native economy (FAO, 2010) [8]. Goat milk has assumed a significant job in the nourishment and financial prosperity of mankind by giving every day basic proteins and minerals, for example, calcium and phosphate (Haenlein, 1980) [12]. Goat milk has been prescribed as a perfect alternative for cow milk, particularly for the individuals who experience the ill effects of bovine milk hypersensitivity (Park and Haenlein, 2007) [22]. Goat milk has higher medicinal value than any other milk and it also contains 4.4 per cent fats, 0.137 percent Calcium, 0.112 per cent Phosphorus, 0.017 per cent Magnesium, 0.170 per cent potassium and 3.4 per cent milk protein (Holmes *et al*., 1946) [14]. On average, goat and cow milk provides approximately 72 and 67 Kcal of energy per 100 g respectively. It is almost naturally homogenized because of smaller sizes of fat globules. Large portion of human community in the world is malnourished because of lack of protein, energy along with minerals and vitamins. Goat's milk can overcome these problems by providing better nutrition. Hence this can give support to human starvation, under nutrition, and malnutrition in the world's lower strata peoples. Goat milk has superior digestibility and an appropriate composition of fatty acids and bioactive compounds which is useful in managing certain medical conditions. The main quality of milk is to supplement nitrogen and amino acids to the young mammals. Milk is considered as an essential portion of dietary fat requirements in adults. Furthermore, milk fat facilitates the uptake of several vital nutrients such as trace elements, vitamins, minerals and performs a defensive function (Brule *et al*., 1982) [4]. The nutritional and health prosperity of goat milk are important to be noted because it avoids various medical complications of people like food hypersensitivity due to cow milk (Walker, 1965) [29]. The vitamin A content in goat milk is more than that in cow milk as in goat's milk conversion of all β-carotene into Vitamin A occurs. Goat milk is whiter than the cow milk. Sufficient amount of vitamin A and niacin is supplemented through goat milk and even high amounts of thiamin, riboflavin and pantothenic acid for human infants is supplemented (Parkash and Jenness, 1968) [29]. Dengue has become a major health problem in India. For treating dengue fever goat milk and its milk products are mostly preferred. Dengue fever has complications like deficiency of selenium and reduced platelet count. Goat milk and its products are enriched with more selenium as compared to cow milk. Goat milk also aid in the

Digestive and metabolic utilization of various minerals (Gunjan *et al.*, 2011) [10].

2. Materials and Methods

2.1. Sampling

During the entire study, the fresh milk samples were collected from the Pantja goats. The milk samples were taken early in the morning from the goats being reared in the Department of Livestock Production Management. During this period, individual goats were milked and after that samples were collected and labeled in 50 ml sterile bottles and brought to the laboratory for further analysis. The collected samples were preserved in a refrigerator at 5˚C until they were investigated.

2.2. Physico-Chemical analysis

The physicochemical examination of the collected samples included colour, specific gravity, boiling point, pH, titratable acidity, total solids, fat, solids-not-fat, protein, lactose, ash, and water.

2.2.1 Colour

To determine the colour of the sample collected, colour of milk samples was determined by comparing it with different color shades in given charts and then the matching color code was noted.

2.2.2 Ph

The pH (power of Hydrogen) of the milk sample was determined by using the digital pH meter as per **IS: 1479** (Part-2) 1961.

2.2.3 Specific gravity

The lactometer was used for determining the sample's specific gravity according to the procedure described as per IS: 1183 (1965).According to this method, the sample was mixed thoroughly and its temperature was maintained similar to the calibrated lactometer temperature. The milk sample was poured into the lactometer cylinder up to 2/3rd capacity. Then the lactometer was kept in the glass cylinder containing milk up to the brim. Further the lactometer was lowered up to zero mark and then left to reach its own level.

$$\text{Specific gravity of milk} = \frac{\text{Corrected lactometer reading (C.L.R.)} + 1}{1000}$$

Where, C.L.R. = O.L.R. + meniscus error ± temperature difference X 0.1

2.2.4 Titratable acidity

The acidity was determined by adopting the procedures recommended in IS: 1479 (Part-1) 1960. The sample was titrated against 0.1 N NaOH solution. In this method, the milk sample was mixed thoroughly and then 10 ml of milk sample was taken with the help of a pipette and transferred into a clean and dried glass (or porcelain) beaker. This was followed by adding 4-6 drops of phenolphthalein indicator. The resultant solution was stirred with a glass rod. Burette was filled with N/10 NaOH solution and its initial reading was noted down. Alkali was added drop by drop to the milk in the beaker and stirred. Milk became pink just at the time of adding alkali but then the color disappeared soon. Further addition of alkali was stopped as soon as milk became slight pink. The amount of NaOH used was calculated by getting the difference between final and initial readings.

