UTILIZATION OF KHAJUR (*Phoenix dactylifera*) CRUSH IN PREPARATION OF RABRI

THESIS

Submitted to
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
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(DAIRY SCIENCE)

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Enrolment Number- PP-3308

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DECLARATION OF STUDENT

I here by declare that the experimental work and its interpretation of the thesis entitled **"UTILIZATION OF KHAJUR (*Phoenix dactylifera*) CRUSH IN PREPARATION OF RABRI"** or part there of has neither been submitted for any other degree or diploma of any University, nor the data have been derived from any thesis / publication of any University or Scientific Organization. The source of materials used and all assistance received during the course of investigation have been duly acknowledged.

Place : Akola
Date: / / 2019

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CERTIFICATE

This is to certify that the thesis entitled **"UTILIZATION OF KHAJUR (*Phoenix dactylifera*) CRUSH IN PREPARATION OF RABRI"** submitted in partial fulfilment of the requirement for the degree of **Master of Science In Agriculture (Animal Husbandry and Dairy Science)** in **Dairy Science** of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafide research work carried out by **KAHANDAL SACHINKUMAR SHIVAJI** under my guidance and supervision.

The subject of thesis has been approved by the Student's Advisory Committee.

Place : Akola
Date : / / 2019

(Dr. R.R.SHELKE)
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THESIS APPROVED BY THE STUDENT'S ADVISORY COMMITTEE INCLUDING EXTERNAL EXAMINER (AFTER VIVA–VOCE)

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%	:	Per cent
/	:	Per
^{0}C	:	Degree Celsius
@	:	At the rate of
BIS	:	Bureau of Indian Standard
C.D.	:	Critical difference
et al.	:	et alia (and others)
etc.	:	et cetera (and other things)
FFA	:	Free Fatty Acids
Fig.	:	Figure
G	:	Gram
i.e.	:	that is
IS	:	Indian Standard
Kg	:	Kilogram
Min	:	Minutes
Ppm	:	Parts Per Million
Rs	:	Rupees
SE	:	Standard error
SNF	:	Solid not fat
TS	:	Total Solids
viz.	:	Namely

(E) THESIS ABSTRACT

a)	**Title of the thesis**	: **"Utilization of Khajur (*Phoenix dactylifera*) crush in Preparation of Rabri.",**
b)	**Full name of student**	: **KAHANDAL SACHINKUMAR SHIVAJI**
c)	**Name and address of Major Advisor**	: **Dr. R. R. Shelke** Asstt. Professor, Department of AHDS, Dr.PDKV, Akola
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ABSTRACT

The present investigation entitled "**Utilization of khajur (*Phoenix dactylifera*) crush in preparation of *rabri***" was conducted at Department of Animal Husbandry and Dairy Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola with a view to study the chemical composition, to evaluate the sensory quality and to estimate the cost of khajur ***rabri*** during the year 2018-2019.

The chemical composition of khajur rabri was determined, in respect to fat ,protein, total sugar, ash, moisture and total solid. Sensory evaluation was carried out with the help of panel of judges in respect to colour and appearance, flavor, body and texture and overall acceptibility. Cost of preparation of khajur *rabri* was carried out by considering the prevailing market price for different constituent of milk *rabri.*

Present investigation was carried out with five treatments and five replications. The treatment details were T_1 control sample, T_2 (97 per cent *rabri* + 3 per cent khajur crush), T_3 (94 per cent *rabri* + 6 per cent khajur crush), T_4 (91 per cent *rabri* + 9 per cent khajur crush), and T_5 (88 per cent *rabri* + 12 per cent khajur crush).

During the chemical analysis it was revealed that the fat content of khajur *rabri* was 19.88, 19.20, 18.09, 17.17 and 16.26. 17.02, 17.15, 17.28, 17.41, 17.53, Ash content was 3.02, 2.91, 2.73, 2.62, 2.51, moisture content was 44.18, 43.75, 43.26, 42.88, 42.26 and total solids content was 55.82, 56.25, 56.74, 57.12, 57.74, for the treatment T_1, T_2, T_3, T_4 and T_5 respectively. In short fat, protein and Ash were normally decreased while total sugar, moisture and total solid were increased with increase in levels of khajur crush.

For sensory evaluation the results revealed that overall acceptability scores obtained were 7.11, 7.52, 7.89, 7.14, and 6.76 for the treatment T_1, T_2, T_3, T_4 and T_5 respectively. The treatment T_3 scored significantly highest scores for flavour, colour and appearance, consistency and overall acceptability which were found superior amongst all the treatments. The khajur crush prepared from all combinations of buffalo milk *rabri* was found acceptable. The cost of production per kg of khajur rabri was slightly decreased with increase in rate of addition of khajur crush percentage. i.e. Rs. 162.41 (T_1), Rs. 160.10 (T_2), Rs. 157.37 (T_3), Rs. 155.23 (T_4) and Rs. 152.73 (T_5).

It can be concluded that khajur crush is very well suitable for preparation of *rabri*. Khajur *rabri* provide all essential nutrients and also relished a person who does not like milk directly or as such.

CHAPTER I

INTRODUCTION

1.1 Background Information

Ancient written records and reports indicates that milk is important food. The use of milk was known from epic Mahabharata and Veda. Shrikrishna also pay attention towards animal rearing, during earlier years, each household in the country maintained its as “Family cow’’.

Milk has a high nutritive value hence it is an ideal food. It supplies body building protein, bone forming minerals, health giving vitamins and furnishes energy providing lactose and milk fat. All this properties make milk an important food for every age of human being.

Milk has been recognised as a complete food by nutritionists all over the world. It has all the ingredients and nutrients necessary for growth and maintenance of a healthy human body. Modern science as well ancient Indian texts and scriptures are full of references eulogizing the virtues of milk as a complete food. Indian scripture have been described milk as the elixir of life or Amrita.

Since time immemorial, a significant proportion of milk has been used in India for preparing wide variety of dairy delicacies- an unending array of sweets and other specialities from different regions of the country. In the process, the basic limitation of milk- its perishable nature has been tastefully overcome. Its processing aims to extend the shelf life of milk, while converting it to mouth watering tit-bits.Thus, diverse method to prepare as well as preserve milk products have been developed. About 50-55 per cent of milk produced in India is converted in to variety of the traditional milk product. Over the millennia, these processes have largely remained unchanged, being in the hands of *halwais*, the traditional sweet meat makers, who forms the core of this cottage industry.

In India, consumption of milk and milk products can be dated back to the times of Lord Krishna whom rendezvous with Gopikas and stealthy eating of butter and *dahi* has been gloriously described. It proves the point that milk and milk products have been ‘assimilated’ into Indian

culture and ethos. No wonder then that today India has the largest population of livestock and stands to produce more milk than any other country in the world. The milk production is growing at an appreciable rate of 4.5-6 per cent against world average of about one per cent (Dairy India Year book, 2007).

Indian dairying is emerging at an important growth level of the Indian economy. It is the single largest contributor to Agriculture sector (17%) in India, contributing about 8% to Gross Domestic Product. Milk production in India has increased fivefold in the last fifty years and it continues to be number one in the world (Gakkhar *et al.,* 2015).

Globally, India- with its 142.0 million tonnes milk production enjoys numerous position in terms of milk production (NDDB, 2016). However, it lags behind when it comes to processing milk for tradable products. At the same time, the world is eyeing India as their future market.

Milk is a highly perishable commodity and easily gets contaminated with all kind of microorganisms and cannot be stored for a great length of time. The remaining surplus can be conveniently converted into concentrated milk product like *Rabri* which is most liked by the people.

The lower heat capacity and the higher thermal conductivity and thermal expansion of buffalo milk clearly indicate that a lower amount of heat energy is required to achieve certain desired heat effects in buffalo milk as compared to cow's milk. Therefore, time–temperature combinations for its heat processing may have to be standardized and suitably modified to get the desired effect. (Sindhu and Arora, 2011).

De (1989) reported indigenous method of *rabri* making while Gayen and Pal (1991) reported small scale and large scale process of *rabri* making. Aneja (1992) and Anantakrishnan *et al.,* (1993) reported simmering method more or less similar to indigenous method. Therefore, simmering method was compared with concentration method to assess the quality of *rabri.* (Singh *et al.,*2014).

The fruits which are popular among the Indians, if added to the milk shake, not only improve the acceptability among average Indian

people but also improve its nutritional quality with the addition of essential vitamin and mineral. At the same time, it will give good market to the preserved food product which is ultimately going to help the farming community engaged in fruit production, preservation and also dairy production.

Presently, herbal products either in the form of cosmetics or foods has become more popular in the world market. In fact, people are now suffering from various diseases. American dietic association noted that regular consumption of fruits, vegetables, whole grains and other foods containing anti-oxidants can provide protection against certain disease (Pszczola, 2001).

The date palm has been a multipurpose species since it was first domesticated some 6,000 years ago. In modern times, significant progress has been made in the development of direct and derived date fruit products and the utilization of by-products from packing and processing; however, comparatively minor attention has been given to date palm products other than the fruits. By highlighting the multipurpose character of five major economic palm species, this paper attempts to broaden the thinking about how other nonfruit and fruit products can be developed. General economic benefits can be derived from broader utilization of all parts of the date palm. Additional socio-economic benefits will also accrue to date farmers in terms of expanding the number of saleable products they produce, and diversifying their income sources.One key recommendation is that the excellent study Date Palm Products (Barreveld, 1993) be updated in light of the numerp ous ublished studies over the past two decades. The revision should also place greater emphasis on nonfruit products and include relevant research on comparable palm species.(Johnson Dennis, 2012)

1.2 Importance and Need of study

Practices of converting milk into various milk products have developed years ago. The Indian milk production system is getting a pull according to the demands of the segmentized milk products market. Currently, 46 per cent of the total milk produced in the country is consumed

as fluid milk and remaining 54 per cent is converted into the different milk products (Hemlata and Reddy, 2001). Thus the conversion of milk into various milk products has become the golden mean between supply and demand of milk. India's milk output during the year 2015 - 16 reached the level of 135 million tonnes, providing per capita availability of 263 g per day. About 50 per cent of this milk is converted into variety of indigenous products like *dahi, shrikhand, chhana, paneer, makkhan, ghee, khoa and khoa* based sweets etc. India is largest milk producing country in the world with production of 146.3 million metric tones in year 2014-15. Milk production and consumption has been on a continuous rise for last few years. Milk output shows absolute increase from 17.5 million metric tones in 1950-51 to 53.9 million metric tones in 1990-91 and after that 137.7 million metric tones in 2013-14 and now it is 146.3 million metric tones in 2014-15 (Anonymous, 2016). India ranked first in the world in total milk production.

Incorporation of fruit and fruit product in the milk products to, render good flavour, increasing palatability and nutritive value is a very old practice. In today's world, with the advent of new techniques in manufacturing, processing, packaging, transportation and preservation food technologists shows interest in innovating the new combinations of fruit and fruit products with popular milk products.

The important link in the post harvest chain is primary processing or value addition and the main objectives of processing are to ensure the maximum off-season availability. India is the second largest producer of fruit after China. At least 50-60 percent of the total production of fruit and vegetable in the country lost due to poor harvest management and low capacity of processing.

1.3 Objectives of the study

However, available literature indicates that no work has been so far carried out on utilization of date fruit crush for blending in *rabri*. It was, therefore, dicide to explore the possibility of utilizing date fruit crush in preparation of *rabri*. The study aims at developing simple technology for better utilization of date fruit crush in *rabri* at domestic level. Thus,

considering above facts, the research topic entitled“Utilization of khajur (*Phoenix dactylifera*) crush in preparation of *rabri*” was selected with following objectives:-

1. To find out optimum level of khajur crush
2. To study the sensory evaluation
3. To determine the chemical composition
4. To calculate the cost structure

In India, the production centers of milk and date fruit are in remote rural areas while the consumption centers are in urban areas. Due to lack of appropriate facilities for the preservation and transportation of milk and non adoption of innovation in the post harvest technology in case of date fruit a lot of wastage and spoilage is generally observed. Considering this fact, it is need of the time to divert the attention and sincere efforts of scientists, food and dairy technologist and horticulturists towards the research and development of commercial utilization of products from khajur crush *rabri*. In view of the above constraints khajur crush *rabri* with its pleasant flavour, aroma and nutritive value is one of the answers to the above difficulties. Secondly, it also helps to increase the average consumption of milk and fruit (date fruit), which is far away from standards given by Nutritionists Advisory Committee, India.

1. 4 Hypothesis

Milk is complete food, which contain all essential nutrients. Date fruit is a nutritious as well as medicinal property also presents. The present study might be very effective for future research in order to minimize the substantial losses of fruits during the post harvest handling. There is very little research work done on processing of date fruit. Now a days value and demand of date fruit products is increasing. The hypothesis for present investigation is that fulfils the daily nutritional needs of date fruit and milk with suitable combination.

1.5 Scope and Limitations

The fruits which are popular among the Indians, if added to the milk shake, not only improve the acceptability among average Indian people but also improve its nutritional quality with the addition of essential vitamin and mineral. At the same time, it will give good market to the preserved food product which is ultimately going to help the farming community engaged in fruit production, preservation and also dairy production.

A fruit seems to be a food that has been enjoyed by the mankind since from long time back. Due to the variable climatic conditions of India, one dietary food is richly endowed with numerous kinds of fruits and vegetables. Fruits being rich in minerals, vitamins and other nutrients are easily accessible, they are of great benefit to man. Some of them are highly seasonal and perishable.The level of khajur and sugar blending may be various according to variety, stage of maturity and sweetness of Khajur (Date), time of blending, temperature of *rabri* at the time of blending and storage, hygienic condition of khajur may affect the sensory and microbial quality of product.

Thus, the conversion of milk into various milk products has become the golden mean between supply and demand of milk. Fruits being rich in minerals, vitamins and other nutrients and easily accessible, they are of great benefit to man.

CHAPTER II

REVIEW OF LITERATURE

This chapter deals with compressive review of literature, which is relevant to study. A review of literature is an essential and important part of scientific investigation. Its main purpose is to determine the previous work done and to assist in delineation of objective of hypothesis and research procedure to be followed. The related past studies on this topic are limited. Hence, along with the directly related references, indirect references are also taken into account and presented bellow.

The literature pertaining to the present investigation entitled "Utilization of khajur (*Phoenix dactylifera*) crush in preparation of *rabri*" with different aspects of the present study has been reviewed under the following captions.

2.1 Compositional and nutritional status of milk

2.2 Khajur (Date) fruit production and utilization

2. 3 Chemical composition and nutritional status of khajur (date)

2. 4 Chemical composition of Khajur crush in 100 g edible portion

2.5 Use of khajur (date) in manufacture of milk products

2.6 Technology for preparation of *rabri*

2.7 Sugar level in *rabri*

2.8 Sensory quality of *rabri*

2. 9 Chemical composition and nutritional status of *rabri*

2.10 Storage of prepared *rabri*

2.11 Cost estimated of khajur crush *rabri*

2.1 Compositional and nutritional status of milk

Joshi *et al*. (1991) stated the composition of cow, buffalo and goat milk as given below:

Type of milk	Moisture (%)	Fat (%)	Total solids (%)	Solid not fat (%)	Titratable acidity (%)
Cow	86.87	4.22	13.13	8.91	0.15
Buffalo	84.15	6.70	15.85	9.15	0.13
Goat	86.58	4.28	13.42	9.14	0.16

De (2011) reported the composition of cow and buffalo milk as:

Constituents	Buffalo milk (%)	Cow milk (%)
Water	84.2	86.6
Fat	6.6	4.6
Protein	3.9	3.4
Lactose	5.2	4.9
Ash	0.8	0.7

Jadhav Sonali (2012) observed the chemical composition of buffalo milk as:

Constituents	(%)
Total Solids	15.73
Fat	6.46
Protein	3.82
Acidity	0.14

Patil Sheetal (2012) noted the chemical composition of cow milk as:

Constituents	(%)
Total Solids	13.13
Fat	4.13
Protein	3.23
Acidity	0.14

Kadam Snehal (2014) determined the chemical composition of cow milk as:

Constituents	(%)
Total Solids	13.09
Fat	4.32
Protein	3.57
Acidity	0.131
Ash	0.77

Ghule (2015) stated the composition of buffalo milk as:

Constituent	(%)
Total Solid	16.06
Fat	6.54
Protein	4.04
Acidity	0.14
Ash	0.80

2. 2 Khajur (Date) fruit production and utilization

Date palm is one of the oldest plant cultivated by man and its origin is thought to be Mesopotamia (Iraq), Gulf region or Indus Civilization. The presence of date fruits in the excavation of Moen-jo-Daro storagevases indicates the presence of date palm cultivation in Sindh as early as 2000 B.C (Jandan, 1974). Whereas, silicified seeds or mineralized date stones of 6000 B.C have been tested from Mehargarh IB and IIB sites of Pakistan (Costantini, 1985). On the other hand some scholars believed that date palm have been brought to the Indo-Pak subcontinent by Alexander the great (Pasha *et al.,* 1972 and Nixon, 1951). While it is a general concept among scholars that dates were probably introduced in Sindh by Forces of Mohammed Bin Qasim in 712 A.D. Because, since the dawn of ancient history, the Date Palm has been an important source of food for the Arabian Peninsula (Popenoe, 1913). They threw date seeds at camping places during wars from which date palm grew and flourished in the Indus

valley.

