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## EVALUATION OF SUITABILITY OF GOAT MILK IN PREPARATION OF GHEWAR: AN INDIAN DELICACY

Shital Sahebrao Deosarkar\* and Ashok Manoharrao Patil  
 Deptt. of Dairy Science, Chhatrapati Shivaji College, Udgir Distt. Latur  
 \*MAFSU, Deptt. of Dairy Technology, Warud, Pusad 445204

**Abstract:** The present investigation was undertaken to evaluate the suitability of goat milk for the preparation of Ghewar, a traditional Indian sweet delicacy, and to compare its quality attributes with conventional buffalo milk-based Ghewar. Rabri used as a topping and impregnation medium was prepared using different proportions of goat milk and buffalo milk. The resulting products were assessed for physicochemical composition, textural properties, sensory attributes, microbiological quality, and storage stability. Significant ( $P < 0.05$ ) differences were observed among treatments with respect to fat, protein, total solids, texture, and sensory characteristics. Incorporation of goat milk improved protein digestibility and mineral content but reduced fat and total solids. Ghewar prepared with Rabri containing 75% goat milk and 25% buffalo milk exhibited the highest overall acceptability score ( $8.58 \pm 0.11$ ). The developed product demonstrated acceptable microbiological quality during refrigerated storage for seven days. The findings indicate that goat milk can be successfully utilized in the preparation of value-added Ghewar with improved nutritional characteristics.

**Keywords:** Goat milk, Ghewar, Traditional dairy products, Functional foods, Indigenous sweets, Value addition

### Introduction

Traditional Indian dairy products constitute an important segment of the food industry and play a significant role in the utilization of milk produced in the country. Among indigenous sweets, Ghewar is a popular disc-shaped confection traditionally prepared from refined wheat flour, ghee, and sugar syrup, often garnished with Rabri, nuts, and spices. Conventionally, Rabri used in Ghewar preparation is manufactured from buffalo milk because of its high fat content and superior body and texture characteristics. However, increasing consumer awareness regarding health, digestibility, and functional attributes has stimulated interest in the use of alternative milk sources.

Goat milk has gained considerable scientific attention owing to its superior digestibility, lower allergenicity, smaller fat globule size, and high concentrations of medium-chain fatty acids. It is also recognized as a valuable source of bioavailable calcium, phosphorus, magnesium, and vitamins (Haenlein, 2004; Park *et al.*, 2007).

Despite its nutritional advantages, utilization of goat milk in traditional Indian sweets remains limited because of its characteristic flavor and comparatively lower total solids content. Development of goat milk-based traditional products may provide new avenues for diversification of goat milk utilization and enhance the income of smallholder farmers. Scientific literature on the incorporation of goat milk in Ghewar manufacture is scarce. Therefore, the present study was undertaken to evaluate the suitability of goat milk for preparation of Ghewar and identify the optimum level of incorporation.

### Materials and Methods

**Procurement of Raw Materials:** Fresh goat milk was obtained from healthy lactating goats maintained at the local goat farms in the vicinity of Udgir Distt. Latur. Buffalo milk was procured and stored at the Deptt. of Dairy Science, Chhatrapati Shivaji College, Udgir Distt. Latur (Maharashtra). Wheat flour, ghee, sugar, nuts, and other ingredients were purchased from local markets.

### Experimental Design

The Rabri topping was prepared using different proportions of goat milk and buffalo milk.

Treatment	Goat Milk (%)	Buffalo Milk (%)
T <sub>0</sub>	0	100
T <sub>1</sub>	25	75
T <sub>2</sub>	50	50
T <sub>3</sub>	75	25
T <sub>4</sub>	100	0

### Composition of Raw Milk

**Table 1. Composition of Milk Used for Rabri Preparation**

Parameter	Goat Milk	Buffalo Milk
Fat (%)	4.15±0.08	6.52±0.12
Protein (%)	3.48±0.06	3.94±0.05
Lactose (%)	4.30±0.05	4.82±0.04
Total Solids (%)	12.72±0.18	16.48±0.20
Ash (%)	0.83±0.02	0.79±0.01

**Preparation of Ghewar:** Ghewar batter was prepared using refined wheat flour, ghee, chilled water, and ice according to standardized procedures. The batter was poured into hot ghee at 180±5°C to obtain the characteristic honeycomb structure. Fried Ghewar discs were immersed in sugar syrup (60°Brix) for 2 min and cooled. Rabri prepared from different milk combinations was applied uniformly over the Ghewar surface at 15% of product weight.

**Preparation of Rabri:** Milk was heated in shallow pans and concentrated to approximately one-third of its original volume with continuous scraping to collect layers. Sugar was added at 6% of the original milk volume. The product was cooled to room temperature and applied to Ghewar.

