

Comparative Aspects of Goat and Cow Milk

Rashmi Arora¹, N Bhojak^{2*} Rajani Joshi³

¹Research scholar Singhania University, Jhunjhunu, Rajasthan

^{2*}GCRC, Govt Dungar College (A Grade), MGS University, Bikaner

³Animal health department govt. Veterinary College Bikaner

ABSTRACT: *The aim of this study is to show the importance and significance of goat milk. Goat is known as poor man's cow. It plays a vital role in the socio-economic structure of rural poor. Goat milk contains higher amount of Ca, Mg and P than cow and human milk but vitamin D, vitamin B₁₂ and folate contents are less. Although fat and protein is somewhat low in goat milk than cow milk, but there is a non significant difference between fat, protein and lactose content of cow's and goat's milk, but fat globules are smaller in goat milk so they are easily digestible. Goat milk is recommended for infants, old and convalescent people. In this review the nutritive value and medicinal value of goat milk is discussed in comparison with cow's milk.*

Keywords— Goatmilk, poorman's cow, fat, protein, lactose, folate.

I. INTRODUCTION

Goats form an important component of livestock industry and play a vital role in the socio-economic structure of rural poor. India has the second highest goat population in the world which is around 120 million constituting about 15% of World's goat population only next to China (FAO, 2004). There are twenty well defined breeds of goats in India, although 70% population are non-descript and meat type. Some of the breeds such as Jamunapuri, Barbari, Beetal, Surti, Jakhrana produce fairly good amount of milk. Goats in India produce around 2.76 million tonnes of milk which is 22.28% of World's production and 3% of total milk produced in the country (FAO, 2004)(1)

Goats produce about 2% of the world's total annual milk supply. (2) Dairy goats in their prime (generally around the third or fourth lactation cycle) average 6 to 8 lb (2.7 to 3.6 kg) of milk production daily (roughly 3 to 4 US quarts (2.7 to 3.6 liters)) during a ten-month lactation, producing more just after freshening and gradually dropping in production toward the end of their lactation. The milk generally averages 3.5% butterfat. (3)

II. MATERIAL AND METHOD

Material: (a) Milk: Forty raw milk (twenty cow's and twenty buffalo's) samples were collected from different private dairy of Bikaner in sterile bottles,

Method of analysis

(a) Chemical Analysis: The process of chemical analysis of milk samples was based on ISI standard methods. For the chemical analysis of milk Fat, Gerber method was used (IS 1224-1958). Protein in the milk samples was estimated by Kjeldahl's Method (ISI Handbook of food analysis Part-I, 1980)(4). Lactose was estimated by Fehling solution (ISI Handbook of Food Analysis Part-11, 1981)(5). The pH value was measured by using digital pH meter (Labtronics Model No. LT11). Acidity was measured by titration method (ISI Handbook of Food Analysis Part-11, 1981) in terms of lactic acid percentage. All these readings were cross checked by Milkoscan (FT 120).

(b) Statistical analysis: The statistical analysis was carried out using T-Test method. The significant difference between means was calculated.

III. RESULT AND DISCUSSION

This study shows that fat of cow's milk was in the range of 3.79% while the goat milk's fat was in the range of 3.73%. The protein of cow and goat's milk was respectively in the range of 2.98 and 3.02. The Lactose was in the range of 4.55 and 4.45% for cow and goat's milk, so there is no significant difference between cow and goat milk composition but different studies show that goat milk is still better and easily digestible because of size of its fat globule and type of amino acid present in its protein.

The differences in physico-chemical, medical, nutritional, biological, radioactivity and immunological aspects of goat and sheep milk was studied by J.M. Jandal. The Solids in goat milk can range from 12 to 18%, and Proteins within the solids are between 3 and 4.5% in Goat milk. (6)

The fat of goat milk is more digestible than that of cow milk because the fat globules of goat milk are smaller and have a greater surface area, and lipases in the gut are supposedly able to attack the lipids more rapidly. However, almost 20% of the fatty acids of goat milk fall into the short-chain fatty acids category (C4:O to C12:O) compared with 10- 20% for cow milk. Lipases attack the ester linkages of the shorter-chain fatty acids more readily, so these differences may contribute to more rapid digestion of goat milk fat (7).

The proteins in goat milk are digested more readily and their constituent amino acids absorbed more efficiently than those of cow milk (8)

A Metabolism trials were carried out with two groups of male, weaned Wistar rats to determine the Nutritional value of the goat and cow milk protein. The food intake, growth rates and protein efficiency ratio did not differ significantly between the two groups ($P > 0.05$). However, nitrogen digestibility and balance of diets were higher ($P < 0.05$) in the group given the goat milk protein diet. So E. Ramos Morales *et al* concluded by this paper that the nutritional value of goat milk protein is higher than that of cow milk. (9)

