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Mineral analysis of Pantja goat milk through atomic absorption spectroscopy

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Abstract

Goat is universally recognized as "Poor man's cow". It is a very versatile animal because of short generation interval, browsing habit, low investment, and high rate of 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 purpose of this research study is to analyze the presence of major and minor minerals in fresh Pantja goat milk. Atomic absorption spectroscopy was used in the analysis of minerals. The overall average minerals (mg/L) content of Pantja goat milk i.e. Calcium 893.06; Magnesium 114.78; Phosphorus 1122.26; Potassium 1168.49; Sodium 635.35; Zinc 2.36; Manganese 0.137; Selenium 0.013 and Iron 0.50, respectively.

Keywords: Mineral, pantja, goat milk

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) [3]. 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) [7]. 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) [8]. Goat milk has higher medicinal value than any other milk and it also contains 4.4 percent fats, 0.137 percent Calcium, 0.112 percent Phosphorus, 0.017 percent Magnesium, 0.170 percent potassium and 3.4 percent milk protein (Holmes *et al.*, 1946). 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) [2]. 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) [22]. 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). 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) ^[6].

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 Sample preparation

Determination of minerals includes digestion of milk sample which was done by adding 50 ml of 24% TCA to 5ml of each milk sample in a volumetric flask. The samples were mixed at 5-6 minutes interval for 30 minutes, and then each sample was centrifuged at 4000 rpm for 5 minutes. Then each sample was filtered using filter paper and filtrate was collected in the Stoppard bottle for further Atomic Absorption analysis. For running the samples on Atomic absorption, different parameters were maintained like Pressure and Temperature. The temperature was fixed at the range of 2500 °C and Pressure of air at the range of 6Psi and the Pressure of Acetylene is 2Psi. After the fixation of parameters, standards of various ppm (parts per million) for each sample were used first. After the standards, different digested samples of different ranges were used for the analysis of the various minerals. Each sample gave a different concentration of minerals one by one serially in µg/ml.

3. Result and Discussion

3.1 Calcium

The Calcium content of milk samples varied from 877.95 to 908.05 mg/L with an average value of 893.06 which is lesser than the reference value of 1,200 mg/L and 1342 mg/L suggested by Underwood (1981) ^[21] and Guler (2007) ^[5]. Khan *et al.* (2006) ^[14] and Garcia *et al.* (2006) ^[4] have reported 701 mg/L and 340 mg/L that is higher calcium content in goat milk.

3.2 Magnesium

The magnesium content of milk samples varied from 111.28 to 117.56 mg/L with an average value of 114.78 which is lower than the reference values 140 mg/L (Haenlein, 2001) ^[18] and 160 mg/L (Park *et al.*, 2007) ^[17].

3.3 Phosphorus

The phosphorus content of milk samples varied from 1116.38 to 1128.79 mg/L with an average value of 1122.26 which is close with the reference value of 1110 mg/L (Haenlein, 2001) ^[18]. (Park *et al.*, 2007) ^[17] has reported 1210 mg/L more phosphorus content in goat milk.

3.4 Potassium

Potassium concentration in milk ranged from 1163.67 to 1171.71 mg/L with an average value of 1168.48 mg/L. Underwood (1981) ^[21] has reported 1500 mg/L higher potassium content in goat milk. The potassium content of caprine milk was lesser than 1240 mg/L and 1690 mg/L as reported by Garcia *et al.* (2006) ^[4] and Mestawet *et al.* (2012) in different goat species.

3.5 Sodium

The sodium content of milk samples varied from 632.76 to 638.54 mg/L with an average value of 635.35 and was higher than the reference value of 500 mg/L (Underwood 1981) ^[21]. Sodium content in goat milk was 454 mg/L and 510 mg/L more than reported by Khan *et al.* (2006) ^[14] and Garcia *et al.* (2006) ^[4].

3.6 Manganese

The manganese content of milk samples varied from 0.143 to 0.152 mg/L with an average value of 0.137 which is lower than the reference value of 0.320 mg/L (Park *et al.*, 2007) ^[17].

