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DEVELOPMENT, STANDARDIZATION AND QUALITY EVALUATION OF (RTE) GOAT MILK SHRIKHAND

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Abstract: Shrikhand is a semi-soft, sweetish-sour Indian dairy dish that is made with whole milk. It has a considerable quantity of milk protein and phospholipids and is created from lactic acid fermentation by *Lactobacillus bulgaricus, Streptococcus lactic, Lactobacillus citrovorum, and Streptococcus thermopiles*. Shrikhand is prepared by using chakka which is produced by combining strained yogurt/curd, sugar and other ingredients in a coarse blender. It is nutrient dense, just like fermented milk products. It's refreshing, similar to *Dahi* (curd), and especially good in the heat. It is popular because to its distinct flavour, taste, and edible qualities, as well as the possibility of therapeutic benefits. The goat milk shrikhand was prepared using goat milk, date paste, jaggery powder, cardamom powder and probiotic culture. Three formulations (T1, T2 and T3) of goat milk shrikhand were prepared with different formulation of date paste (40%, 30% and 20%) and jaggery powder (10%, 20% and 30%). The goat milk shrikhand with T2 formulation with 30% date paste and 20% jaggery powder was seen to be best on the basis of sensory evaluation like taste, texture, colour, flavour, consistency and overall acceptability. The selected goat milk shrikhand was evaluated for physiochemical, microbial and sensory properties.

Keywords: Goat milk, chakka, date paste, shrikhand, sensory evaluation.

I. Introduction: Food habits and cooking methods in India are massively changes in last few years because of urbanization, changes in culture and social modification. Due to busy life pressure on peoples, they preferred easy and low time-consuming cooking methods and quick cooked products. Consumers are mostly attracted to RTE and REC snacks in recent five years which is fastest growing food sector because of their convenience. Different types of food are come under RTE products such as sweet, salted, fried, canned food, fast food, baked food, dried or preserved food, extruded food, etc. Demand for Ready-to-Eat meals has captured a large amount of the food retail market in India. The market for ready to eat/cook food products in India are stood at 261million in 2017 and it will be increases and rich at 647 million in 2023 and grow over 16% CAGR rate (Temgire et al., 2021).

Goat is one of the main contributors of milk and meat products. Goat milk is different from cow and other milk in composition, nutritional and therapeutic attributes. Goat milk contains higher amount of Ca, Mg and P than cow and other milk but vitamin D, vitamin B12 and folate contents are less. It is recommended for infants, old and convalescent people. The flavour of goat's milk (goaty flavour) is more intense in comparison to cow's milk, which can restrict the acceptance of its derivatives by consumers. Goat milk offers superior digestibility, alkalinity, buffering capacity, therapeutic benefits in medicine and human nutrition, antimicrobial properties, anticarcinogenic effect, and is used for malabsorption disorders, diabetes, and cardiovascular disease (Yadav et al., 2016).

The gross composition of goat milk is higher than that in bovine milk, except for lactose which is low. Fat globules are smaller and probably one of the reasons for easy digestion of this milk. Its products are high source of protein, fat, phosphate and calcium. Its composition varies with factors such as diet, breed, environment, and management. Goat's milk is the most complete food known which is highly compatible and nourishing natural food. So, it is highly nutritious that it can actually serve as a substitute for a meal. It is also preferred due to its low-fat content and its capability to neutralize the acids and toxins present in the body (Getaneh G et al., 2016).

According to Singh et.al, India occupies the first position in global goat milk production (6.09 million tonnes) and in India goat is 3rd (3% of total milk) largest milk contributing species. The top five goat milk producing states are Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat and Maharashtra accounting for 79.5% of total goat milk production. Goat milk output in India is probably higher than what is shown in official figures because a significant portion of the milk is consumed at home and isn't documented for marketing. However, milk productivity stays constant throughout the year, averaging 0.46 kg/day/goat over the past ten years. There have been constant increases in the estimated 218 million dairy goats in the world as of 2017. At present, goat milk marketing structure does not exist and milk in country side is being sold at very low price (25-35 per litre) which made dairy goat farming uneconomic. However, dairy goat farming may grow very fast in organized manner by providing reasonable price (60/litre) of goat milk to farmers. It may make commercial dairy goat farming at par or better than commercial goat meat production (Singh et al., 2023).