Calculation

$$\% \text{ Acidity} = \frac{\text{No. of ml } \frac{n}{10} \text{ NaOH used} \times 0.009 \times 100}{\text{Weight of milk}}$$

2.2.5 Total fats

The fat content of the collected milk sample was as per the procedure IS: 1224 (Part-1) 1977. For this, 10 ml of sulphuric acid was filled in the butyrometer and then 10.75 ml milk was added to the butyrometer carefully by letting it to flow slowly down the glass walls so that it does not mix with the acid. Then 1 ml amyl alcohol was added and the neck of the butyrometer was cleaned and closed with a cork. The butyrometerwas agitated and inverted so that the three liquids mixed properly. Then centrifugation was done for at 1200 rpm for 4-5 minutes in the Gerber centrifuge. Further the butyrometer was removed from the centrifuge and the meniscus was adjusted to get the reading. The reading value in the scale was the resultant per cent of fat in the milk (% mass/volume).

2.2.6 Total solids

Total solids were calculated by following formula:

Richmond's Formula

$$\text{Total solids } \% = \frac{CLR}{4} + 1.21F + 0.14$$

Where,
CLR= Corrected lactometer reading F= Fat per cent
-The fat percentage of milk sample was calculated by Gerber's method.
-The lactometer reading and temperature of the milk were observed and then
corrected lactometer reading was calculated.
-Place the figures of fat and CLR in the following formula for calculating total solids.

2.2.7 Solids-not-fat (SNF)

Solids-not-fat milk was calculated by using formula:

$$\text{SNF } \% = \frac{CLR}{4} + 0.21$$

Where,
CLR= Corrected lactometer reading

- The fat percentage of milk sample was calculated by gerber's method.
- The lactometer reading and temperature of the milk was observed and
  corrected lactometer reading was calculated.
- The figures of fat and CLR were placed in the above mentioned formula for calculating solids-not-fat.

2.2.8 Protein

The protein content was calculated by the micro- kjeldahl method as per explained in AOAC (2005) [3]. In this method, 15 gm K_2SO_4, 1gm $CUSO_4.5\ H_2O$, and 8-10 boiling chips were added to a digestion flask. Then, 5±1.0 ml of the milk

sample (pre-warmed to 38±1˚C and mixed) was transferred to the flask and added with 25 ml concentrated H_2SO_4. The contents were digested until the mixture became clear. The mixture was cooled and its volume was made up to 100 ml in a volumetric flask by pouring distilled water. The sample was allowed to cool down and 25ml of neutralized aliquot was distilled. The ammonia which liberated was collected in 20 ml of 2% boric acid solution which had 1 ml of mixed indicator (0.1% bromocresol green and 0.1% of methyl red in a ratio of 5:1). This solution was titrated against 0.1N HCl. A blank was also maintained simultaneously.
The nitrogen content was estimated as follows:

$$\% \text{ Nitrogen} = \frac{(S - B) \times 0.014 \times D \times 100}{W}$$

Where,
S= Titer value of the sample.
B= Titer value of blank.
N= Normality of HCL
W= Weight of the sample.
D= Dilution factor.

2.2.9 Ash percentage
Ash percentage of milk was calculated as per the method described in AOAC (2005) [3]. In this method, 5gm of milk was taken in a crucible made of silica and evaporated till dry in a steam bath. After this the sample was ignited and placed in a furnace at 550ºC until ash became carbon-free. Then the crucible was cooled in desiccators and weighed. Further, the ash was calculated by the following formula:

$$\text{Ash}\% = \frac{\text{Dried weight - Crucible weight}}{5} \times 100$$

2.2.10 Moisture
The moisture content of the sample (milk) was estimated by subtracting percentage of total solids from 100. Total solids in milk were estimated as per the method described in AOAC (2005) [3]. The specific gravity of milk was calculated by lactometer. Lactometer reading was corrected according to the temperature of the milk and formula used to estimate total solid content of milk is as follows:

% Total solids =0.25C.L.R. +1.2 F

Where,
C.L.R. = Corrected lactometer reading.
F = fat% of milk
So moisture content = 100 – total solids (%)

2.2.11 Carbohydrates
Carbohydrate percentage in milk will be calculated by difference. The sum of moisture, protein, fat and ash was subtracted from 100.