Date palm belongs to family Arecaceae, is a monocot, perennial plant extensively cultivated for its edible sweet fruit. The fruit is a drupe known as a date. The term *Phoenix dactylifera L*. was given by Carolus Linnaeus in his binomial nomenclature in 1753. The term *Dactylifera* is derived from the Greek word “Dactylor” which means “finger”. Date palm being a dioecious plant is conventionally propagated through its offshoots because propagation through its seeds will not bring the true to type progeny of Date Palm. However Plant tissue culture is a new and fast growing method for propagation of date palm and is practicing in many date palm growing regions, including Sindh, where a well established institute namely “Date Palm Research Institute, Khairpur” is working on various aspects of date palm including its propagation through plant tissue culture.

Date Palm likes a warm climate where summers are considerably longer than winters. As per an Arabic saying the date palm should be grown with its feet in running water and its head in fire. Date Palm prefers a rainfall of 200 to 250 mm; late rains during flowering and ripening periods are harmful for date palm. Date palm requires sandy loam and clayey loam soils and can tolerate soils with high levels of salts up to 22,000 parts per million. Date Palm may reach an age of 100-150 years and height of 100-120 feet or 30 m (Gepts, 2002).

The dates in one growing season take 200-210 days from pollination to full fruit maturation (Saleem, 2004). According to Al-Hooti *et al.,* (1997) fruit maturation undergoes through four major stages, identified by their Arabic names as: *Kimri, Khalal* (Doka stage), *Rutab* (Dang stage), *Tamar* (Pind or Chuhhara stage).

Shahib *et.al*. (2003) reported that fruits (dates) of the date palm (*Phoenix dactylifera* L.) contain a high percentage of carbohydrate (total sugars, 44-88%), fat (0.2-0.5%), 15% salts and minerals, protein (2.3-5.6%), vitamins and a high percentage of dietary fibre (6.4-11.5%). The flesh of dates contains 0.2-0.5% oil, whereas the seed contains 7.7-9.7% oil. The weight of the seed is 5.6-14.2% of the date. The fatty acids occur in both flesh and seed as a range of saturated and unsaturated acids, the

seeds containing 14 types of fatty acids, but only eight of these fatty acids occur in very low concentration in the flesh. Unsaturated fatty acids include palmitoleic, oleic, linoleic and linolenic acids. The oleic acid content of the seeds varies from 41.1 to 58.8%, which suggests that the seeds of date could be used as a source of oleic acid. There are at least 15 minerals in dates. The percentage of each mineral in dried dates varies from 0.1 to 916 mg/100 g date depending on the type of mineral.

Lemlem *et.al*. (2017) mention that, Date palm production has long history in Afar Region which is mostly practiced by agro pastoralists along the Awash River. The agronomic practices of date palm production such as propagation and irrigation methods and plant spacing employed by agro pastoralists are traditional and in appropriate for the production of date palm which is inherited from generation. The agro pastoralists used local varieties that are low yielders as well as low in quality. Moreover, they are using post harvest handling practices that are not suitable for the production of high quality date fruits. Further more,date palm production in Afar Region is constrained with lack of improved varieties, high incidence of diseases, and insect pests. Continuous training, and extension services, research, and developmental interventions in the cultivation and management of date palm trees as well as handling of date fruits by the responsible stakeholders are recommended to improve the incomes and livelihoods of the agro pastoralists in the study area.

According to Bouhadi *et.al*. (2017) the interest in the fermentative production of lactic acid has increased due to the prospects of environmental friendliness and of using renewable resources instead of petrochemicals. In this context, they have judged that it is gainful to use the date juice which is with a low commercial value as a substrate for the production of lactic acid by *Streptococcus thermophilus*. Further, dates are rich in sugar ranging from 65% to 80% on dry weight basis mostly of inverted form (glucose and fructose), which can used as carbon source for the fermentation and the production of microbial biomass. The parameters optimization for lactic acid production by *S. thermophilus* grown on medium based on dates in order to improve yields is applied in this study. The

results showed that the maximum lactic acid production (36.9g/l) is obtained after the enrichment of date juice with yeast extract (15%), MgSO4 (0.5g/l), MnSO4 (0.02g/l) and K2HPO4 (1g/l).

2.3 Chemical composition and nutritional status of khajur (date) :

Anonymous (1972) metioned the chemical composition of freshly dried date as mentioned below.

Constituents	Per 100g of edible part	Constituents	Per 100g of edible part
Moisture (gm)	15.3	Phosphorus (mg)	50
Protein (gm)	2.5	Iron (mg)	7.3
Fat (gm)	0.4	Mineral matter (mg)	2.1
Carbohydrate(gm)	75.8	Nicotinic acid (mg)	0.9
Energy (kcal)	317	Carotene (mg)	44
Fiber (gm)	3.9	Thiamine (mg)	0.011
Calcium (mg)	120	Riboflavin (mg)	0.023

Further, Anonymous (1972) described the analysis of edible portion (80 per cent) of the dried hard preserved dates as: moisture 11.09 per cent; protein 2.9 per cent; fat 0.5 per cent; carbohydrates 82.9 per cent; and ash 1.8 per cent; calcium 35.9 mg; phosphorus 129.3 mg; and iron 3.4 mg, calorific value 347 cal./100 g.

Shanmugavelu (1987) mentioned nutritive value of Persian date as:

Constituents	Per 100g of edible part	Constituents	Per 100g of edible part
Moisture (gm)	26.1	Calcium (gm)	0.07
Protein (gm)	3.1	Phosphorus (gm)	0.08
Fat (gm)	0.2	Iron (gm)	0.6
Carbohydrate (gm)	70	Vitamin A (IU)	600
Mineral matter (gm)	1.3	Vitamin B (gm)	90
Energy (kcal)	283	Nicotinic acid (mg)	0.8
Fiber (gm)	2.1	Riboflavin (mg)	30

Al-Shahib *et al*. (2003) reported that the fruits of the date palm (*Phoenix dactylifera L.*) contain a high percentage of carbohydrate (total sugars, 44-88%), fat (0.2-0.5%), 15 salts and minerals, protein (2.3-5.6%), vitamins and a high percentage of dietary fiber (6.4-11.5%). The flesh of dates contains 0.2-0.5% oil, whereas the seed contains 7.7-9.7% oil.

Sahari *et al*. (2007) studied the effect of varieties on the composition of dates (*Phoenix dactylifera* L.) Thirty-four date varieties, from start of Tamar stage of maturity, were analyzed for moisture, protein, lipid and ash. The mean percent of moisture, protein, lipid and ash were 29.35, 3.3,0.42 and 2.25g/100 g (fresh weight basis), respectively. Predominant sugars were fructose (12.62-43.31 g/100 g) and glucose (16.41-54.23g/100 g, fresh weight basis).

Elleuch *et al*. (2008) analyzed the date by-products of two date palm (*Phoenix dactylifera* L.) cultivars, Deglet-Nour and Allig, from the Degach region (Tunisia), for their main chemical composition. The following values (on a dry matter basis) were obtained for fleshes of Deglet-Nour and Allig cultivars, respectively: sucrose 52.7% and 13.9%, glucose 13.7% and 29.9%, fructose 12.6% and 29.0%, total dietary fiber 14.4% and 18.4%, protein 2.1% and 3%, ash 2.5% and 2.52%. Insoluble dietary fiber, the major fraction of total dietary fiber, constituted 9.19–11.7% dry matter for Deglet-Nour and Allig, respectively.

Nath *et al.* (2008) reported that date fruits provide abundant quantities of iron, potassium, calcium, nicotinic acid and small amount of protein, copper, magnesium, chlorine, sulphur, vitamin A, B_6 and B_{12}. Date pulp contains moisture 20 per cent, sugar 60-65 per cent, fiber 2.5 per cent, protein 2 per cent and less than 2 per cent fat, mineral matter and pectic substances.

Tang *et al*. (2013) the main chemical composition of the date fruit include carbohydrate, diatary fibres, enzymes, protein, fat, minerals, vitamin, phenolic acid and carotenoids. Many studies have shown that date fruit has antioxidant, antimutagenic, anti-inflamentory, gastroprotetive, hepatoprotective, nephroprotective, anticancer and immunostimulant activities.

Rania *et al*. (2014) revealed that date varieties contained significantly varied ($P < 0.05$) amounts of total polyphenols and total flavonoids, which ranged between 35.82 and 99.34 mg gallic acid equivalent/100 g and 1.74–3.39 mg catechin equivalent/100 g, respectively. The antioxidant activities of the studied date varieties were as follows: ferric□reducing antioxidant power (FRAP) was within the range of 2.82–27.5 mmol/100 g, chelation of Fe2+ ion ranged from 54.31% to 94.98%, and scavenging of H_2O_2 ranged from 38.48% to 49.13%. There were many correlations (positive, negative, and weak) between antioxidant and mineral extractability of Sudanese date fruits.

El-Sharnouby *et al*. (2014) reported that date fruits (Tamr) contained moisture ranged from 10 to 22%, total sugars 62 to 75%, protein 2.2 to 2.7%, fiber 5 to 8%, fat 0.4 to 0.7%, ash 3.5 to 4.2%, total acidity 0.06 to 0.20%, ascorbic acid30.0 to 50.0 mg %,on dry weight basis. Date fruit as a nutritive product contains sugar substances about (70.6-76.3%), proteins (1.9-3%), fat (0.2-2.8%), minerals (1.3%) and vitamins.

Sultana *et al*. (2015) investigated the nutritional values of three different varieties (Trounja, Lagou, Gounda) of Tunisian dates available in Bangladeshi local markets. Moisture and total solids were (13.2-14.1%) and (85.9-86.8%), respectively. Ash and crude fibers contents were (2.13-2.18%) and (6.05-6.9%), respectively. The dates were rich in

carbohydrate (51.8–55.0% dry weight), while low concentrations of protein and lipid (2.0–2.2% and 0.12–0.72%, respectively). Dates represented little amounts of vitamin-A (0.7-1.2 mg%) and vitamin-C (0.7-0.9 mg%). High source of energy, as 100gm of date flesh can provide an average between (226.49-241.79) kcal. 11 minerals were determined from dates by Atomic Absorption Spectrophotometer. The predominant mineral was potassium (460-680 mg%). They contains low sodium (0.6-1.0mg%). Rich source of calcium (51-60 mg%), phosphorus (52-60 mg%) and magnesium (48-53 mg%) were found. Good source of iron (0.79-0.90 mg%), manganese (0.85-1.1 mg%), zinc (0.69-0.72 mg%), copper (0.32-0.36 mg%), chromium (0.36-0.42 mg%) and selenium (0.22-0.31 mg%) were found.

Gaikwad *et al.*(2016) reported the average dried date fruit crush contents as 74.20, 0.40, 2.70, 1.60, 6.50 and 63.00 per cent of total solids, fat, protein, ash, total fibre and total sugar, respectively

Nagvekar Shruti (2016) stated chemical composition of khajur (date) as:

Constituents	**(%)**
Total solids	76.06
Fat	0.3
Protein	4.37
Ash	1.4

Ahmed *et al*. (2017) showed that, all date varieties were rich in sugars especially glucose and fructose, minerals especially K, Fe, Na and Mg and vitamin C as well as exhibited antioxidant activity. Date syrup had no significant effect on pH value and whey syneresis of resultant yoghurt compared with control. Also, using date syrup in yoghurt manufacture had no adverse effect but may enhance the viability of starter culture. However, both the viscosity and the whiteness degree have been negatively affected by using the date syrup.

Mohamed *et al*. (2017) All date varities were rich in sugar especially glucose and fructose, mineral especially K, Fe, Na and Mg and

Vitamine C, also study fresh date varities in Egypt (Salma, Magdy and Khalas) are characterised by high content of Vitamin C, iron, phosphorous, zinc, fructose and glucose as well as antioxidant properties .

2.4 Chemical composition of khajur crush in 100 g edible portion

Mohamed et.al. (2014) showed that Sudanese date varieties contained significantly different ($P < 0.05$) amounts of moisture, ash, fiber, oil, and carbohydrates, but have almost similar amounts of protein. Moreover, results revealed that date varieties contained significantly varied ($P < 0.05$) amounts of total polyphenols and total flavonoids, which ranged between 35.82 and 99.34 mg gallic acid equivalent/100 g and 1.74–3.39 mg catechin equivalent/100 g, respectively. The antioxidant activities of the studied date varieties were as follows: ferric-reducing antioxidant power (FRAP) was within the range of 2.82–27.5 mmol/100 g, chelation of Fe ion ranged from 54.31% to 94.98%, and scavenging of H O ranged from 38.48% to 49.13%.There were many correlations (positive, negative, and weak) between antioxidant and mineral extractability of Sudanese date fruits.

2.5 Use of khajur (date) in manufacture of milk products :

Albamdan (2002) studied rheological properties of a newly formulated nutritious dairy drink from milk and date extract concentrate (Dibbs). The dibbs was extracted from three date cultivars (Khlass, Sukkari, and NubotSeif), and then added to milk in a specified amounts ranging from 2.5 to 15 ml dibbs/100 ml milk to form the sweetened and nutritious milk-dibbs drinks.

Hashim *et al.* (2009) studied the effect of fortification of date fiber on quality of yogurt. He reported that fortification with date fiber did not cause significant changes in acidity and pH of the product. Yoghurt fortified with date fiber had firmer texture (higher hardness values) and darker colour (lower L* and higher a*) as compared with control. Consumer ($P<0.05$) affected by fiber fortification.

Bhingardive K. (2009) prepared Indian dairy product i.e. Galuabjamun blended with date paste. She concluded that most

acceptable quality gulabjamun can be prepared by using 20 per cent date. There was some reduction in sugar syrup absorption in gulabjamun containing date, but the date had a positive effect on flavour acceptability.

Kadam *et al.* (2010) prepared yoghurt using two different varieties of date palm paste cultivars viz. Behri and Safri at varying levels of concentration. The efforts were made to investigate the influence of different varieties of date paste on physical properties (settling time and synersis), chemical characteristics (pH, acidity, moisture, fat, protein and total soluble solids), sensory quality (appearance, colour, flavour, taste, texture and overall acceptability). Yoghurt sample prepared with incorporation of 10% date palm paste of Safri variety resulted in superior organoleptic as well as chemical characteristics compared to other treated samples, justifying its suitability in date palm paste yoghurt preparation.

Trigueros L. and E.Sendra (2012) studied the use of such blanching water for reconstituting skim milk powder to produce low fat yogur. Physicochemical properties and antioxidant activity of two date cultivars (Medjoul and Confitera) blanching water were determined. Quality characteristics of yogurts (control, Medjoul and Confitera) were evaluated during 28 days of refrigerated storage. Results showed that Confitera blanching water is considered a good source of natural antioxidants and organic acids, and has a promising future as a functional ingredient, whereas, Medjoul blanching water had a high content of sugars. Regarding yogurt characteristics: Confitera yogurt presented highest populations of lactic acid bacteria, and gave soft gels of weak structure, Medjoul yogurts presented higher firmness and sensory scores than Confitera.