**Physicochemical Analysis:** The finished products were analyzed by applying AOAC (2016) methods as herein under:

- Moisture (%)
- Fat (%)
- Protein (%)
- Ash (%)
- Total solids (%)
- Acidity (% lactic acid)
- pH

**Texture Profile Analysis:** Texture analysis included hardness, crispness and fracturability.

**Sensory Evaluation:** A panel of ten semi-trained judges evaluated the products using a 9-point hedonic scale for:

- Color and appearance
- Flavor
- Body and texture
- Sweetness
- Overall acceptability

**Microbiological Analysis :** Standard plate count, yeast and mold count, and coliform count were determined according to standard methods.

**Statistical Analysis:** Data were analyzed using Completely Randomized Design (CRD). Significant differences among means were tested at P<0.05.

## Results and Discussion

### Physicochemical Composition

**Table 2. Physicochemical Characteristics of Goat Milk Ghewar**

Treatment	Moisture (%)	Fat (%)	Protein (%)	Total Solids (%)	Ash (%)
T <sub>0</sub>	18.2±0.22	21.6±0.28	8.24±0.10	81.8±0.22	1.42±0.03
T <sub>1</sub>	18.8±0.20	20.8±0.24	8.42±0.12	81.2±0.20	1.48±0.02
T <sub>2</sub>	19.4±0.18	20.1±0.22	8.58±0.11	80.6±0.18	1.54±0.03
T <sub>3</sub>	20.2±0.24	19.2±0.20	8.76±0.10	79.8±0.24	1.60±0.04
T <sub>4</sub>	21.1±0.26	18.4±0.18	8.94±0.12	78.9±0.26	1.68±0.03

Increasing levels of goat milk significantly increased protein and ash contents while reducing fat and total solids.

### Texture Characteristics

**Table 3. Texture Profile Analysis of Ghewar**

Treatment	Hardness (N)	Crispness (N)	Fracturability (N)
T <sub>0</sub>	12.8±0.36	9.42±0.24	10.4±0.28
T <sub>1</sub>	12.2±0.34	9.56±0.26	10.2±0.22
T <sub>2</sub>	11.8±0.30	9.74±0.22	9.96±0.24
T <sub>3</sub>	11.4±0.28	9.86±0.20	9.72±0.20
T <sub>4</sub>	10.8±0.24	9.92±0.18	9.48±0.18

The reduction in hardness with increasing goat milk incorporation may be attributed to smaller fat globule size and altered protein interactions.

### Sensory Evaluation

**Table 4. Sensory Scores of Goat Milk Ghewar**

Treatment	Color and Appearance	Flavor	Body and Texture	Overall Acceptability
T <sub>0</sub>	8.56±0.12	8.48±0.14	8.62±0.10	8.54±0.11
T <sub>1</sub>	8.54±0.10	8.52±0.12	8.58±0.11	8.56±0.10
T <sub>2</sub>	8.48±0.11	8.46±0.10	8.50±0.12	8.48±0.11
T <sub>3</sub>	8.60±0.09	8.64±0.10	8.52±0.10	8.58±0.11
T <sub>4</sub>	8.22±0.14	7.88±0.18	8.16±0.14	8.08±0.15

Treatment T<sub>3</sub> received the highest overall acceptability score. Pure goat milk Ghewar exhibited slightly lower flavor scores owing to the characteristic goaty note.

### Microbiological Quality

**Table 5. Microbiological Quality of Ghewar During Refrigerated Storage**

Treatment	Standard Plate Count (log cfu/g) Day 0	Day 7
T <sub>0</sub>	2.84±0.08	3.42±0.10
T <sub>3</sub>	2.76±0.06	3.28±0.08

No coliform organisms were detected in any treatment throughout storage.

The present investigation demonstrated that goat milk can be effectively utilized in the preparation of Ghewar through incorporation into Rabri. The lower fat and total solids content of goat milk influenced the physicochemical characteristics of the final product. However, the smaller fat globule size and higher protein digestibility of goat milk contributed positively to texture and nutritional quality.

Partial replacement of buffalo milk with goat milk successfully reduced the characteristic goaty flavor while preserving the nutritional advantages associated with goat milk. The higher ash content observed in goat milk-based products indicates enhanced mineral density, which may improve the nutritional value of Ghewar.

**Industrial Significance:** Development of goat milk Ghewar offers several advantages:

- Diversification of goat milk utilization.
- Value addition to traditional sweets.
- Enhanced nutritional quality.
- Increased income opportunities for goat farmers.
- Development of premium niche dairy products.

### Conclusion

The present study established the suitability of goat milk for preparation of Ghewar. Incorporation of goat milk through Rabri significantly improved protein and mineral contents without adversely affecting sensory quality. Ghewar prepared with Rabri containing 75% goat milk and 25% buffalo milk exhibited optimum physicochemical and sensory characteristics and was identified as the most acceptable formulation. The developed product has considerable potential for commercialization as a functional and value-added traditional dairy delicacy.

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