Table 1: Nutritional composition of goat milk (Getaneh G et al., 2016)

Composition	Percent
Total Solid	13.9
Fat	4.8
Protein	3.7
Lactose	5.0
Ash (Minerals)	0.85

Shrikhand is a most indigenous fermented and sweetened milk product having a typical pleasant sweet-sour taste. Shrikhand has originated in western India. Shrikhand in Sanskrit means "Sandal". Shrikhand, derived from curd, is rich in milk constituents like casein, minerals, fat-soluble vitamins and B complex vitamin like

riboflavin and folic acid. Shrikhand is ethnic fermented milk food assumes special importance due to its pleasant taste. And it is also very popular in Indian states i.e. Maharashtra, Gujarat, Karnataka and along Rajasthan because of its high nutritive, therapeutic value, characteristics flavour and taste and palatable nature. Shrikhand, a well-known product, is known for its superior shelf-life due to its preparation process using lactic acid fermentation (Dhanmeher et al., 2022)

Date palm (Phoenix dactylifera L.) a flowering plant species, is cultivated for its sweet fruit, dates, which provide essential vitamins, carbohydrates, proteins and minerals. They are rich in polyphenols and functional dietary fibres, aiding digestion. Increased awareness of the health benefits of dates could boost their commercial and nutritive importance in the growing demand for natural, cheap food (Sharma et al.,2022).

Jaggery (Gur), a natural sweetener, is produced by concentrating the sweet juice of palm trees or sugarcane. It is preferred over white sugar for sweet dishes due to its unique characteristic. Jaggery contain protein, minerals, vitamins, iron, copper and is a potent source of iron and copper. It is an energy food, purifying blood and regulating liver function. It is a natural sweetener and has a sweet, winy fragrance and flavour. It has a heady aroma and a delicious flavour, somewhere between brown sugar and molasses. As a form of sugar, it forms an important item of diet and is either consumed directly or as a sweetening agent for sweet preparation (Hirpara et al.,2020).

II. Materials and Methodology:

The research work was conducted in the Food Science Laboratory at SNDT College of Home Science, Pune a conducted college of SNDT Women's University, Mumbai

2.1 Material:

2.1.1 Raw materials required for study:

The raw materials required for this study were goat milk, date paste, jaggery powder, cardamom powder and starter culture.

2.1.2 Packaging material used:

Polypropylene cups were used to store the shrikhand as it has good water vapour resistance, good moisture and gas barrier properties and are being used commercially on a large scale.