Patil S. (2012) studied on Utilization of date in manufacturing of *khoa burfi*. She concluded that the most acceptable quality of *khoa burfi* can beprepared by using 10% date.

Singh *et.al*. (2013) reported that the ripe fruits of date palm (*doka* or khalal) are used for fresh consumption and processing. Date fruit pulp is used for flavoring the bakery products. In India, limited work has been carried out on post harvest management for proper utilization of date fruits. Keeping this in view, an attempt was made to utilize *doka* stage fruits

for preparation of nutritious biscuits. The small size, astringent in taste, unfit for dry date and *pind khajoor* these can be utilized to prepare biscuits. The fruits were cut in to pieces, after removing seeds, for drying and grinding to make powder. Biscuits were prepared in bakery by adding date pulp powder in ratio of 10, 20 and 30% in wheat flour and other ingredients like sugar, milk and ghee. In control biscuits date pulp powder was not mixed. The study indicated that date biscuits prepared by adding of 10 or 20% pulp powder were suitable on organoleptic score basis for taste, flavour, appearance and acceptability as well as rich in sugars and protein from nutrition point of view.

Hossain *et al.* (2014) conducted research to test the feasibility of using date palm (*Phoenix dactylifera* L.), brown sugar as an alternative to refined cane sugar in preparing sweet *dahi*. Quality assessment tests were conducted on four different types of dahi prepared by adding different levels of date palm brown sugar, such as 10% (A), 12% (B), 14% (C) and 12% refined cane sugar (D, as control). All the samples were analyzed for organoleptic, chemical and microbiological qualities. The scores for smell and taste, body and texture, color and appearance, and total scores for four types of dahi samples showed significant differences at various levels ($p<0.01$ to $p<0.05$). It was found that scores for all the organoleptic parameters of sample B were the highest among the samples, whereas sample D obtained the lowest scores.

Gaikwad *et al*. (2016) fibre fortified *basundi* was prepared using different levels of dried crushed date fruit (*Phoenix dactylifera*) with a view to optimize the process for its manufacture and to study its chemical, sensory and microbiological qualities. Initially the preliminary trials were conducted by blending of different levels of date fruit crush viz; 0, 2, 4, 6, 8, 10 and 12% in the *Basundi* with 5% sugar to finalize the experimental treatments. The experimental treatments viz; no addition of date fruit crush (T0), addition of 2% date fruit crush (T1), 4% date fruit crush (T2), 6% date fruit crush (T3), 8% date fruit crush (T4) and addition of 10% date fruit crush (T5) with 5% sugar level. Experimental *basundi* samples were analyzed for sensory, chemical and microbiological qualities. The mean sensory score for color and appearance, body and texture, flavour and

overall acceptability ranged from 6.15 to 8.88, 6.15 to 8.25 and 6.13 to 8.00, respectively.

Nagvekar S. (2016) concluded that date fruit could be successfully utilized for the preparation of pantua. The most acceptable quality pantua can be prepared by using 20 per cent date. There was some reduction in sugar syrup absorption rate in pantua containing date, but the date had a positive effect on flavour acceptability and its consumption. On the basis of sensory quality use of date more than 20 per cent level for blending of pantua did not show any beneficial effect. Further, it may also be concluded that 5 hours working period is an optimum time for sugar syrup absorption in pantua. The production cost of most acceptable quality pantua (T2) was ` 203.59 per kg.

2.6 Technology for preparation of rabri :

Pawar R. (2003) studied on preparation of rabri blended with mango pulp and reported that sensory quality and acceptability of product is improved with addition of 6% mango plup blending was found more suitable in this study.She mentioned a procedure for preparation of rabri blended with mango pulp as given below-

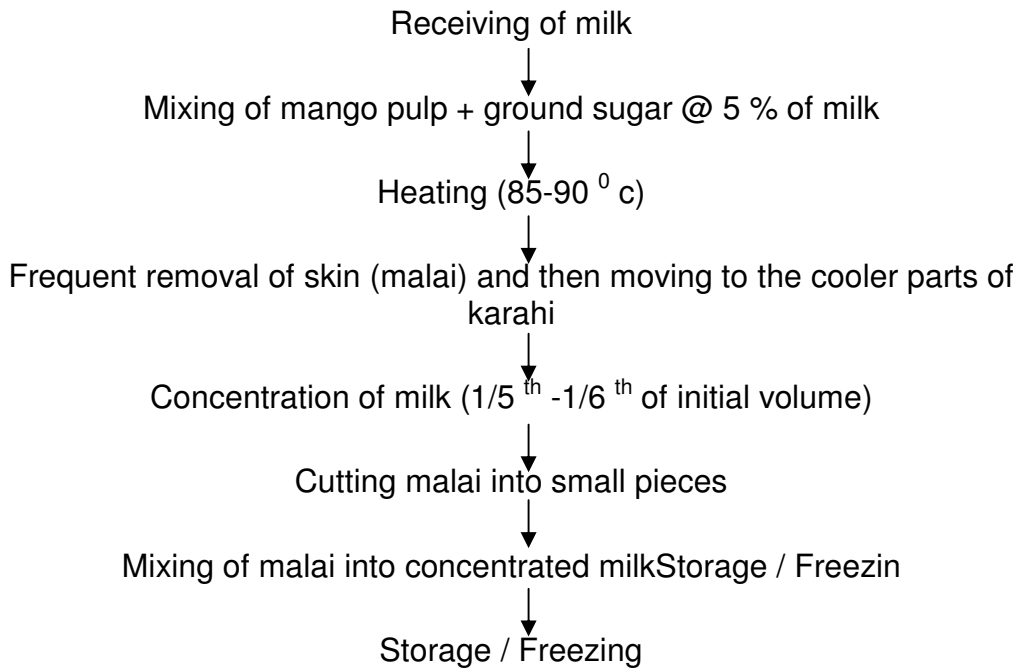

Fig. Flow Diagram for preparation of rabri

Poul et al.,(2009) prepared milk shake from different proportions of buffalo milk and custard apple pulp i.e. 100:0(T0), 90:10(T1), 85:15(T2) and 80:20(T3), The sensory score for overall acceptability of custard apple milk shake of treatments T0, T1, T2, T3 were 8.28, 8.51, 8.26 and 7.88, respectively. It was observed that the custard apple milk shake prepared from 90 parts of buffalo milk and 10 parts of custard apple pulp was most acceptable and ranked between between like very much to like extremely. The addition of higher proportion of pulp in the blend scored towards lower side by a panel of judges.

Singh *et al. (*2014) reported simmering and concentration methods of *rabri* making was compared on the basis of total manufacturing time, yield, sensory evaluation and comments of judges over physical attributes of *rabri* samples. Simmering method (A) required comparatively more manufacturing time (195±4.08 min.) than concentration method (B) (150±4.24 min.) Yields of *rabri* by these two methods were recorded to be 25.75 and 26.33 per cent respectively. rabri samples from both methods were classed as excellent but overall score was higher in case of process "B".Rabri samples produced by concentration method were having cooked, nutty, pleasing flavor, soft flakes and dark pale colour whereas, samples from simmering method were found to have slight caramelized flavour, little stiff flakes and brownish color.

Gaikwad *et al*. (2016) observed the fiber fortified *basundi* prepared using different levels of dried crushed date fruit (Phoenix dactylifera) with a view to optimize the process for its manufacture and to study its chemical, sensory and microbiological qualities. Initially the preliminary trials were conducted by blending of different levels of date fruit crush viz; 0, 2, 4, 6, 8, 10 and 12% in the *basundi* with 5% sugar to finalize the experimental treatments. The experimental treatments viz; no addition of date fruit crush (T0), addition of 2% date fruit crush (T1), 4% date fruit crush (T2), 6% date fruit crush (T3), 8% date fruit crush (T4) and addition of 10% date fruit crush (T5) with 5% sugar level. Experimental *basundi* samples were analyzed for sensory, chemical and microbiological qualities. The mean sensory score for color and appearance, body and texture, flavor

and overall acceptabilityranged from 6.15 to 8.88, 6.15 to 8.25 and 6.13 to 8.00, respectively.

Kaushik *et al*. (2016) prepared *rabri* using date syrup as sugar substitute. *Rabri* which is a highly nutritious product due to combined nutrition of date and milk. Phoenix dactyliferais a very nutritional fruit which contain about two third sugars, one-quarter of water, cellulose, pectin, ash and vitamins. On the other hand *rabri* also have very nutritive and contains all milk benefits and high calories due to 7-8 percent sugar content. As naturally we all like sugar and it provide large amount of energy for day to day life but sugar abusing is a bad habit which can lead to various serious health problems. Therefore, this study will be done to replace refined sugar with natural sugar of date. Various ratios of the date syrup has been taken pursue by the sensory evaluation. After getting a standard value of various parameter the final value was obtain Milk:date syrup (93:7) which was evaluated by 10 untrained panelist on the basis of 9 point hedonic scale and the *rabri* samples were stored at refrigeration condition (5℃). Analysis of samples were carried out at 5 days interval for physical chemical parameters.

2.7 Sugar level in *rabri*

Gayen and Pal, (1991) conducted studies to optimize the manufacturing process of *rabri* with addition of sugar @ 5, 6 and 7 per cent of initial amount of milk was studied on the acceptability of *rabri*, addition of sugar @ 6 per cent of milk produced the most acceptable product.

Chatterjee *et al.* (1994) explained the process of *rabri* preparation. The process involved heating of milk at 90 to 95℃ , repeated removal of clotted cream in a total quantity equal to approximately one-tenth of initial volume of milk, 3 fold concentration of the remaining portion, addition of sugar at level equal to 6 per cent of the initial quantity of milk and adding back to cream.

2.8 Sensory quality of *rabri* :

Pawar (2003) prepared buffalo milk *rabri* blended with mango pulp. She reported the sensory evalution of mango pulp *rabri* were as

colour 12.93 (out of 15), body and texture 29.01, 28.07 I (out of 35), flavour 35.20, 35.57 and 36.55 (out of45) and total score 82.96, 83.91 and 81.10 (out of 100) in *rabri* in which sugar was added at the level of 5, 6 and 7 per cent respectively

Patel *et al*. (2004) studied organoleptic quality of unhomogenized *rabri* and reported colour and appearance 13.25, 12.50 and 13.30 (out of 15), body and texture 31.60, 28.78 and 30.72 (out of 35), flavour 41.39, 38.97 and 37.61 (out of 45) and total score 91.23, 85.25 and 86.63 (out of 100), respectively and for homogenized *rabri* recorded colour and appearance as 13.74J 13.10 and 13.43 (out of 15), body and i texture as 32.39, 32.03 and 30.52 (out of 35), flavour as I 41.53, 39.11, 37.69 (out of 45) and total score as 92.65, 89.23 and 86.64 (out of 100) for open pan, vaccum and RO plus open pan, respectively.

Khaskheli *et al.* (2008) studied chemical and sensory quality of indigenous milk-based product "*Rabri*". The results of sensory evaluation of *rabri* were rated by panel of judges. All the attributes i.e. appearance, aroma, taste/flavour, body/texture, sweetness and acceptability were within the acceptable range. Score rated for appearance of the Rabri was in between 2.50 and 3.83 from a total score of 5, while mean score was 3.21 + 0.08. Of the total score 10, the aroma perceived the score in between 4.33 and 7.50 with a mean score of 5.43 + 0.17. The taste/flavour rated the minimum score of 16.50 and the maximum 22.83, while the average score was calculated as 18.87 + 0.28 from a total score of 30. Body/texture received the highest score of 21.50 and the lowest 14.33. Whereas mean score was computed as 18.68 + 0.29. The sweetness of *Rabri* was acceptable and perceived the score in between 4.50 and 7.00 from a total score of 10. The mean score was computed as 5.49 + 0.15. The overall acceptablity profile stood minimum score of 3.33 and the maximum 7.17 from a total score of 10. The mean score was calculated as 5.29 + 0.27.

Gaikwad *et al*. (2016) observed the fibre fortified *basundi* prepared using different levels of dried crushed date fruit (Phoenix dactylifera) with a view to optimize the process for its manufacture and to

study its chemical, sensory and microbiological qualities. Initially the preliminary trials were conducted by blending of different levels of date fruit crush viz; 0, 2, 4, 6, 8, 10 and 12% in the *basundi* with 5% sugar to finalize the experimental treatments. The experimental treatments viz; no addition of date fruit crush (T0), addition of 2% date fruit crush (T1), 4% date fruit crush (T2), 6% date fruit crush (T3), 8% date fruit crush (T4) and addition of 10% date fruit crush (T5) with 5% sugar level. Experimental basundi samples were analyzed for sensory, chemical and microbiological qualities. The mean sensory score for colour and appearance, body and texture, flavour and overall acceptability ranged from 6.15 to 8.88, 6.15 to 8.25 and 6.13 to 8.00, respectively.

2.9 Chemical composition and nutritional status of *rabri*

Aneja *et al*. (2002) reported the chemical composition of *rabri* as moisture-30 per cent, fat- 20 per cent, protein-10 per cent, sugar-20 per cent, lactose 17 per cent and ash-3 per cent.

Pawar (2003) stated the chemical composition of *rabri* without addition of mango pulp (control) as given below

Constituents	%	Constituents	%
Total Solids	55.36	Non reducing sugar	12.66
Fat	17.78	Ash	2.38
Protein	11.88	Acidity	0.26
Reducing sugar	11.37		

Khaskheli *et al*. (2008) reported the percentage of moisture content in *rabri* ranged between 24.33 to 38.85per cent, fat 16.23 to 22.55 per cent, protein 9.94 to 12.01per cent, lactose/sucrose 27.08 to 43.72 per cent and ash 2.09 to 2.84 per cent. Overall mean values were observed as 31.76±0.96 per cent, 19.42±0.33 per cent, 10.74±0.10 per cent, 35.82±0.99 per cent and 2.43±0.03 per cent for moisture, fat, protein, lactose/sucrose and ash respectively. Energy values of *rabri* varied between 315.59 to 400.15 Kcal/100g with an overall mean of 361.05±4.73 Kcal/100g.

Gaikwad *et al.* (2016) prepared fibre fortified *basundi* using different levels of dried crushed date fruit (*Phoenix dactylifera*) with a view to optimize the process for its manufacture and to study its chemical, sensory and microbiological qualities. Initially the preliminary trials were conducted by blending of different levels of date fruit crush viz; 0, 2, 4, 6, 8, 10 and 12% in the *basundi* with 5% sugar to finalize the experimental treatments. The experimental treatments viz; no addition of date fruit crush (T0), addition of 2% date fruit crush (T1), 4% date fruit crush (T2), 6% date fruit crush (T3), 8% date fruit crush (T4) and addition of 10% date fruit crush (T5) with 5% sugar level. Experimental *basundi* samples were analyzed for sensory, chemical and microbiological qualities. It was observed that basundi samples under different treatments showed significant differences ($P<0.05$) for fat, protein, total sugar, total solids, acidity, ash and total fibre content. The values were ranged from 9.05 to 10.28, 8.76 to 9.54, 24.56 to 29.24, 44.78 to 49.37 per cent, 0.31 to 0.42 per cent L. A., and 1.18 to 1.54 and 0.00 to 0.15 per cent, respectively.