2.3 Statistical analysis
The observations were statistically analyzed using Factorial Completely Randomized design (FCRD), two ways ANOVA according to the method described by Snedecor and Cochran (2004) [27] to study the effect of lactation order and lactation stage on Pantja goat milk.

3. Results and discussion

3.1 Milk Colour
The milk samples from Pantja goat milk are represented a perfect white colour. On storing milk sample for some period time, there was development of pale yellow colour, which might be due to the accumulation of fat globules on the surface of the milk.

3.2 Specific gravity
The results obtained for the specific gravity of Pantja goat milk was 1.036 g/ml. however, the specific gravity of milk ranged from 1.030 to 1.040 g/ml. These results are in agreement with the findings of Chornbai *et al.* (1999). However, values are slightly lower than those reported by Devide *et al.* (2001).

3.3 Milk fats
In the present investigation, the overall fat content in the Pantja goat milk was 4.96 per cent and it was ranged from 4.60 to 5.85 per cent. These results are close with Haeniein (2002), Kuchik and Sedlaekova (2003). However, slightly values of fat were reported by Tike (2007) [28].

3.4 Total solids (TS)
The overall total solids content in Pantja goat milk was 14.67 per cent and it was ranged between 14.01 to 15.79 per cent. The present findings showed a similar trend as reported by Agsanga (2002) [1]. However, values are slightly higher than those reported by Roy and Vadodaria (2006) [25].
3.5 Solids-not-fat (SNF)
The overall solids-not-fat content of Pantja goat milk was 10.06 per cent and it was ranged from 8.86 to 11.04 per cent. These findings were in agreement with the observations of Antunac *et al.* (2001) [2]. However SNF content in Pantja goat milk was slightly higher than that reported by Guru *et al.* (2006) [11].

3.6 Protein
The overall protein content in Pantja goat milk was 3.82 per cent and it was ranged from 3.12 to 4.06 per cent. These results are corroborated with the findings Roy and Vadodoria (2006), Guru *et al.* (2006) [11] and Tike (2007) [28].

3.7 Carbohydrates
The overall carbohydrate content of Pantja goat milk was 5.09 per cent and it was ranged from 4.34 to 5.95 per cent. These results are in agreement with Miklic and Rogelj (2000). However values are slightly lower than that of reported by Maree (2003) [20], Kuchick and Sedlackovba (2003).

3.8 Water
The overall water content of Pantja goat milk was 85.27 per cent and it was ranged from 84.47 to 86.91 per cent. The average water content recorded in this study was in close agreement with the results reported by Sanyal (1993) [26], however Gelais *et al.* (2003) [9] reported a higher level of water content in goat milk as 88.0 and 88.4 per cent, respectively.

3.9 Ash
The overall total ash content in the Pantja goat milk was 0.78 per cent and it was ranged from 0.70 to 0.85 per cent. The result is in confirmation with Haenlein (2002) [13] and Maree (2003) [20].

3.10 pH
The overall pH content of Pantja goat milk was 6.44 and it was ranged from 6.47 to 6.54. Somewhat similar pH was reported by Patil (1982) [24], Fandlalan and Davide (2001) [6-7].

3.11 Titratable acidity
In the present investigation the overall titratable acidity noticed in the Pantja goat milk was 0.129 per cent and it ranged from 0.124 to 0.138 per cent. The results are in confirmation with the results reported by Chornobai *et al.* (1999) [5] and Fandialan and Davide (2001) [6-7].

4. Conclusions
The colour of Pantja goat milk was perfect white and overall average composition of Pantja goat milk i.e. water, fats, protein, carbohydrates, total solids, solids not fat, ash, titratable acidity, specific gravity and pH was 85.27, 4.96, 3.82, 5.09, 14.73, 10.06, 0.78, 0.130 per cent, 1.036 g/ml and 6.44, respectively.

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