3.7 Zinc

Zinc concentration in the milk varied from 2.33 to 2.40 mg/L with an average value of 2.36 mg/L which is close with reference value of 2.13 mg/L of Croatian goat (Slacanac *et al.*, 2011). Underwood (1981) ^[21] and Mestawet *et al.* (2012) has reported 4.0 mg/L and 5.47 mg/L more zinc content in goat milk.

3.8 Selenium

Selenium concentration in the Pantja goat milk ranged from 0.012 to 0.016 mg/L with an average value of 0.0130 mg/L which is close with reference value of 0.0133 mg/L (Park *et al.* 2007) ^[17].

3.9 Iron

Iron concentration in the milk ranged from 0.20 to 0.80 mg/L with an average value of 0.050 mg/L which is close with reference value of 0.40 mg/L (Miles *et al.*, 2001). Guler (2007) ^[5] has reported 3.88 mg/L higher iron content in goat milk.

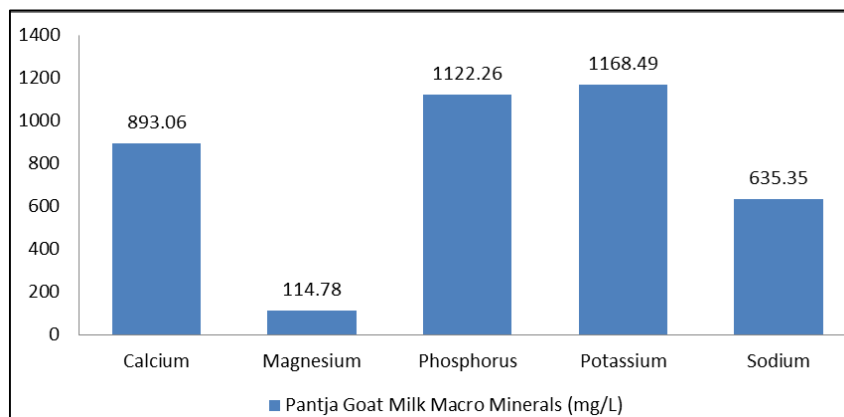


Fig 1: Macro minerals in Pantja goat milk (mg/L)

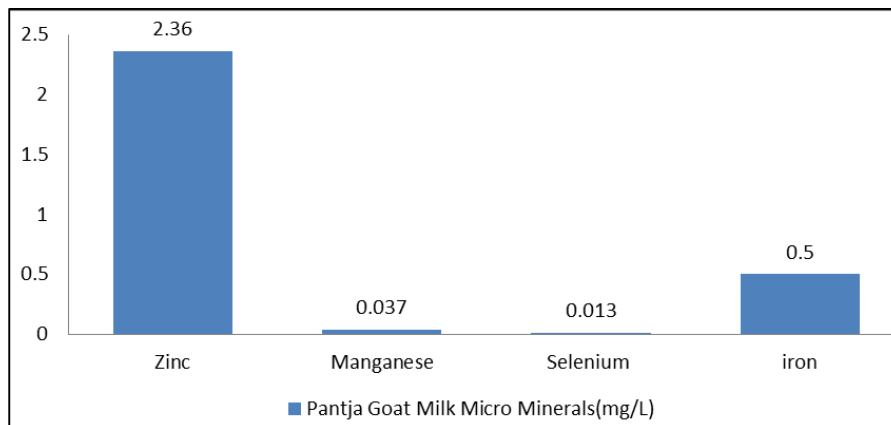


Fig 2: Micro minerals in Pantja goat milk (mg/L)

4. Conclusion

The overall average minerals (mg/L) content of Pantja goat milk i.e. Calcium 893.06; Magnesium 114.78; Phosphorus 1122.26; Potassium 1168.49; Sodium 635.35; Zinc 2.36; Manganese 0.137; Selenium 0.013 and Iron 0.50, respectively.

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