Gupta *et al. (*2016) conducted a study for assessment of nutritive value of *rabri,* Over all Moisture, fat, protein, lactose, sugar, ash contents were recorded to be 40.34, 9.22, 10.73, 15.53, 21.49 and 2.86 respectively irrespective of different fat and sugar levels, whereas these values ranged from 34.59-46.45 per cent, 3.50-13.75 per cent, 9.04-12.08 per cent, 14.88-15.89 per cent, 14.15-27.24 per cent and 2.32-3.40 per cent respectively due to different fat and sugar levels on account of 5,7 and 9 per cent of sugar levels different constituents of rabri were found to be 43.70, 39.76 and 37.58 per cent moisture, 10.08,9.42 and 8.16 per cent fat, 11.66,11.01 and 9.52 per cent protein, 15.44,15.36 and 15.80 per cent lactose, 15.23,22.21and 27.04 per cent Sugar, 2.73,2.87 and 3.00 per cent ash on account of 1.5,3.0 and 4.5 per cent of fat levels different constituents of rabri were found to be 43.93,39.52 and 37.58 per cent moisture, 4.66,10.25 and 12.75 per cent fat, 10.94,10.36 and 10.89 per cent protein, 15.75,14.95 and 15.91 per cent lactose, 21.80,20.60 and 22.06 per cent Sugar, 3.35,2.66 and 2.59 per cent ash content, respectively. The effect of different fat and sugar levels were found to be

significant at 1per cent on Moisture, fat, protein, lactose, sugar, ash content of *rabri.*

Gite *et.al*. (2017) prepared rabri by using different levels of custard apple pulp (Annona squamosa L.) with a view to optimize the process for its manufacture and to study its chemical and sensory qualities. The *rabri* was prepared from different proportions of *rabri* and custard apple pulp i.e. 100:0 (R0), 80:20 (R1), 70:30 (R2), 60:40 (R3), 50:50 (R4). The mean sensory score of *rabri* was within the acceptable range.Prepared custard apple *rabri* contain 35.56% moisture,1.96 % ash, 14.6 % crude fat, 8.7 % crude protein, 39.18 % carbohydrate, 62.63 % total solid and 0.4 % acidity.

2.10 Storage of prepared Rabri

Chauhan *et al.* (2014) conducted a study to evaluate the effect of various four storage periods (0 day, 5 days, 10 days and 15 days) and four different types of milk (cow milk, buffalo milk, combined milk and skim milk) used for the preparation of *rabri*. These samples were stored at 5˚C, and evaluated the three species of microorganisms (standard plate count X 105 Cfu/g, coliform count X 102 Cfu/g and yeast and mould count X 102 Cfu/g) which were noticed during storage. This evaluation process replicated thrice. The various storage periods and four different types of milk used for the preparation of *rabri*, affected significantly at 0.1 % level of significance but the microbial populations were not affected significantly at 5% level of significance. The interaction between storage periods and milk, storage periods and microbes and milk and microbes significantly affected at the level of 0.1%. The overall interaction among storage period, milk and microbes found to be non-significant effect at 5% level of significance. The intensity of contamination was depending on types of milk and days of storage periods. The presence of total solids plays role in growth of microbes such as least number of cfu/g present in sample prepared by buffalo milk, whereas highest noticed in skim milk. The role of storage periods, as *rabri* samples got old the intensity of contamination and growth of microbes increased. Least number of cfu/g noticed at 0 day and highest at 15 days of storage. The significant increase in SPC was observed after

10 to 15 days, but non-significant growth of coliform count and yeast mould count was noticed between 0 to 10 days of storage but growth was observed after 10 days of storage. It was recommended that the best quality of *rabri* can be obtained by using buffalo milk at current day of preparation, the least microbial load was found at 0 to 10 days of storage but it would be remain consumable up to 15 days when it stored at 5˚C.

Kaushik *et al.,*(2016) stated that the changes observed in fresh sample of rabri during the storage time were decrease, pH, acidity, fat, protein but the moisture keeps increasing and the scores for sensory attributes decreases. The *rabri* using date syrup can be stored at refrigeration temperature up to 16 days and can be consumed.

2.11 Cost estimated of khajur crush *rabri*

Pawar (2003) estimated the cost structure of *rabr*i prepared using mango pulp; where the cost of sugar, mango pulp, attendant and processing was taken into account. The cost of end product was estimated at Rs. 22.37 per kg, which was mostly contributed by sugar and mango pulp.

Gaikwad (2014) reported the cost of production of the *basundi* by using Date fruit samples under different treatments was Rs. 105.00 (T_0) to Rs. 113.00 (T_5)/kg. of *basundi.*

Thaware (2016) estimated the cost structure of *rabri* prepared by using custard apple pulp; where the cost of sugar, custard apple pulp, attendant and processing was taken into account. The cost of end product was estimated at Rs. 106.50 per kg, which was mostly contributed by sugar and custard apple pulp.

Gite (2017) noted the cost of custard apple *rabri* prepared from buffalo milk. The cost of custard apple *rabri* and *basundi* was found high as compared to the market sample and the cost of 1kg of *rabri* is Rs. 165.80 respectively.

CHAPTER III

MATERIALS AND METHODS

Present investigation was undertaken to prepare "Utilization of Khajur (*Phoenix dactylifera*) crush in preparation of *Rabri*". The khajur crush *rabri* was evaluated for it's chemical composition, and overall acceptability. The cost structure of the product was also worked out. The research was conducted in the Department of Animal Husbandry and Dairy science, Dr. Panjabrao Deshmukh Krishi Vidyapith Akola. This chapter deals with various materials including ingredients and instruments used; the methods employed in the preparation of khajur *rabri* and samples with their analysis are described under the following subheadings:

3.1Material required

3.1.1 Procurement of Buffalo milk

3.1.2 Standardization of milk

3.1.3 Purchase of Khajur (Date fruits)

3.1.4 Extraction of khajur (Date fruit) pulp

3.1.5 Chemicals

3.1.6 Sugar

3.1.7 Mixer

3.1.8 Muslin cloth

3.1.9 Karahi

3.1.10 Perforated spoon

3.1.11 Weighing balance

3.2 Method

3.2.1Treatment detail

3.2.2 Preparation of khajur pulp

3.2.3Technique of preparation of *rabri*

3.2.4 Technique of preparation of khajur crush rabri

3.2.5 Sensory evaluation of khajur crush rabri

3.2.5.1 Chemical analysis of khajur crush rabri

3.2.5.2Determination of Fat

3.2.5.3Determination of Protein

3.2.5.4Determination of Lactose

3.2.5.5 Determination of ash

3.2.5.6 Determination of total solids

3.2.5.7 Determination of Moisture

3.3 Statistical Analysis

3.1Material required

The material used and methods was employed during the course of present investigation on Utilization of buffalo milk for preparation of *rabri* by using khajur crush is as follows.

3.1.1 Procurement of Buffalo milk

Clean Fresh, whole buffalo milk was procured from Livestock Instructional Farm of Department of Animal Husbandry and Dairy science, Dr. PDKV, Akola was standardized at 6% fat and utilized for preparation of *rabri* blended with khajur crush.

3.1.2 Standardization of milk

The buffalo milk was standardized for fat by using Pearson`s square method. Milk was standardized at 6% fat and utilized for preparation of *rabri* blended with khajur crush.

3.1.3 Purchase of Khajur

Good quality branded khajur (Lion) was purchased from the local market and used for the experimental purpose as per treatment. Uniform quality and brand was maintained for all replication.

3.1.4 Extraction of khajur pulp

Approximately the required amount of khajur was cleaned. and washed with clean water. The seeds was removed and Pulp was

extracted manually from well ripe fruits. The pulp extracted was converted into homogenous mass with the help of mixer.

3.1.5 Chemicals

Analytical grade chemicals was used for chemical analysis of milk, khajur crush.

3.1.6 Sugar

Clean crystalline cane sugar was purchased from local market and used as per requirement.

3.1.7 Mixer

Electric mixer (Bajaj) was used for grinding the khajur crush for blending in rabri.

3.1.8 Muslin cloth

Muslin cloth was used for filtration of milk.

3.1.9 Karahi

An iron karahi having 31cm diameter and 8.5cm depth with a capacity to hold five litres of milk was used for desiccation of milk.

3.1.10 Perforated spoon

Stainless steel perforated spoon with diameter 150 mm, length 500 mm and holes having diameter of 4 mm was used for removing clotted cream layers.

3.1.11 Weighing balance

Electronic digital balance with a precision of 0.1 mg was used for measure the weight of milk ,khajur crush, sugar etc.

3.2 Method

3.2.1 Treatment detail

Preliminary trials were conducted to find out the blending ability of khajur crush along with *rabri* to have proper body and texture. After trying different levels of khajur crush the above proportions were finalized for the study.

T_1–Rabri as per standard procedure (control)

T_2–Rabri as per standard procedure + 3% Khajur crush

T_3–Rabri as per standard procedure + 6% Khajur crush

T_4 –Rabri as per standard procedure + 9% Khajur crush

T_5–Rabri as per standard procedure + 12% Khajur crush

(as per standards sugar was added @) 6% by weight of milk)

I. Number of treatment - 5

II. Number of replication - 5

III. Design of experiment – CRD

3.2.2 Preparation of Khajur pulp

The fresh dates were washed and cleaned. The fruits were deseeded and cut into small pieces. The pulp was prepared by using electrically operated mixer cum grinder The pulp prepared was used to incorporate in the mix of *rabri* as per treatments.

3.2.3. Technique of preparation of *rabri*

Buffalo milk was normally used for preparation of *rabri* owing to its high total solid and superior taste in final product. Rabri is traditionally prepared by heating small quantity of whole milk at simmering temperature in shallow *karahi* over a open fire. The milk is slowly evaporated without being stirred with frequent scrapping at the bottom. The surface of milk simmering in *karahi* is intermittently fanned to permit formation of skin, pieces of skin which form on the surface of milk are continusely broken up and move to cooler part of *karahi*. When the desired body and texture have been developed and volume reduced to 2/4 then sugar is added. The clotted cream is immersed in the remaining concentrated milk. The whole milk was heated for short period to mix the clotted mass uniformly into the concentrated milk. The schematic flow diagram for preparation of *Rabri* will be used as given by Aneja (1997) as given below.

Milk (Standerdized at 6% fat)

↓

Filtration

↓

Heat at simmering temperature (85-90˚C) in a *karahi*

↓

Fan the surface to facilitate skim formation

↓

Break skin with wooden stick and remove to cooler part of *karahi*

↓

Reduce volume to 1/4

↓

Add sugar @ 6% of original volume of milk

↓

Immerse the layer of skin in sweetened condensed milk

↓

Heat gently for a while

↓

Rabri

↓

Cool to room temperature

↓

Mixing

↓

Store at refrigeration condition (0-4^{0}C)

Figure1: Flow sheet for Preparation of *rabri*

Plate 1.Evaporation of milk and extraction of khajur (Date fruit) crush used for preparation of rabri.

3.2.4 Technique of preparation of khajur crush *rabri*

Milk (Standerdized at 6% fat)

↓

Filtration

↓

Heat at simmering temperature (85-90^{0}C) in a *karahi*

↓

Fan the surface to facilitate skim formation

↓

Break skin with wooden stick and remove to cooler part of karahi

↓

Reduce volume to 1/4

↓

Add sugar @ 6% of original volume of milk

↓

Immerce the layer of skin in sweetened condensed milk

↓

Heat gently for a while

↓

Rabri

↓

Cool to room temperature

↓

Addition and uniform mixing of khajur crush as per treatment's

↓

Store at refrigeration condition(0-4^{0}C)

Figure 2 : Flow sheet for preparation of khajur crush rabri

3.2.5 Sensory evaluation of khajur crush *rabri*

The sample of fresh product were subjected to organoleptic evaluation. Sensory evaluation was performed by 9 point numeric score card in respect of flavour, body and texture, colour and appearance by offering sample to panel of judges selected on the basis of their judging ability. The same panel judged the sample of each trial throughout the experiment period to avoid the possibility of variation.

The 9 point numeric score card as prescribed by Pal and Gupta (1985)was used for sensory evalution as given below :

Code No.	Flavour	Colour and appearance	Consistency	Overall acceptability
I				
II				
III				
IV				
V				

3.2.5.1 Chemical analysis of khajur crush rabri

Khajur crush rabri prepared by buffalo milk and khajur crush with different treatment combinations were subjected to chemical analysis, which comprised the determination of moisture, fat, protein, lactose, ash, total solid, moisture and SNF.

3.2.5.2 Determination of Fat

Fat content of khajur rabri was determined as per Gerber's method described in IS 1224 (Part-1) 1958.

Clean and dry butyrometers was kept in butyrometer stand with open mouth up words.10 ml of H_2SO_4 was added with the help of tilt measure. Then 10 gm of sample was gently added by the sides of butyrometer with the help of pippet and 1ml of amyl alcohol was added with the help of tilt measure. The butyrometer was then stoppered. The contents of the butyrometer was mixed (shaken) thoroughly till brick red colour was obtained. The butyrometer was placed in centrifuge machine

Plate 2. Various treatment combination of khajur crushrabri

Plate 3. Sensory evaluation of khajur crushrabri by panel of judges

and revolved at a speed of 1100 rpm for 4 min. on centrifuging, after Butyrometer was removed from centrifugal machine in upright position with stopper end downwards. The fat coloumn which appered clear yellowish liquid in the stem portion was recorded. The samples were taken in duplicate.

3.2.5.3 Determination of Protein

Protein was determined as per method prescribed by Indian Standard Institute in BIS 1981 Handbook of Food Analysis, Dairy Products, Part 1.

Procedure

The representative sample of khajur crush rabri was weighed exactly 5.0 g and transferred to Kjeldahl's flask, 0.2 g of copper sulphate solid and 10 g of potassium sulphate crystals and 25 ml of concentrated sulphuric acid were added to the flask. The digestion was carried out for 3 to 4 hours, to get clear liquid. Following digestion, the flask was allowed to cool and diluted with 200 ml of ammonia free distilled water. The same was transferred quantitatively to 1000 ml conical flask. The digested material was steam distilled after the addition of 50 percent sodium hydroxide (NaOH) solution. The liberated ammonia was observed in 50 ml of 0.1 N sulphuric acid containing 2 to 3 drops of methyl red indicator. After completion of the distillation the distillate was titrated against 0.1 N sodium hydroxide (NaOH) solution. A blank determination was also carried out simultaneously and nitrogen was calculated as under.

$$\text{Percent nitrogen} = \frac{(A-B) \times 0.0014}{W} \times 100$$

Where,

A = volume in ml of N/10 NaOH in blank determination.

B = volume in ml of N/10 NaOH in the test.

W = volume in mg of sample taken.

The protein percent was calculated by multiplying nitrogen percentage with factor 6.38.

Proteinpercentage = percent total nitrogen x 6.38

3.2.5.4 Determination of lactose

The lactose per cent was determined as per the procedures, recomndedby IS : 1479 part I (1960).

3.2.5.5 Determination of ash

The ash content was determined as per the procedure described by IS 1479(PART -II), 1961. The residue (total solids) obtained in silica crucible. The crucible was transferred to 'muffle furnace'. Then it was heated gradually to 550^0C temperature for about 3 hours. On complete ashing, it was cooled in desiccator and weighted. The procedure was repeated till a constant weight was obtained.

$$\% \text{ Ash} = \frac{\text{Weight of residue (ash)}}{\text{Weight of sample}} \times 100$$

3.2.5.6 Determination of Total solids

The percentage of total solids of custard apple rabri was determined as per method given by Arora *et al*. (1992).

Procedure

I. The total Flat bottomed 50 cm diameter porcelain crucible was taken, cleaned and dried in hot air oven for 1 ½ hrs.

II. Weight of crucible was taken and added 5 g of khajur crush *rabri* sample in to it.

III. Crucible was put into hot air oven adjusted at 100^0C for 3 to 4 hours.

IV. Removed the crucible from oven and cooled in desiccators and weighted.

V. Again placed the crucible for ½ hour in oven.

VII. Afterward the crucible from oven was removed and cooled in desiccators and weighted.

VIII. This process continued / repeated till getting the constant solids were determined by formula.

$$\text{Total solids, per cent by weight} = \frac{100\ w}{W}$$

Where,

w = Weight in gm of the after drying and

W = Weight in gm of the prepared sample taken for the test

3.2.5.7. Determination of moisture

Moisture was estimated by accurately weighing the 5g sample and subjected to oven drying at 105℃ for 4 hr. It was again weighed after cooling in desiccators until constant weight. The resultant loss in weight was calculated as moisture content (AOAC, 1990).

$$\text{Moisture \%} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Weight of sample 3}} \times 100$$

3.3 Statistical Analysis

The data obtained during present investigation was statistically analyzed by adopting Completely Randomized Design (CRD) as described by Amble (1975).