2.2 Methodology:

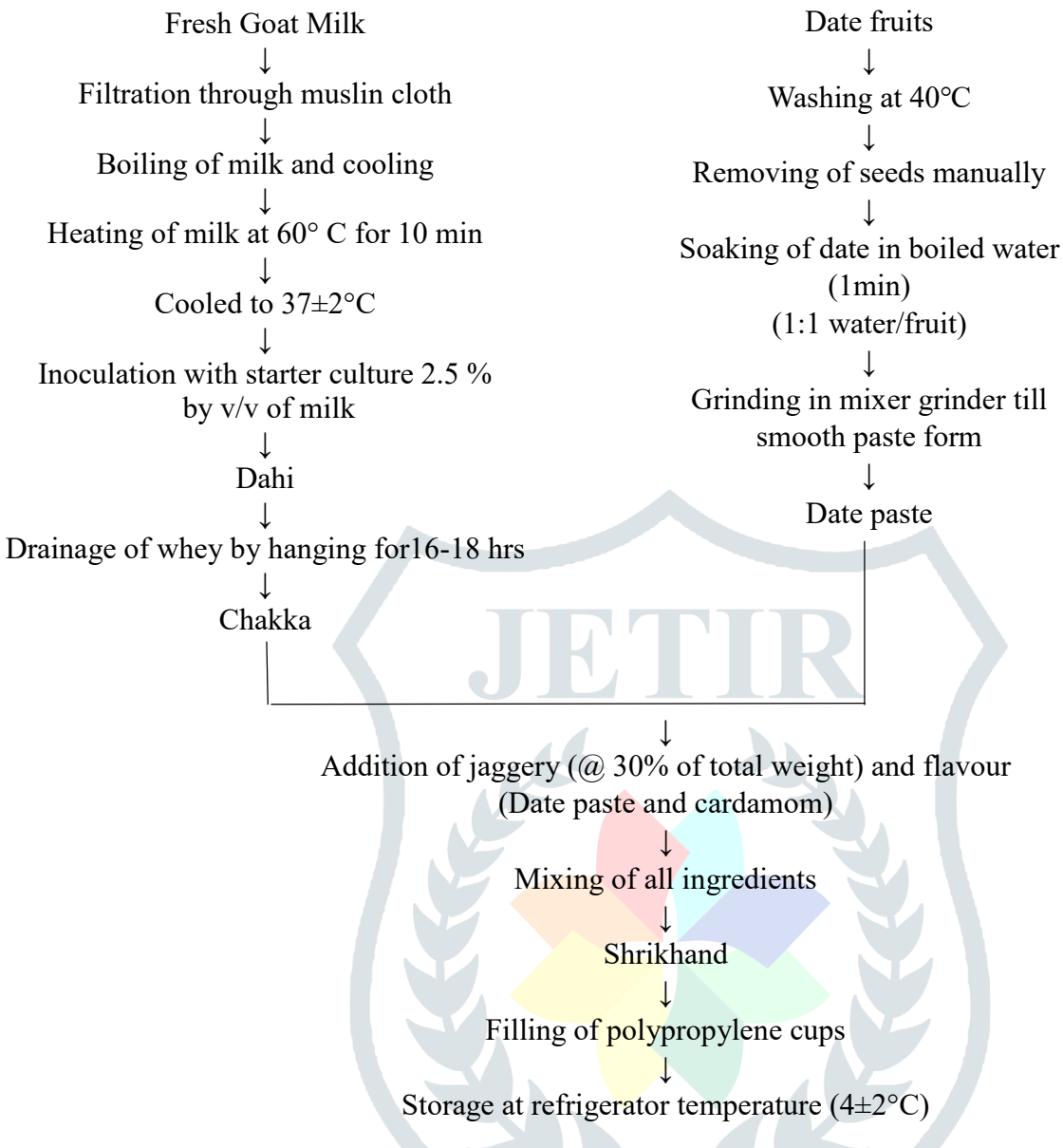

Figure 1: Flowsheet for preparation of goat milk shrikhand

2.2.1 Trial details:

Table 2: Trial details with various variations in ingredients

Ingredients	Trial 1	Trial 2	Trial 3
Chakka	25	25	25
Date paste	5	15	10
Jaggery powder	20	10	15
Cardamom	-	0.60	0.60

2.2.2 Proximate analysis, sensory evaluation and shelf-life study:

Proximate analysis was conducted for parameters such as total solids, moisture content, reducing sugar, acidity as lactic acid, carbohydrate and protein. The analytical test was performed using standard methods.

The sensory evaluation was carried as per the experimental sampling protocol. 30 untrained panel members for sensory evaluation. A 5-point Hedonic Rating Scale was used for the parameters: Taste, Texture, Flavour, Colour, Consistency and Overall Acceptability.

The scoring key used was: 5- Liked extremely, 4- Liked moderately, 3- Neither liked nor disliked, 2- Disliked moderately and 1-Disliked extremely

The prepared goat milk shrikhand were packed in PP cups and stored in refrigerated condition. The sample were stored for 30 days to study the shelf-life and determined the best before for shrikhand. The moisture content, reducing sugar, acidity as lactic acid, yeast and mold, coliform count and sensory evaluation were carried out on 0^{th}, 7^{th}, 14^{th}, 21^{st}, 28^{th} days.

III. Results and Discussion:

3.1 Organoleptic Evaluation:

The data for organoleptic evaluation of three trials reveals that amongst the trials there was a highly significance difference in consistency (p 0.004); a significant difference in texture and flavour (p 0.03) and no significant difference in taste, colour and overall acceptability ($p \geq 0.05$).

Table 3: Organoleptic evaluation of goat milk shrikhand for taste, texture, flavour, colour, consistency and overall acceptability (Score out of 5)

Characteristics	Mean±SD			F-Test	P value
	Trial 1	Trial 2	Trial 3		
Taste	3.70± 0.44	4.40± 0.54	4.30± 0.27	3.739	0.05
Texture	3.70± 0.57	4.30± 0.27	4.40± 0.22	4.778	0.03
Flavour	3.70± 0.27	4.10± 0.22	4.10± 0.22	4.571	0.03
Colour	3.90± 0.54	4.20± 0.27	4.20± 0.27	1.000	0.33
Consistency	3.50± 0.50	4.50± 0.35	4.20± 0.27	8.778	0.004
Overall acceptability	3.90± 0.54	4.10± 0.22	4.10± 0.22	0.500	0.619

A significant higher score for taste (4.40) and consistency (4.50) was recorded for the goat milk shrikhand with addition of cardamom powder (trial 2), whereas the lowest score recorded for trial 1. A significant higher score for flavour (4.10) and colour (4.20) was recorded for goat milk shrikhand.

The goat milk shrikhand were most accepted when the cardamom powder was added according to the result of sensory evaluation. Cardamom powder overcome the goaty flavour of goat milk and enhance the flavour of shrikhand.