Mauro Fisberg *et al* have carried out to evaluate the effect of the daily intake of goat's milk with modified protein or lipid profile on the health and nutritional status of preschoolers. Children receiving treatments MFGM and GM presented significantly higher weight gain ($6.44 \pm 3.54\%$ and $6.46 \pm 5.08\%$, respectively) than the others. In addition, children receiving treatment MFGM showed an increase in hemoglobin from 11.71 ± 1.03 g/dL to 12.29 ± 0.43 g/dL ($p=0.023$). Children fed goat's milk showed an increase in red blood cells. Treatment MFGM was the best alternative to replace regular goat's milk, with an improvement in haematological parameters. (10)

The possible differences between goats and cow milk, the importance and usefulness of processed goats milk and products were discussed by Omo Ohiokpehai, the acidity of that of goat milk is slightly lower than that of the cow, i.e. pH 6.4 as compared to pH 6.7 the four major components of goat milk are lactose, fat, nitrogen compounds and minerals. These components are also similar to that of cows milk. However, the goat milk contains more small fat globules, i.e. globules of less than 1.5 μ m in size. These small globules are compared to that of the cow the percentage is 28 and 10 respectively. It had been showed that goat milk is better digested than cows milk. Therefore, consuming goat milk is very useful for both adult and growing children; Processing of goat milk will preserve and improve the nutritive value of the milk; (11)

IV. TABLES

Table 1 BASIC COMPOSITION OF VARIOUS MILKS (MEAN VALUES PER 100G)(12)

| Constituent | Doe (Goat) | Cow |
|------------------|------------|------|
| Fat (g) | 3.8 | 3.6 |
| Protein (g) | 3.5 | 3.3 |
| Lactose (g) | 4.1 | 4.6 |
| Ash (g) | 0.8 | 0.7 |
| Total solids (g) | 12.2 | 12.3 |
| Calories | 70 | 69 |

Table 2 MILK COMPOSITION ANALYSIS, PER 100 GRAMS (13)

| CONSTITUENTS | UNIT | COW | DOE (GOAT) |
|-----------------------------|------|------|------------|
| Water | g | 87.8 | 88.9 |
| Protein | g | 3.2 | 3.1 |
| Fat | g | 3.9 | 3.5 |
| Carbohydrate | g | 4.8 | 4.4 |
| Energy | kcal | 66 | 60 |
| Energy | kJ | 275 | 253 |
| Sugars (lactose) | g | 4.8 | 4.4 |
| Cholesterol | mg | 14 | 10 |
| Calcium | IU | 120 | 100 |
| Saturated fatty acids | g | 2.4 | 2.3 |
| Monounsaturated fatty acids | g | 1.1 | 0.8 |
| Polyunsaturated fatty acids | g | 0.1 | 0.1 |

These compositions vary by breed, animal, and point in the lactation period.

Table 3: chemical composition (%) of goat's and cow's milk samples

| Item | Cow's milk Mean ± SD | Goat's milk Mean ± SD |
|---------|----------------------|-----------------------|
| Fat | 3.79 ± 0.202245 | 3.73 ± 1.972332 |
| T.P. | 2.98 ± 0.373432 | 3.02 ± 0.590274 |
| Lactose | 4.55 ± 0.72112 | 4.45 ± 0.519626 |

Table 4: T Test for cow and goat milk FAT

| Parameter | Fat | |
|----------------|-------------|-----------|
| | Cow | Goat |
| Source of Milk | Cow | Goat |
| No. of Samples | 20 | 20 |
| Min-Max | 3.33 – 4.09 | 1.17_3.92 |
| Mean | 3.79 | 3.73 |
| S.D. | 0.202245 | 1.972332 |
| Combined SD | 0.454857 | |
| T Value | 0.118719 | |

Min. = Minimum, Max. = Maximum, SD = Standard Deviation.

T > 1.96 Significant, T < 1.96 Non-Significant

Table 5: T Test for cow and goat milk protein

| Parameter | Protein | |
|----------------|------------|-------------|
| | Cow | Goat |
| Source of Milk | Cow | Goat |
| No. of Samples | 20 | 20 |
| Min-Max | 2.2 – 3.57 | 2.10 – 4.33 |
| Mean | 2.9815 | 3.0215 |
| S.D. | 0.373432 | 0.590274 |
| Combined SD | 0.160242 | |
| T Value | 0.249619 | |

Min. = Minimum, Max. = Maximum, SD = Standard Deviation

T > 1.96 Significant: T < 1.96 Non-Significant:

Table 6: T Test for cow and goat milk Lactose

| Parameter | Lactose | |
|----------------|------------|-------------|
| Source of Milk | Cow | Goat |
| No. of Samples | 20 | 20 |
| Min-Max | 2.2 – 3.57 | 2.90 – 5.19 |
| Mean | 4.5545 | 4.451501 |
| S.D. | 0.721121 | 0.519626 |
| Combined SD | 0.203913 | |
| T Value | 0.505112 | |

Min. = Minimum, Max. = Maximum, SD = Standard Deviation>

1.96 Significant: t<1.96 Non-Significant:

V. CONCLUSION

It is concluded by above study that nutritive value of goat milk and cow milk is not significantly different but the size of fat globule is smaller for goat milk which increases the digestibility and nutritive importance of goat milk.

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