CHAPTER IV

RESULTS AND DISCUSSION

The present investigation entitled “Utilization of Khajur (*Phoenix dactylifera*) crush in Preparation of *Rabri*”, was undertaken to study the utility of khajur crush in the preparation of *rabri*. The prepared *rabri* was evaluated for sensory, chemical and microbiological quality attributes. The results obtained during the course of investigation were presented and discussed in this chapter.

The khajur *rabri* thus prepared and results obtained there on are discussed under following heads :

4.1 Chemical composition of buffalo milk

4.2 Chemical composition of Khajur (Date fruit)

4.3 Sensory evaluation of Khajur *rabri*

- **4.3.1 Colour and appearance.**
- **4.3.2 Flavour.**
- **4.3.3 Body and Texture**
- **4.3.4 Overall acceptability.**

4.4 Chemical composition of Khajur *rabri*

- **4.4.1 Fat.**
- **4.4.2 Protein**
- **4.4.3 Total sugar**
- **4.4.4 Ash.**
- **4.4.5 Mosture.**
- **4.4.6 Total solid.**

4.5 Production cost of Khajur *rabri*

4.1 Chemical composition of buffalo milk

The buffalo milk was procured from Livestock Instructional Farm (LIF), Department of Animal Husbandry and Dairy Science, Akola. The milk was analyzed for fat, protein, total solids and total sugar. Result obtained were presented in Table 1.

Table 1 : Average chemical composition of buffalo milk

Constituents	%
Total solids	15.86
Fat	6.82
Protein	3.57
Total sugar	4.30

These observations indicate that the buffalo milk used in the present investigation was of good quality. It is clear from the figures of total solids, fat, protein and acidity that they lie within the limits of legal standards for buffalo milk in Maharashtra state as prescribed by PFA rules, 1976, cited by De (2015).

Following results are in agreement with present results.

Joshi *et al*. (1991) stated 6.70 and 4.22 per cent fat, 15.85 and 13.13 per cent total solids and 0.15 and 0.13 per cent acidity for buffalo and cow milk, respectively.

Dongale (2001) mentioned 6.06 per cent fat, 15.83 per cent total solids and 0.12 per cent acidity for buffalo milk.

Patil (2008) reported chemical composition of buffalo milk as 15.43, 6.14, 3.70 and 0.14 per cent for total solids, fat, protein and acidity, respectively.

De (2015) reported the average chemical composition of buffalo milk as water 84.2 per cent, fat 6.6 per cent, protein 3.9 per cent and ash 0.8 per cent, whereas for cow milk as 86.6, 4.6, 3.4, and 0.7 per cent water, fat, protein, and ash, respectively.

Ghule (2015) stated an average chemical composition of buffalo milk as total solids 16.06 per cent, fat 6.45 per cent, protein 4.04 per cent, ash 0.802 per cent and acidity 0.146 per cent.

Chorge (2016) reported chemical quality of buffalo milk as 15.53, 6.22, 3.87, 0.79 and 0.141 per cent for total solids, fat, protein, ash and acidity, respectively.

Nagvekar Shruti (2016) mentioned chemical quality of buffalo milk as total solids 15.54 per cent, fat 6.11 per cent, protein 3.6 per cent

and acidity, 0.14 per cent.

The chemical composition of buffalo milk used for the preparation of *rabri* corroborate well with the values reported by the above mentioned workers.

4.2 Chemical composition of Khajur (Date fruit)

Chemical composition reported by Nagvekar Shruti (2016) is presented in Table 2.

Table 2 : Chemical quality of khajur :

Constituents	%
Total solids	75.39
Fat	0.38
Protein	4.39
Ash	1.6

4.3 Sensory evaluation of khajur *rabri*

Sensory evaluation of any product is the best method of judging its acceptability by the consumers. The assessment was done by studying the characters like colour and appearance, flavour, consistency and overall acceptability of product by the panel of judges by using “Nine Point Hedonic Scale” score card. Each sample was bearing a code number so as to avoid its identity and have impartial results.

4.3.1 Colour and appearance

Sensory score obtained for colour and appearance of *rabri* prepared under different treatments is evaluated, tabulated and presented in Table 3 and illustrated in Fig.1.

The mean score for colour and appearance of the khajur *rabri* for treatments T_1, T_2, T_3, T_4 and T_5 was recorded as 7.37, 7.67, 7.81, 7.30 and 6.95 respectively. The data shows that treatment T_3 scored highest score followed by T_2, T_1, T_4 and T_5.

Treatment T_3 (7.81) was significantly superior over the rest of the treatments. The significant differences was observed between the treatments for colour and appearance score.

Table 3: Effect of different levels of khajur crush on colour and appearance of *Rabri*

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	7.40	7.37	7.10	7.57	7.40	7.37
T_2	7.40	8.17	7.30	7.97	7.50	7.67
T_3	7.50	7.69	8.05	8.51	7.30	7.81
T_4	6.60	7.87	7.40	7.51	7.10	7.30
T_5	7.35	6.99	6.85	6.61	6.96	6.95
F –test						Sig
SE(M)±						0.1675
CD at 5%						0.4943

It was observed that addition of khajur crush up to 6 per cent level, increases the colour and appearance score of khajur *rabri*, however addition of khajur crush beyond 6 per cent level there was decrease in the colour and appearance score of *rabri*. There were significant differences amongst all the treatments fosr colour and appearance score.

The above result are in agreement with following research works.

Pawar (2003) reported the colour and appearance of mango pulp *rabri* ranked between like very much to like extreamly 8.20 to 8.25

Gaikwad *et al.* (2015) used date fruit powder in preparation of *basundi* and noted that the score for colour and appearance is improved due to addition of date fruit powder upto 6%.

Surve (2017) reported that addition of date upto 10% increased the score for colour and appearance in milk shake.

Mete *et al.* (2017) used 20% khajoorwith honey in *burfi* and reported that score for colour and appearance of *burfi* was increased due to addition of khajur and honey.

However, Nagvekar (2016) used date pulp in preparation of *pantua* and reported that score for colour and appearance was decreased due to addition of date pulp in *pantua* which is in contrast with present

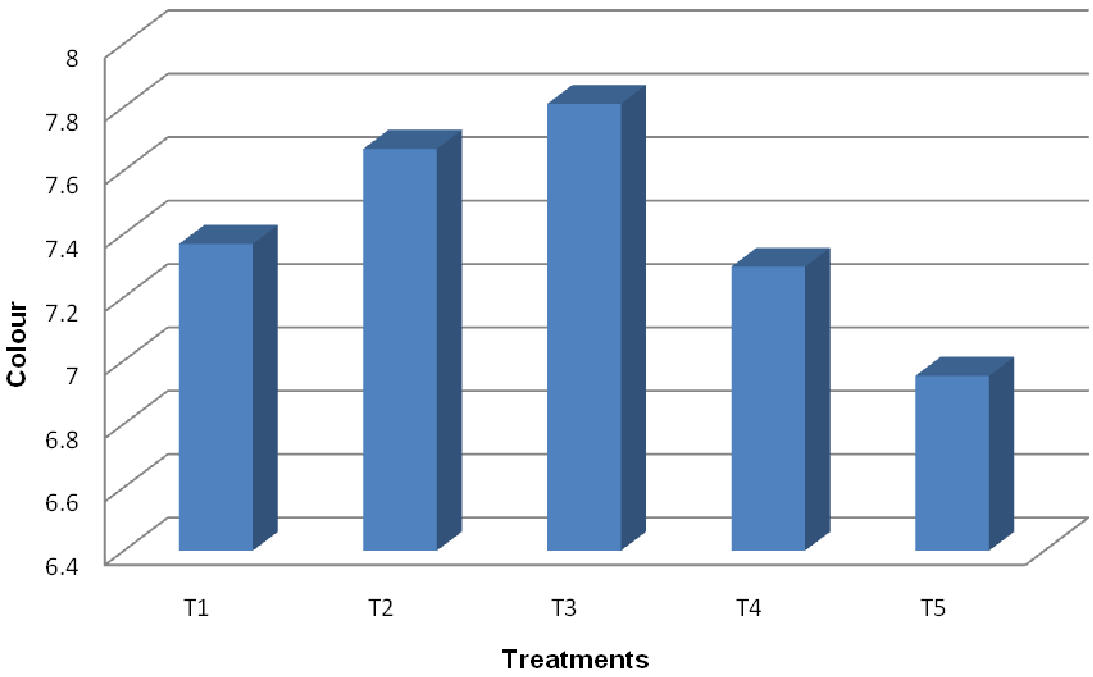

Fig.1 Effect of different level of khajur crush on colour and appearance of *rabri*.

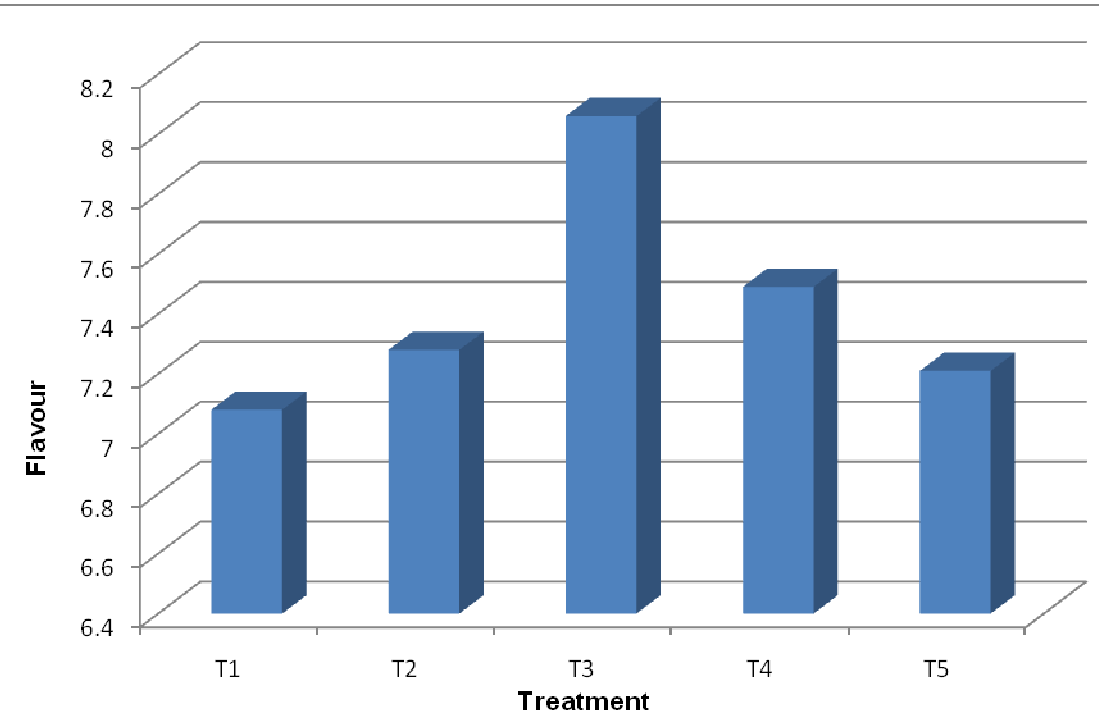

Fig. 2 Effect of different level of khajur crush on flavor of *rabri*.

result.

The reduction in score may be due to the effect of light dull colour at lower level as well as dark colour at higher level of khajur crush which was not liked by the Judges.

4.3.2 Flavour

The data pertaining to sensory score for flavour of *rabri* are given in Table 4 and illustrated in Fig. 2.

Table 4 : Effect of different levels of khajur crush on flavor of Rabri

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	6.90	7.77	6.86	6.97	6.90	7.08
T_2	7.10	6.59	7.65	7.88	7.20	7.28
T_3	7.60	8.31	8.05	8.27	8.05	8.06
T_4	6.95	7.72	7.40	7.89	7.49	7.49
T_5	7.20	7.98	7.30	7.64	7.35	7.42
F –test						Sig
SE(M)±						0.1755
CD at 5%						0.5177

From the table 4 showed mean score for flavour ranged from 7.08 to 7.42 . The score of flavour for treatments T_1, T_2, T_3, T_4 and T_5 was 7.08, 7.28, 8.06,7.49 and 7.42 respectively. The treatment T_1 scored lowest score followed by T_2, T_3, T_4 and T_5. All the treatments were ranked in between like very much to like extremely.

Treatment T_3 (8.06) was significantly superior among rest of the treatments. The significant differences was observed between flavour score of treatment T_2, T_3, T_4 and T_5

It was observed from above findings that as the levelof khajur crush increased in the blend, the flavour score of the product also increased up to the level of 6% khajur crush in the *rabri.* This might be due to pleasant flavour of khajur crush which of preferably enhanced its flavour of khajur crush *rabri.*

Khasheli *et al*. (2008) reported sensory quality of indigenous milk based product *rabri*, The flavour rated the minimum score of 16.50 and the maximum 22.83. whilst the average score was calculated as 18.87±0.28 from total score of 30.

Pawar (2003) reported the colour and appearance of mango pulp *rabri* ranked between like very much to like extreamly 8.20 to 8.25.

Chopde *et al*. (2016) reported average flavour score of *rabri* varied from 6.2 to 8.3.

Gaikwad *et al.* (2015) used date fruit powder in preparation of *basundi* and noted that the score for flavour is improved due to addition of date fruit powder upto 6%.

Surve (2017) reported that addition of date upto 10% increased the score for flavour in milk shake.

Mete *et al.* (2017) used 20% khajur with honey in *burfi* and reported that score for flavour of *burfi* was increased due to addition of khajur and honey.

However, Nagvekar (2016) used date pulp in preparation of *pantua* and reported that score for flavour was decreased due to addition of date pulp in *pantua* which is in contrast with present result.

Patel and Upadhyay (2003) stated that the buffalo milk rabri has a pleasant, cooked, nutty flavour accompanied by optimum sweetness.

4.3.3 Body and Texture

The Table 5 and Fig. 3 represent average score for texture of *rabri* prepared under different treatments.

Table 5 revealed that mean score for the body and texture attributes of khajur crush *rabri* was in the range 6.88 to 6.29. The mean score of body and texture for treatment T_1, T_2, T_3, T_4 and T_5 was 6.88, 7.57, 7.89, 6.58 and 6.29 respectively. Treatment T_2 and T_3 were significantly superior over rest of the treatments T_1, T_2 and T_3.

Treatments T_2 (7.57), T_3 (7.89) and T_4 (6.58) ranked in between like very much to like extremely. Treatment T_5 (6.29) scored in between like moderately to like very much. Addition of khajur crush in the blend beyond 6 per cent reduced the score for body and texture of the *rabri*.

Table 5 : Effect of different levels of khajur crush on body and texture of *Rabri*

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	6.90	7.10	7.0	6.53	6.88	6.88
T_2	7.30	7.52	7.60	7.94	7.50	7.57
T_3	7.70	7.99	7.60	8.36	7.80	7.89
T_4	6.80	6.80	6.30	6.40	6.60	6.58
T_5	6.60	6.25	6.25	6.17	6.20	6.29
F –test						Sig
SE(M)±						0.1045
CD at 5%						0.3083

Pawar (2003) reported the colour and appearance of mango pulp rabri ranked between like very much to like extreamly 8.20 to 8.2.

Gaikwad *et al*. (2015) used date fruit powder in preparation of *basundi* and noted that the score for texture is improved due to addition of date fruit powder upto 6%.

Surve (2017) reported that addition of date upto 10% increased the score for texture in milk shake.

Mete *et al.* (2017) used 20% khajoorwith honey in *burfi* and reported that score for texture of *burfi* was increased due to addition of khajoor and honey.

However, Nagvekar (2016) used date pulp in preparation of *pantua* and reported that score for texture was decreased due to addition of date pulp in *pantua* which is in contrast with present result.

Patel and Upadhyay (2003) mentioned that the buffalo milk *rabri* had smooth and optimum consistency with small, soft flakes.