3.2 Proximate Analysis:

Table 4: Results of proximate analysis of goat milk shrikhand.

Parameters	**0th day**	**7th day**	**14th day**	**21st day**	**28th day**
Moisture %	46.95	47.24	49.81	50.38	54.63
Total solids %	53.05	52.76	50.19	49.62	45.37
Acidity as lactic acid %	1.62	1.224	1.224	0.99	0.657
Reducing sugar %	35.40	31.50	26.88	23.24	18.21

The moisture content of goat milk shrikhand is increase from 46.95% to 54.63%. One of the reasons is that jaggery being hygroscopic in nature and another one is date paste which contain high percent of moisture. The moisture content value found in this experiment is comparable to certain other findings from Deshmukh et al., (2022) investigation into the physio-chemical characteristics of shrikhand combined with date pulp.

Total solids are the term used to describe the dry substance that is left over after moisture has been removed. According to the current observation, the proportion of total solids in goat milk shrikhand decreased as the percentage of moisture increased. The present investigation was similar to some other findings works. Deshmukh et al., (2022) studied on physio-chemical characteristics of shrikhand combined with date pulp. The observation found that increased the percentage moisture declined the percentage of total solids.

During the storage period, the starter culture of goat milk shrikhand progressively transformed lactose into lactic acid and other organic acids, causing a steady decrease in titratable acidity. As per the research conducted by Sivasankari R. et al. (2017) on the Standardization and Evaluation of Probiotic Shrikhand, a noteworthy reduction in pH was observed in every sample during storage, which could potentially be attributed to a rise in acidity during storage. From the finding, it can be inferred that there is a decrease in acidity in goat milk shrikhand as a result of an increase in pH.

There was a little decrease in the amount of reducing sugar in goat milk shrikhand during the study because lactic acid bacteria require sugar for fermentation, the synthesis of cellular energy, and the creation of lactate, or lactic acids, during storage. Similar research was conducted by Srinivas, J. et al. (2017), they discovered that all cases had increasing reducing sugar concentrations when sucrose levels decreased, which may be related to sucrose breakdown. The observation above makes it evident that there is no sucrose breakdown, which results in a decrease in the amount of sugar in goat milk shrikhand.

3.3 Microbial Analysis:

Table 5: Results for microbial analysis of goat milk shrikhand

Sr. No.	Storage days	Yeast and mold count (cfu/gm)	Enumeration of coliform count (cfu/gm)
1	0^{th} day	No growth	Nil
2	7^{th} day	No growth	Nil
3	14^{th} day	2×10^7	Nil
4	21^{st} day	2×10^7	Nil
5	28^{th} day	4×10^7	3×10^7

From the data presented in above table, it is observed that yeast and mold is increasing after 14 days during storage period of 30 days. The microbial load is less which may be due to the inhibitory effect of low temperature on the growth of microorganisms. Similar results were observed by Salunke et al. (2005), Microbiological quality of shrikhand sold in Maharashtra State. They reported that the average value of yeast and mold count in shrikhand ranged between 3.52 to 5.24 log cfu/gm. According to Food Safety and Standards regulations (2010), the yeast and mold count of shrikhand should not be more than 50 cfu/g. The developed product conformed to the legal standard.

In prepared goat milk shrikhand the coliform count was nil which indicates that hygienic conditions adapted during manufacturing as well as the sanitation was carried out which was adequate. But after 21 day the count was seen to be increase may due to some unhygienic practices during analysis. According to Food Safety and Standards regulations (2010), coliform count of shrikhand should not be more than 10 cfu/g. The prepared product conforms to the standard.

Conclusion: Milk, a nutrient-dense food, is consumed by around 6 billion people worldwide. It provides energy, high-quality protein, and essential micronutrients like calcium, magnesium, potassium, zinc, and phosphorus. Dairy products are also crucial for strong bones. Goat milk, rich in fat, protein, lactose, vitamins, enzymes, and mineral salts, is particularly beneficial for those with lactose intolerance. It is particularly suitable for infant foods and should be promoted in developing countries like India, where malnutrition and poverty are prevalent. The study aimed to develop an Indian-flavoured goat milk shrikhand enriched with date paste and jaggery powder, improving its keeping quality through appropriate packaging and storage conditions. The market for dairy products and milk is expanding, with goat milk offering significant economic opportunities due to health benefits. Adding unique flavours or combining with Indian recipes could differentiate it. Future production of goat milk products, such as shrikhand wadi, could be a promising development.

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