4.3.4 Overall acceptability

The effect of khajur crush at different levels on overall acceptability of *rabri* is tabulated in Table 6 and illustrated in Fig. 4. For overall acceptability, average score obtained for colour and appearance,

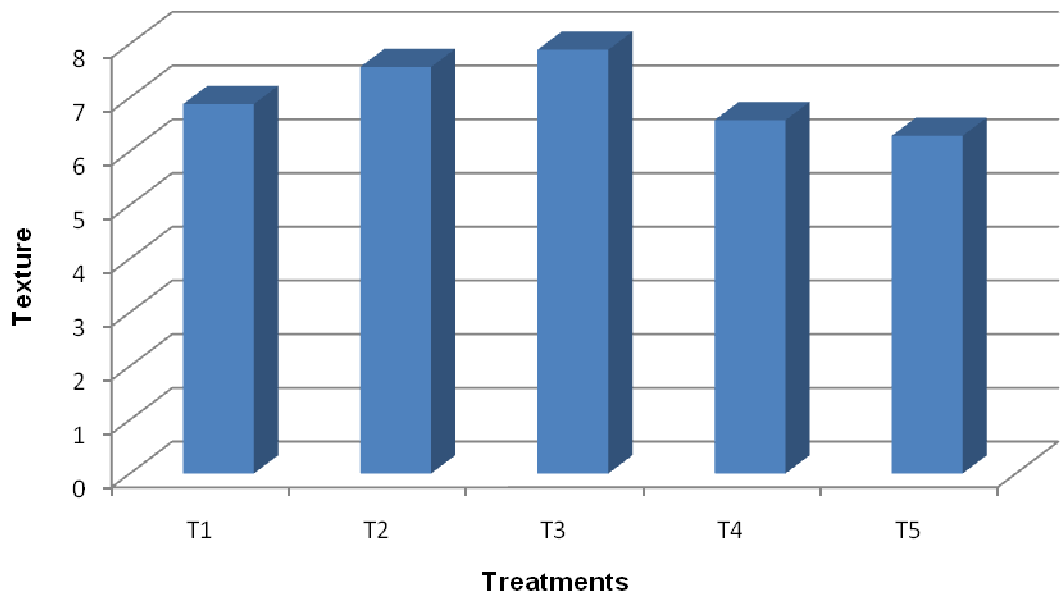

Fig. 3 Effect of different level of khajur crush on texture content of *rabri*.

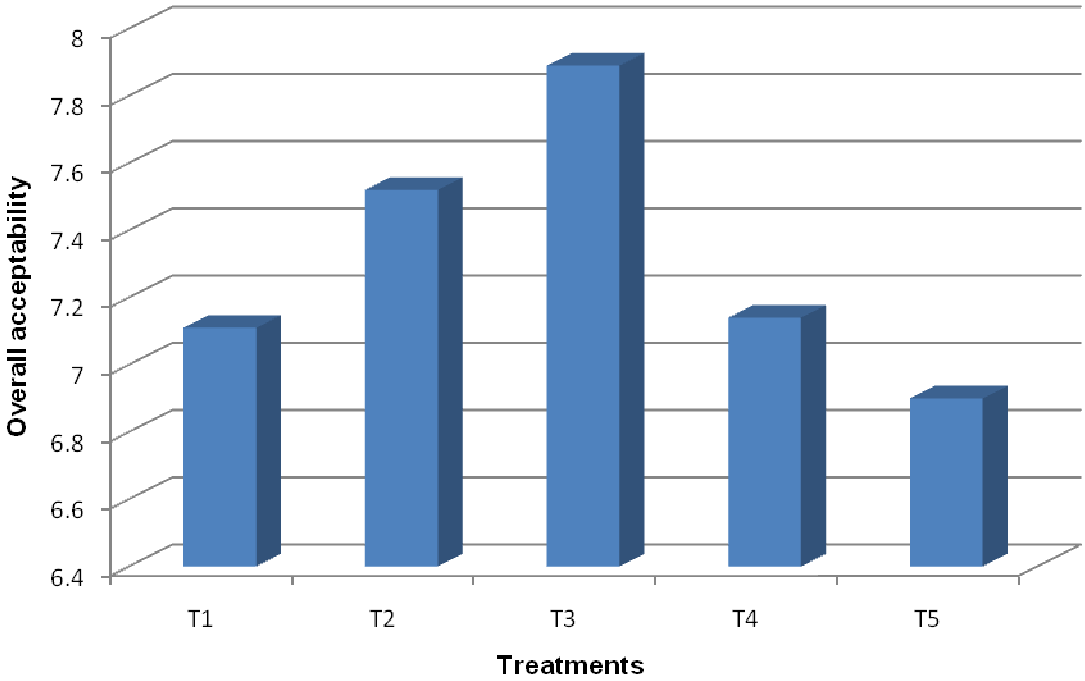

Fig. 4 Effect of different levels of Khajur crush on overall acceptability of *rabri*.

flavour and consistency was considered.

It is evident from Table 6 that the overall acceptability score of khajur *rabri* for various treatments ranging from 7.11, 7.52, 7.89, 7.14 and 6.76 respectively. Highest score 7.89 was observed for treatment T_3 and lowest score was observed as 6.76 for treatment T_5.

The treatment T_2 (7.52), T_3 (7.89) and T_4 (7.14) ranked between like very much to like extremely. Treatment T_4 (7.14) ranked between like moderately to like very much.

Table 6: Effect of different levels of khajur crush on overall acceptability of *Rabri*

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	7.10	7.35	7.10	6.91	7.10	7.11
T_2	7.25	7.41	7.50	7.94	7.50	7.52
T_3	7.40	7.86	8.0	8.26	7.95	7.89
T_4	6.60	7.63	7.30	7.04	7.15	7.14
T_5	6.90	6.97	6.80	6.91	6.90	6.76
F –test						Sig
SE(M)±						0.1634
CD at 5%						0.3409

The treatment T_3 was statistically significant over rest of the treatments. Therefore treatment combination of *rabri* and khajur crush (94:6) was more acceptable over other treatments.

The overall acceptability of khajur crush rabri could be attributed to the different characters of colour and appearance, flavour, body and texture of the final product. There seemed to be a direct relation with the level of khajur crush.

Pawar (2003) reported the overall acceptability of mango pulp rabri ranked between like very much to like extreamly 8.20 to 8.25.

Gaikwad *et al.* (2015) used date fruit powder in preparation of *basundi* and noted that the score for overall acceptability is improved due to addition of date fruit powder upto 6%.

Surve (2017) reported that addition of date upto 10% increased the score for overall acceptability in milk shake.

Mete *et al*. (2017) used 20% khajur with honey in *burfi* and reported that score for overall acceptability of *burfi* was increased due to addition of khajur and honey.

However, Nagvekar (2016) used date pulp in preparation of *pantua* and reported that score for overall acceptability was decreased due to addition of date pulp in *pantua* which is in contrast with present result.

4.4 Chemical composition of khajur *rabri*

Khajur *rabri* was subjected to chemical analysis for fat, protein, lactose, ash, moisture and Total solid. The results obtained were furnished under the table 7 to 12.

4.4.1 Fat content of khajur *rabri*

The fat content of khajur *rabri* under different treatment combinations was determined. The results obtained for fat content are presented in Table 7 and graphically represented in Fig. 5.

Table 7: Effect of different levels of khajur crush on fat content of *Rabri* %

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	19.50	20.00	20.00	20.00	19.90	19.88
T_2	19.00	20.00	18.80	19.20	19.00	19.20
T_3	18.00	18.17	18.05	18.12	18.10	18.09
T_4	16.95	17.10	17.00	17.70	17.10	17.17
T_5	16.05	16.11	16.00	16.05	17.10	16.26
F –test						Sig
SE(M)±						0.1528
CD at 5%						0.4509

The fat content of khajur crush *rabri* of different treatments varied from 19.88 to 16.26 per cent. The mean fat content of treatments T_1, T_2, T_3 ,T_4 and T_5 was 19.88, 19.20, 18.09, 17.17 and 16.26 per cent respectively.

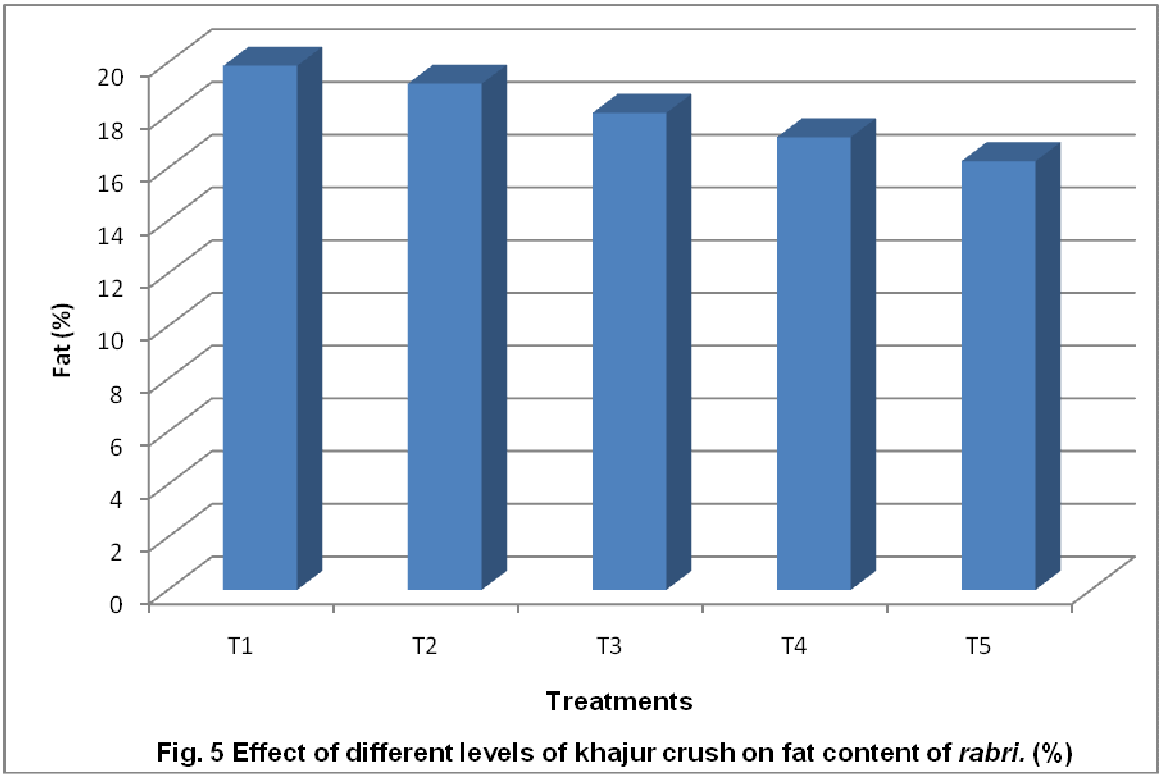

Fig. 5 Effect of different levels of khajur crush on fat content of *rabri.* (%)

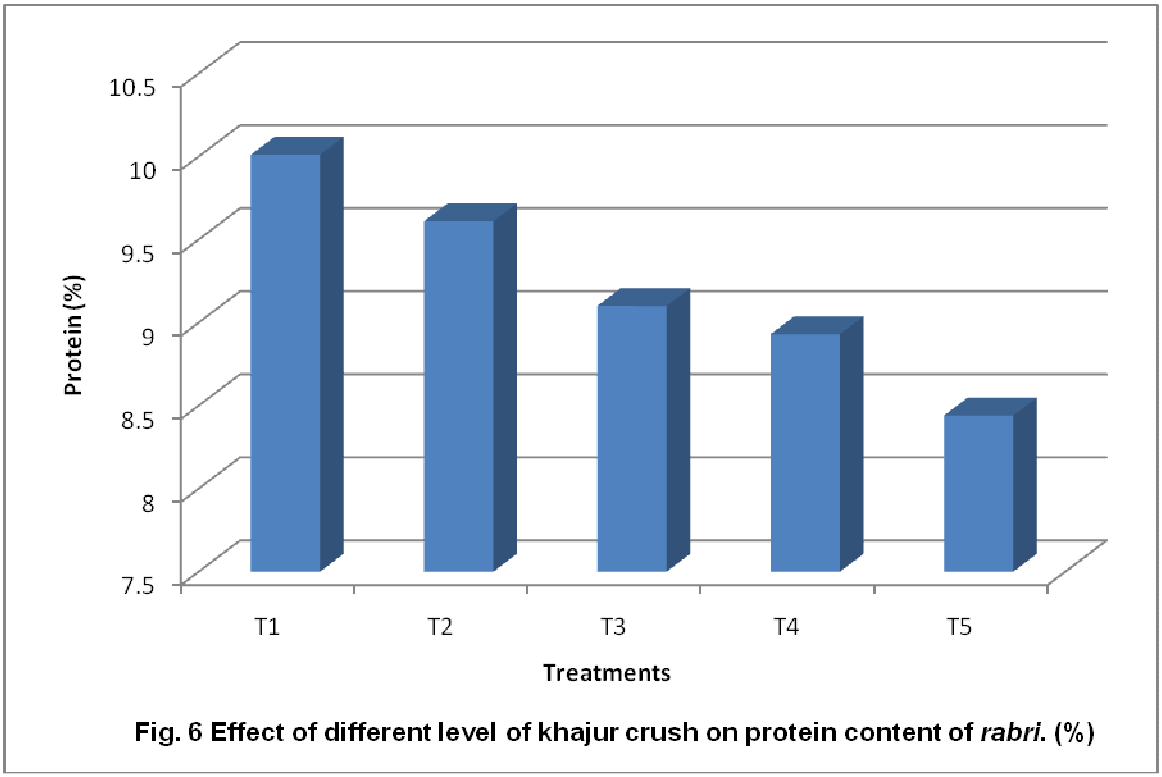

Fig. 6 Effect of different level of khajur crush on protein content of *rabri.* (%)

It was observed from the data in table 7 that the mean value of fat per cent of khajur crush *rabri* was statistically significant. It indicate that fat content of khajur crush *rabri* was affected due to addition of khajur crush.

In all above treatment significant difference was noted due to addition of khajur crush which lowering fat contain of khajur *rabri*. These might be increase in rate of addition of khajur crush which contain less fat.

Pawar (2003) recorded the fat content in *rabri* was decreased due to addition of mango pulp from 18.07 to 15.02 per cent.

Jadhav *et al.* (2002) recorded the fat content in different combination of sapota *rabri* and observed that fat content was decreased from 19.00 to18.17 per cent.

Thaware (2016) recorded that fat content was decreased due to addition of custard apple *rabri* from 19.98 to 16.05 per cent.

Gaikwad *et al*. (2015), Mete *et. al.* (2017) and Surve (2017) also reported that fat content was decreased in milk shake, *burfi* and *basundi* due to addition of dates.

These results were in agreement with present results.

4.4.2 Protein content of *rabri*

The data in respect to the protein content of khajur *rabri* is presented in Table 8 and graphically represented in Fig. 6.

Table 8: Effect of different levels of khajur crush on protein content of *Rabri* (%).

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	9.90	10.12	10.00	10.00	10.02	10.01
T_2	9.70	9.74	9.40	9.79	9.40	9.61
T_3	9.16	9.00	9.10	9.20	9.05	9.10
T_4	8.90	9.52	8.70	8.80	8.75	8.93
T_5	8.35	8.46	8.25	8.53	8.60	8.44
F –test						Sig
SE(M)±						0.0851
CD at 5%						0.2512

The data from the table 9 it was revealed that, the protein content of khajur *rabri* of different treatments varied from 10.01 to 8.44 per cent. The mean protein content of treatment T_1, T_2, T_3, T_4 and T_5 was10.01, 9.61, 9.10, 8.93 and 8.44 per cent respectively.

Treatment T_1 (10.0 per cent) was significantly superior over the treatments T_3, T_4 and T_5 and the treatment T_2 was at par with T_1. The treatment was statistically significant over the treatment T_5.

It was observed that as the proportion of khajur pulp in the blend increase there was decreased in the protein content in *rabri*. This might be due to less protein content in khajur pulp as compared to *rabri*.

Pawar (2003) recorded that protein content in *rabri* was decreased due to addition of mango pulp from 11.03 to 9.8 per cent.

Jadhav *et al.* (2002) recorded that protein content in *rabri* was decreased due to addition of sapota from 10.03 to 8.7 per cent.

Thaware (2016) recorded that protein content in *rabri* blended was decreased due to addition of custard apple pulp from 10.00 to 8.50 per cent.

Gaikwad *et al.* (2015), Mete *et. al*. (2017) and Surve (2017) also reported that protein content was decreased in milk shake, *burfi* and *basundi* due to addition of dates.

These results were in agreement with present results.

4.4.3 Total sugar content of khajur *rabri*

The observations recorded in respect of total solid of khajur *rabri* are presented in Table 10 and graphically represented in figure 7.

It observed from table 10 that the mean total sugar of khajur *rabri* for treatment T_1, T_2, T_3, T_4 and T_5 was 17.02, 17.15, 17.28, 17.41 and 17.53 per cent respectively. The total sugar content in custard apple *rabri* was varied from 17.02 to 17.53 per cent significant difference where observed between treatments for total sugar content of *rabri*.

It was observed that the total sugar of khajur *rabri* was increasing with increasing the level of khajur crush in the *rabri*.

Table 9: Effect of different levels of khajur crush on total sugar content of *Rabri.* (%)

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	17.01	17.00	17.08	17.00	17.00	17.02
T_2	17.10	17.20	17.10	17.19	17.15	17.15
T_3	17.20	17.31	17.25	17.32	17.30	17.28
T_4	17.30	17.49	17.35	17.47	17.45	17.41
T_5	17.32	17.70	17.50	17.60	17.55	17.53
F –test						Sig
SE(M)±						0.03612
CD at 5%						0.1065

Pawar (2003) recorded that lactose content in *rabri* was increased due to addition of mango pulp from 16.20 to 17.03 per cent.

Thaware (2016) recorded that total sugar content in *rabri* was increased due to addition of custard apple pulp from 17.02 to 17.52 per cent.

Jadhav *et al.* (2002) recorded that total sugar content in *rabri* was increased due to addition of sapota *rabri* from 16.8 to 17.4 per cent.

Gaikwad *et al.* (2015), Mete et al. (2017) and Surve (2017) also reported that protein content was increased in milk shake, *burfi* and *basundi* due to addition of dates.

These results were in agreement with present results.

4.4.4 Ash content of khajur *rabri*

The observations in respect of ash content of khajur *rabri* are presented in Table 10 and graphically represented in Fig. 8.

The ash content in khajur *rabri* ranged from 3.02 to 2.51 per cent. The ash content of khajur *rabri* of treatment T_1, T_2, T_3,T_4 and T_5 were 3.02, 2.91, 2.73, 2.62 and 2.51 per cent respectively. The ash content of treatment T_1 was highest than rest of the treatments. The treatment T_1, T_2, T_3 and T_4 was significantly at par. But T_1 and T_2 treatments was statistically significant over T_5 treatment. Lowest ash content was found in treatment T_5 (2.51).

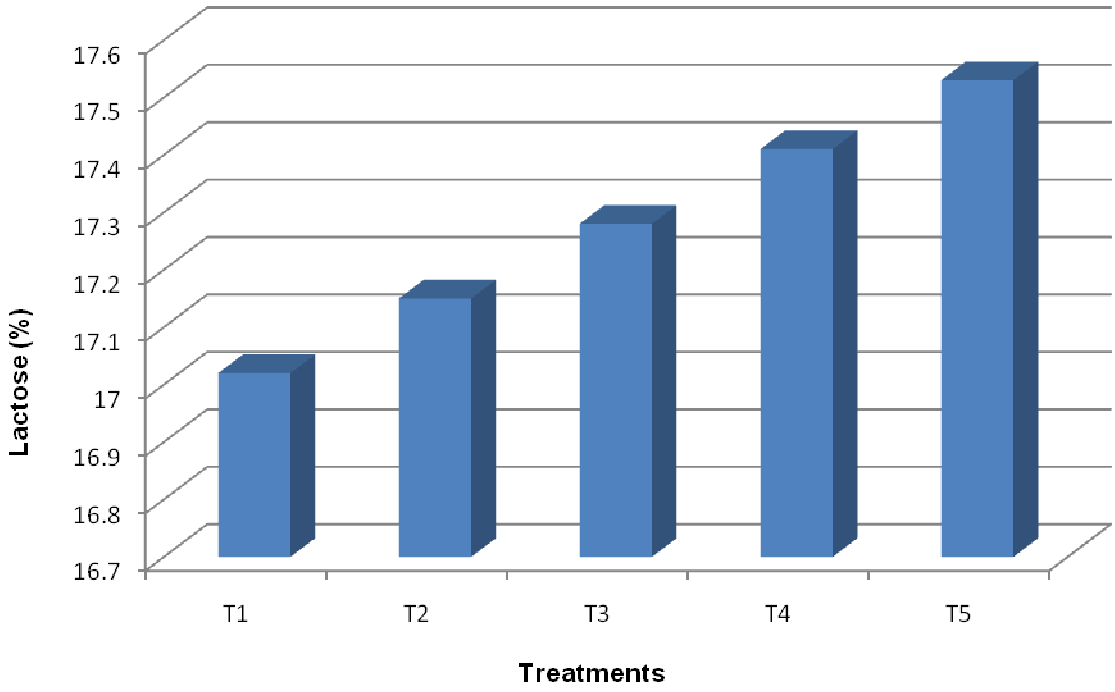

Fig. 7 Effect of different levels of khajur crush on total sugar content of *rabri*. (%)

Table 10: Effect of different levels of khajur crush on ash content of *Rabri*. (%)

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	2.98	3.04	3.02	3.02	3.03	3.02
T_2	2.95	2.99	2.85	2.91	2.85	2.91
T_3	2.72	2.75	2.71	2.73	2.73	2.73
T_4	2.55	2.67	2.55	2.69	2.62	2.62
T_5	2.45	2.54	2.48	2.55	2.51	2.51
F –test						Sig
SE(M)±						0.02054
CD at 5%						0.06060

From the above results it was observed that ash content of khajur rabri decreased with increase in proportion of khajur crush in the *rabri* because ash content in khajur pulp is lower.

Pawar (2003) recorded that ash content in *rabri* was decreased due to addition of mango pulp from 2.8 to 2.3 per cent.

Jadhav *et al.*(2002) recorded that ash content in *rabri* was decreased due to addition of sapota from 2.71 to 2.3 per cent.

Thaware (2016) recorded that ash content in rabri was decreased due to addition of custard apple from 3.01 to 2.50 per cent.

Gaikwad *et al.* (2015), Mete *et. al.* (2017) and Surve (2017) also reported that protein content was decreased in milk shake, *burfi* and *basundi* due to addition of dates.

These results were in agreement with present results.

4.4.5 Moisture content of khajur *rabri*

The observation in respect to moisture content of khajur *rabri* are tabulated in Table 11 and graphically represented Fig.9.

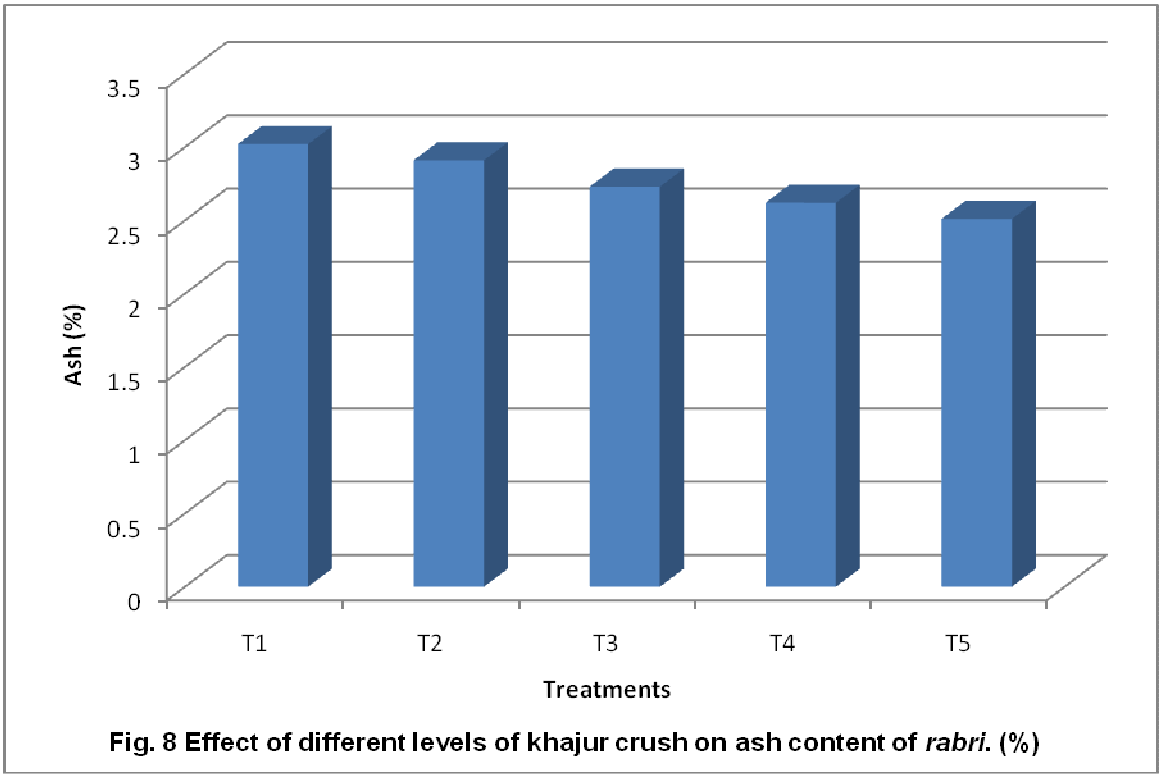

Fig. 8 Effect of different levels of khajur crush on ash content of *rabri*. (%)

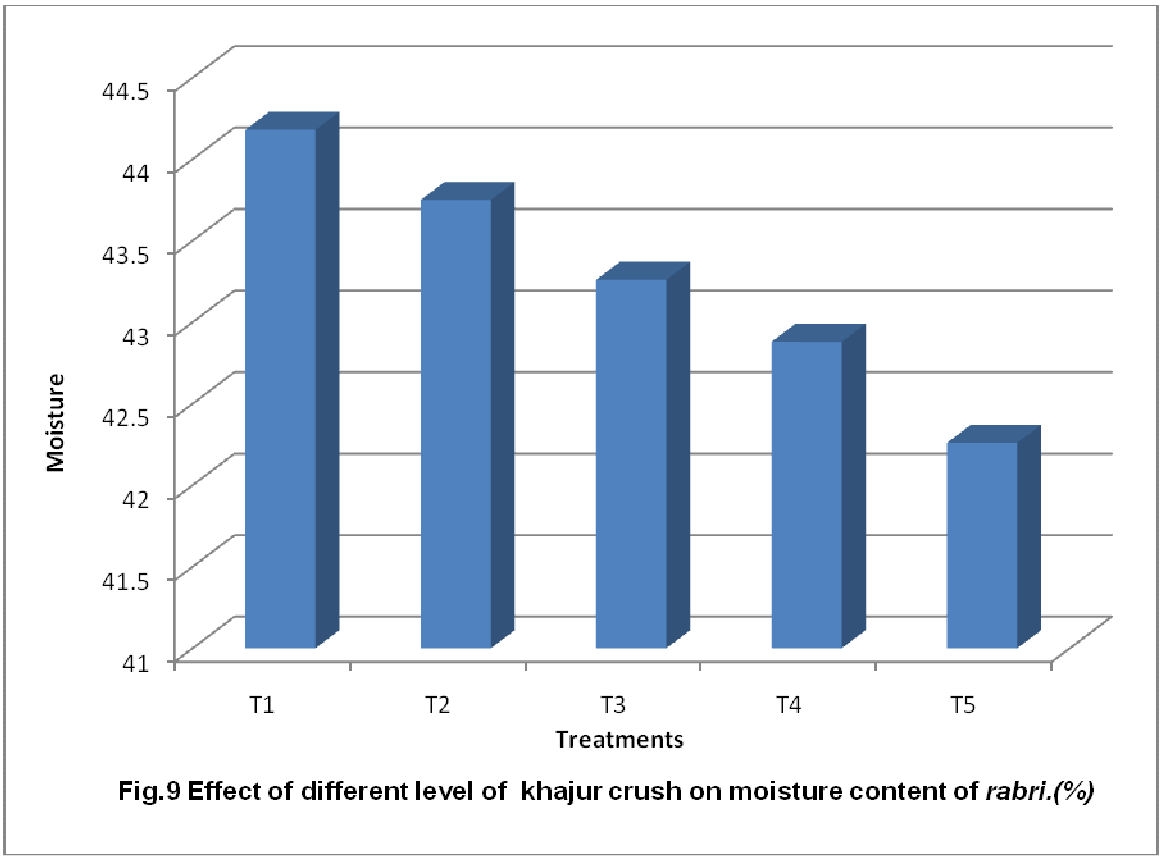

Fig.9 Effect of different level of khajur crush on moisture content of *rabri.(%)*

Table 11: Effect of different levels of khajur crush on moisture of *Rabri* (%)

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	44.19	44.15	44.19	44.17	44.19	44.18
T_2	43.85	43.66	43.80	43.71	43.75	43.75
T_3	43.59	43.11	43.20	43.13	43.25	43.26
T_4	42.90	42.84	42.95	42.80	42.90	42.88
T_5	42.40	42.19	42.40	42.01	42.30	42.26
F –test						Sig
SE(M)±						0.05451
CD at 5%						0.1608

The moisture content of khajur *rabri* ranged from 44.18 to 42.26 per cent. The total solids content of treatment T_1, T_2, T_3, T_4 and T_5 were 44.18, 43.75, 43.26, 42.88 and 42.26 per cent respectively. The moiture content of khajur *rabri* was highest in T_1 (44.18%) and lowest in T_5 (42.26%). Treatment T_5 (42.26) was significantly superior over the treatments T_1, T_2, T_3 and T_4. The treatment T_3 (43.26) was statistically significant over the treatment T_1 and T_2.

There was increase in moisture content of khajur *rabri* with increase in level of khajur crush in the blend and addition of cane sugar.

Pawar (2003), Jadhav *et al.* (2002), Thaware (2016) also noted that in *rabri* moisture content decrease due to addition of various fruit pulp.

These results were in agreement with present results.

4.4.6 Total solids of khajur *rabri*

The observations in respect to total solids content of Khajur *rabri* are tabulated in Table 12 and graphically represented Fig. 10.

Table 12: Effect of different levels of khajur crush on total solid of Rabri (%)

Treatments	Replications					Mean
	R-I	R-II	R-III	R-IV	R-V	
T_1	55.81	55.85	55.81	55.83	55.81	55.82
T_2	56.15	56.34	56.20	56.29	56.25	56.25
T_3	56.41	56.89	56.80	56.87	56.75	56.74
T_4	57.10	57.16	57.05	57.20	57.10	57.12
T_5	57.60	57.81	57.60	57.99	57.70	57.74
F –test						Sig
SE(M)±						0.05451
CD at 5%						0.1608

The total solids content of khajur *rabri* ranged from 55.82 to 57.74 per cent. The total solids content of treatment T_1, T_2, T_3, T_4 and T_5 were 55.82, 56.25, 56.74, 57.12 and 57.74 per cent respectively. The total solids content of khajur *rabri* was highest in T_5 (57.74%) and lowest in T_1 (55.82%). Treatment T_5 (57.74) was significantly superior over the treatments T_1, T_2, T_3 and T_4.The treatment T_3 (56.74) was statistically significant over the treatment T_1 and T_2.

There was increase in total solids content of khajur *rabri* with increase in level of khajur crush in the blend and addition of cane sugar.

Pawar (2003) recorded that total solid content in *rabri* was increased due to addition of mango pulp from 52.07 to 55.53 per cent.

Jadhav *et al.* (2002) recorded that total solid content in *rabri* was increased due to addition of sapota from 55.3 to 57.17 per cent.

Thaware (2016) recorded that total solid content in *rabri* was increased due to addition of custard apple pulp from 55.82 to 57.75 per cent.

Gaikwad *et al.* (2015), Mete *et. al.* (2017) and Surve (2017) also reported that protein content was increased in milk shake, *burfi* and *basundi* due to addition of dates.

These results were in agreement with present results.

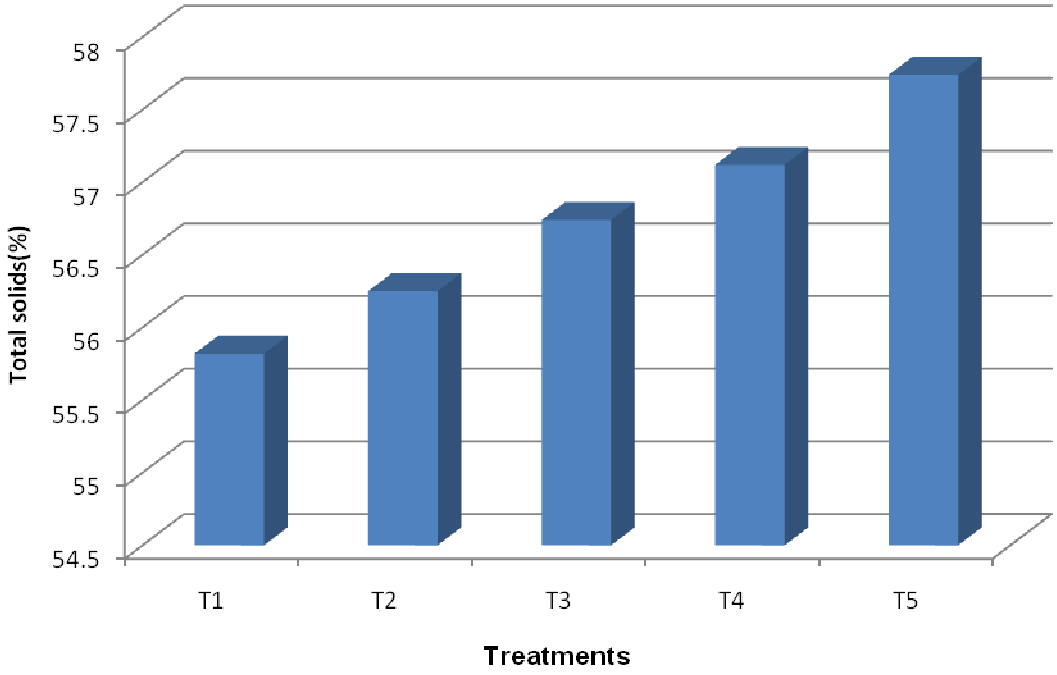

Fig.10 Effect of different level of khajur crush on total solids content of *rabri*.(%)

4.5 Production cost of khajur *rabri*

Cost of khajur *rabri* prepared from buffalo milk in combination with different proportions of khajur pulp was worked out and is presented in Table 13 and graphically represented Fig. 11.

While estimating the cost of the finished product, the cost of the ingredients used in the preparation of khajur *rabri* was rated as per the prevailing (2018 to 2019) market price. In addition to these fuel cost, miscellaneous cost and the labour charges @ 10 per cent of total cost were also taken into consideration.

The cost of production of khajur *rabri* (per kg) for treatment T_1 ,T_2, T_3, T_4,and T_5 was Rs. 162.41, 160.10, 157.37, 155.23 and 152.73 respectively. The treatment T_3 Rs 160.00 was most acceptable by judges and production cost was comparatively than treatment T_4 and T_5. It was recorded that cost of production was slightly decreases due to level of addition of khajur pulp.

The khajur *rabri* prepared from buffalo milk and khajur crush blend T_3 (94:6) was most acceptable to the judges. This treatment combination was economical than treatment T_4 and T_5. Treatment T_3 scored highest score of overall acceptability (7.89) and rated between like very much to like extremely.

Pawar (2003) estimated the cost structure of *rabri* prepared by using mango pulp, where the cost of sugar mango pulp, attendant and processing was taken into account. The cost of end product was estimated at Rs. 22.37 per kg, which was mostly contributed by sugar and mango pulp.

Nagvekar Shruti (2016) prepared *pantua* by incorporation 0f date (*phoenix dactylifera l.)* pulp. He reported cost of production varied from 180.74, 193.98, 203.59, 214.04, 222.71 and 233.33 for treatment T_0, T_1, T_2, T_3, T_4, and T_5 respectively.

Table 13: Effect of different levels of Khajur crush on Production cost of *rabri* (Rs)

Rate of ingredients: 1) Milk – 40 Rs per kg. 2) Sugar - Rs 35 per kg. 3) Khajur crush - Rs 65 per kg.

Sr. No.	Particular	Treatment combinations									
		T_1		T_2		T_3		T_4		T_5	
		Qty (gm)	Amount (Rs.)	Qty (gm)	Amount (Rs.)	Qty (gm)	Amount (Rs.)	Qty (gm)	Amount (Rs.)	Qty (gm)	Amount (Rs.)
1	Milk (Rs40 /lit)	1	40	1	40	1	40	1	40	1	40
2	*Rabri* obtained	230		230		230		230		230	
3	Khajur crush (Rs65/kg) Quantity and amount	00	00	7	0.45	15	0.90	23	1.49	32	2.08
4	Sugar@ 6% (Rs35/kg) Quantity and amount	60	2.10	60	2.10	60	2.10	60	2.10	60	2.10
5	Other(fuel, labour, miscellaneous)	_	5.00	_	5.00	_	5.00	_	5.00	_	5.00
5	Total cost *Rabri* (Rs/400gm)	290	47.1	297	47.55	305	48.00	313	48.59	322	49.18
6	Cost *Rabri* / (Rs/Kg)	_	162.41	_	160.10	_	157.37	_	155.23	_	152.73

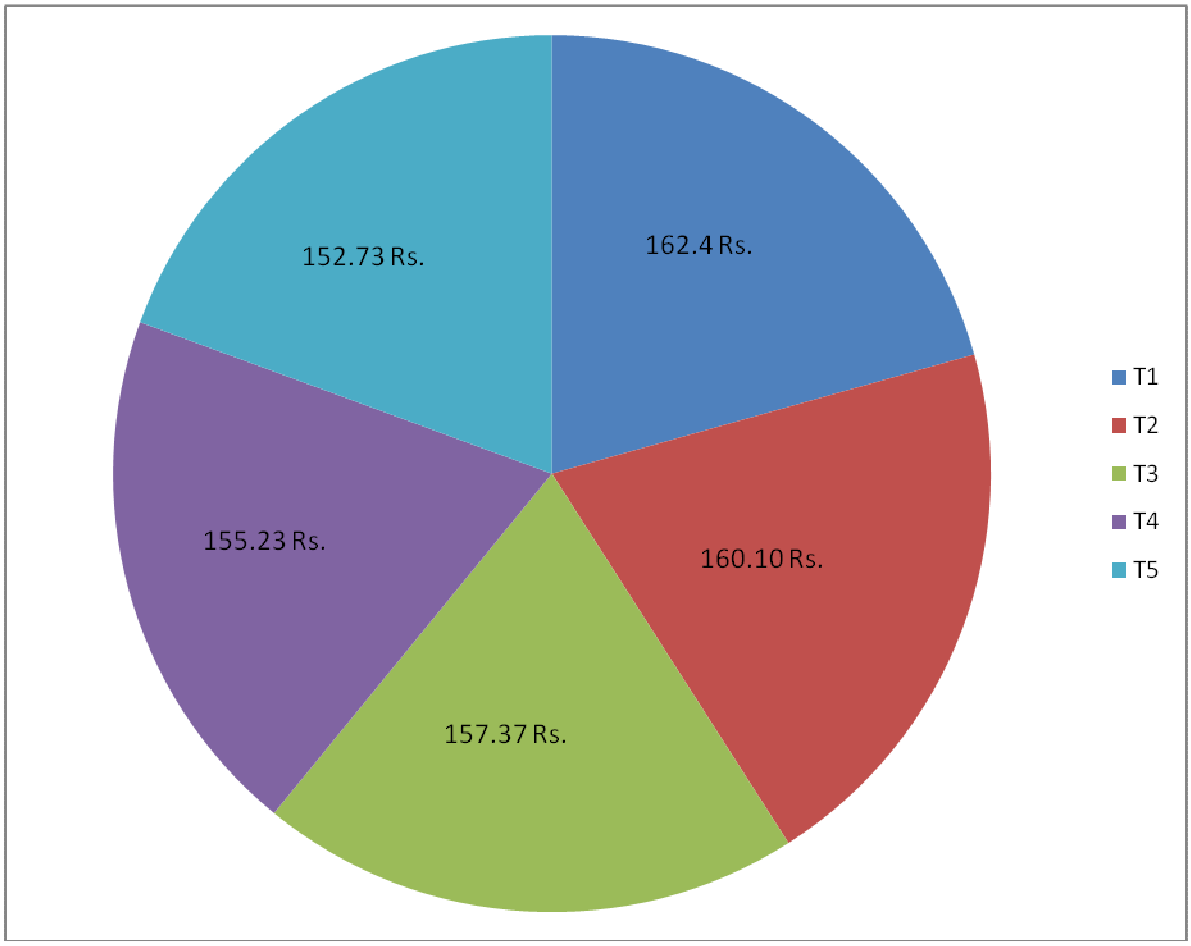

Fig.11 Production cost of khajur crush *rabri* (per/kg)

Surve (2017) prepared milk shake blended with Date (*phoneix dactylifera*) and Jaggery. He reported cost of production varied from 87.12, 105.08, 121.93 for treatment J_1D_1, J_1D_2, J_1D_3, 87.19, 104.66, 121.81 for treatment J_2D_1, J_2D_2, J_3D_3, and 86.77, 104.25, 120.58 for treatment J_3D_1, J_3D_2, J_3D_3 respectively.

Khajur *rabri* has very good potential to capture popularity due to its nutritional benefits and novelty. Further, it has better scope in future as far as fortification, marketing and packaging are concerned. Also it may capture better popularity due to its taste and also being a dairy based drink.

The main advantage of using khajur pulp is that it is easy to digest and it can be easily consumed by children and people of all ages. It is rich in carbohydrates and provide good amount of proteins and minerals like calcium, phosphorus and iron. The fruit are tonic, enriches blood and increases muscular strength, cooling, sedative to the heart and relieves vomiting.

From the present investigation it can be concluded that acceptable khajur *rabri* can be prepared by blending 94 per cent buffalo milk with 6 per cent Khajur pulp with addition of 6 per cent sugar.

CHAPTER V

SUMMARY AND CONCLUSION

The present investigation entitled "Utilization of Khajur (*Phoenix dactylifera*) crush in Preparation of *Rabri*" was undertaken with a view to standardize the technique for preparation of khajur *rabri* utilizing buffalo milk and khajur crush, so as to utilize this fruit in a better way.

For Utilization of khajur (*Phoenix dactylifera*) crush in preparation of *rabri* were (T_1 control sample + T_2 97 per cent *rabri* + 3 per cent khajur crush, T_3 94 per cent *rabri* + 6 per cent khajur crush, T_4 91 per cent *rabri* + 9 per cent khajur crush, and T_5 88 per cent *rabri* + 12 per cent khajur crush) and respectively.

The khajur *rabri* prepared was subjected to proximate analysis, sensory evaluation and cost of production. The results obtained in present investigation are summarized here below.

5.1 Sensory evaluation of Khajur (Date fruit) *rabri*

5.1.1 Flavour

The score for flavour the treatment T_3 (8.06) was significantly superior among the rest of the treatments. The significant differences was between flavour score of treatment T_2, T_3, T_4 and T_5. The treatment T_1 scored lowest score followed by T_2, T_3 T_4 and T_5.

5.1.2 Body and texure

The mean score of body and texture treatment T_1, T_2, T_3 , T_4 and T_5 was 6.88, 7.57, 7.89, 6.58 and 6.29 respectively. Treatment T_2 and T_3 were significantly superior over rest of the treatments T_1, T_2 and T_3.

Treatments T_2 (7.57), T_3 (7.89) and T_1 (6.88) ranked in between like very much to like extremely. Treatment T_5 (6.29) scored in between like moderately to like very much.

5.1.3 Colour and appearance

The score for colour and appearance score for Treatment T_3 scored the highest score followed by T_4, T_5 T_2 and T_1. Treatment T_3 (7.81)

was significantly superior over the rest of the treatments.

5.1.4 Overall acceptability

The overall acceptability is the cumulative effect of all the sensory parameter and it was notably higher for treatment T_3 (94 per cent rabri and 6 per cent khajur pulp) scored at 7.89 and lowest score as 6.76 for treatment T_5. The treatment T_3 was statistically significant over rest of the treatments. Therefore treatment combination of *rabri* and khajur crush (94:6) was more acceptable over other treatments.

5.2 Chemical composition of khajur *rabri*

5.2.1 Fat

The fat content of khajur *rabri* of different treatments varied from 19.88 to 17.17 per cent. The mean fat content for treatments T_1, T_2, T_3, T_4 and T_5 was 19.88, 19.20, 18.09, 17.17 and 16.26 per cent, respectively. The mean value of fat per cent of khajur *rabri* was statistically significant. It indicate that fat content of khajur *rabri* was affected due to addition of khajur pulp.

5.2.2 Protein

The protein content of khajur *rabri* was highest as (10.01 per cent) for treatment T_1 and lowest for treatment T_5 (8.44 percent). Treatment T_1 (10.01 per cent) was significantly superior over the treatments T_3, T_4 and T_5 and the treatment T_2 was at par with T_1. The treatment was statistically significant over the treatment T_5.

5.2.3 Total sugar

The total sugar content in khajur *rabri* was varied from 17.02 to 17.53 per cent. The highest TS of khajur *rabr*i was recorded for treatment T_5 (17.53%). The TS of khajur *rabri* was increasing with increasing the level of khajur crush in the blend.

5.2.4 Ash

The ash content ranged from 3.02 (T_1) to 2.51 (T_5) per cent. The ash content of treatment T_1 was highest than rest of the treatments. The treatment T_1, T_2, T_3 and T_4 was significantly at par. But T_1 and T_2

treatments was statistically significant over T_5 treatment.

5.2.5 Total solid

The total solids content for treatment T_1, T_2, T_3 T_4 and T_5 were 55.82, 56.25, 56.74, 57.12 and 57.74 per cent respectively. The total solids content of khajur rabri was highest in T_5 (57.74%) and lowest in T_1 (55.82%). Treatment T_5 (57.74%) was significantly superior over the treatments T_1, T_2, T_3 and T_4. The treatment T_3 (56.74%) was statistically significant over the treatment T_1 and T_2.

5.3 Cost structure of khajur rabri

The production cost of khajur *rabri* (per kg) for treatment T_1 ,T_2, T_3, T_4,and T_5 was Rs. 162.41, 160.10, 157.37, 155.23 and 152.73 respectively. The treatment T_3 Rs 157.23 was most acceptable by judges and production cost was comparatively less than treatment T_4 and T_5. It was recorded that cost of production was slightly increase in rate of addition of khajur crush.

CONCLUSION

1. The khajur *rabri* prepared from 94 per cent buffalo milk *rabri* and 6 per cent khajur pulp (T_3) was most acceptable and recorded highest score 7.89 for overall acceptability.
2. It was observed that fat, protein, and ash contain was decreased with increasing in rate of addition of khajur pulp and vice versa , while total solid and Total sugar increased with increase in rate of addition of khajur pulp.
3. It was recorded that cost of production was slightly increased with increase in rate of addition of khajur pulp.
4. The cost of production of khajur crush *rabri* for treatments T_3 Rs 157.37 per kg which was most acceptable by judges and production cost was comparatively less than treatment T_4 and T_5, It was further observed that due to addition of khajur crush cost of production decreases.

CHAPTER VI

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APPENDIX–I

SCORE CARD
FOR SENSORY EVALUATION OF KHAJUR (*Phoenix dactylifera*)
CRUSH RABRI

Trial No: _____ Date: / / 2019

Name of Evaluator: _____

Code No.	Flavour (9)	Colour and appearance (9)	Consistency (9)	Overall acceptability (9)
I				
II				
III				
IV				
V				

(Signature of Evaluator)

Particulars :

Particulars	Score
Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6
Neither like nor dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1