STUDIES ON PREPARATION OF *KHOA BURFI* BLENDED WITH GUAVA (*Psidium guajava L.*) PULP

by

Mr. Rahate Sumit Mahadeorao
(Reg. No. 018/130)

A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI - 413 722, DIST. AHMEDNAGAR,
MAHARASHTRA, INDIA

in partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

DAIRY SCIENCE

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE

POST GRADUATE INSTITUTE,
MAHATMA PHULE KRISHI VIDYAPEETH,
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2021

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part
there of has not been submitted
by me or other person to any
other University or Institute
for a Degree or
Diploma

Place : MPKV, Rahuri (S.M. Rahate)

Dated : / /2021

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The assistance and help received during the course of this investigation have been duly acknowledged.

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Place: M. P. K. V., Rahuri (S. M. Rahate)

Date: / /2021

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LIST OF ABBREVIATIONS

%	:	per cent
%LA	:	per cent lactic acid
@	:	At the rate of
^{0}C	:	Degree Celsius
AR	:	Analytical Reagent
BIS	:	Bureau of Indian Standards
CD	:	Critical Difference
cm	:	Centimetre (s)
et al.	:	And Other (et alli)
Fig.	:	Figure
g	:	Gram
GR	:	Guaranteed Reagent
h	:	Hour (s)
i.e.	:	That is
Kcal	:	kilo calorie
lit.	:	Litre
LR	:	Laboratory Reagent
M.S.	:	Maharashtra state
mg	:	Milligram
ml	:	Millilitre
mm	:	Millimetre
MT	:	Metric ton
N	:	Normality
N.D.D.B	:	National Dairy Development Board
N.D.R.I.	:	National Dairy Research Institute
No.	:	Number(s)
RCDP	:	Research cum Development Project
S.E.	:	Standard Error
Sig	:	Significant
SNF	:	Solid not fat
SSHE	:	Scraped Surface Heat Exchanger
TS	:	Total solids
viz.	:	Namely
Wt.	:	Weight

ABSTRACT

"STUDIES ON PREPARATION OF *KHOA BURFI* BLENDED WITH GUAVA (*Psidium guajava L.*) PULP"

by

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A candidate for the degree
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Mahatma Phule Krishi Vidyapeeth, Rahuri 413 722
2021

Research Guide	**: Dr. B.D. Patil**
Department	**: Animal Husbandry and Dairy Science**

The present study entitled "STUDIES ON PREPARATION OF *KHOA BURFI* BLENDED WITH GUAVA (*Psidium guajava L.*) PULP" was carried out at Department of Animal Husbandry and Dairy Science, Post Graduate Institute, M.P.K.V Rahuri. The main objectives of this research work was to optimize the levels of guava pulp in *burfi,* to investigate physico-chemical, textural properties and sensory changes of *burfi* added by guava pulp.

The levels of guava pulp, sugar and skimmed milk powder for final experimental trials were finalized in pre-experimental trials on the basis of sensory evaluation.

The levels of guava pulp 11, 14 and 17 per cent. 25 per cent of sugar and 4 per cent skimmed milk powder were selected for further study. The results obtained from chemical and sensory evaluation were analyzed by Completely Randomized Design (CRD).

The sensory evaluation carried out by the panel of judges using 9 point hedonic scale. The results showed that the different levels of guava pulp had a significant effect on improving the quality regarding colour and appearance, flavour, body and

texture, and overall acceptability of *burfi.* The sensory evaluation indicated that, the *burfi* prepared by blending with 14 per cent guava pulp (T_2) had highest score for colour and appearance (8.50) further treatments show dull yellow to green colour. The flavour score (8.52) which is highest but in further treatments sour flavour was appear and the body and texture score decreases as we increase the level of pulp. The overall acceptability of *burfi* prepared by blending with 14 per cent of guava pulp (T_2) had the highest score (8.40 out of 9) by 9 point hedonic scale and ranked as the most acceptable treatment.

The data revealed that fat, protein, total solids and ash per cent of *burfi* were decreased with increased in the levels of guava pulp while moisture and acidity (%LA) percentage was increased with increased in the levels of guava pulp. The *burfi* prepared with addition of 14 per cent (T_2) of guava pulp contained 16.35 per cent fat, 13.51 per cent protein, 79.49 per cent total solids , 2.96 per cent ash, , 0.40 per cent acidity (%LA) and 20.51 per cent moisture.

Burfi samples were evaluated for textural qualities viz., Hardness, cohesiveness, adhesiveness and springiness. Hardness, cohesiveness, adhesiveness and springiness for treatment (T_0) was 0.571 kg, 0.206, 0.181 kg and 0.169 mm for treatment, T_1 it was 0.564 kg, 0.199, 0.198 kg and 0.167 mm, for T_2 it was 0.550 kg, 0.187, 0.211 kg and 0.165 mm and for treatment T_3 it was 0.530 kg, 0.143, 0.228 kg, 0.164 mm.

Hence, it is concluded that best quality *burfi* can be prepared by using 14 per cent of guava pulp, 25 per cent sugar and 4 per cent skimmed milk powder.

1. INTRODUCTION

In Vedas, milk is defined as an elixir of God because it has a combined source of mental, physical, and intellectual energy. It holds true even today and at all times to come. It is the only complete drink for infants and a nourishing drink throughout the existence of human life. Milk is the traditional diet has varied greatly in different region of the world. Milk is regarded as a complete food in the human diet. Milk is provided all the nutrient elements essential for the nourishment of the human body. Milk is consume as a whole or by converting it into various milk products such as coagulated, fermented, heat desiccated and frozen milk products.

India is rising as a largest milk producing country in the world with annual growth rate of 6.5 per cent as well as annual milk production is 187.7 MT during year 2018-19. With per capita availability of milk in India has increased from 176 grams per day in 1990-91 to 394 grams per day (NDDB, Statistic, 2019). However, out of total milk production 55 per cent of milk is converted into milk product. Therefore, it needed to convert more and more milk into milk products to satisfy the demand of consumers. (Adani, 2011).The conversion of surplus milk into variety of traditional milk products has been practiced since old times primarily for means of preservation. These traditional dairy products have made a great impact in the social, cultural and economic prospects of Indian heritage. Also in maintaining and nutritional well-being of people and are gradually becoming popular all over the world (Bandyopadhyay *et al.*, 2006). It has also been estimated that 6.5 per cent of total milk produced in India is converted into *khoa* and condensed milk products (Shete *et al.*, 2012). The value of *khoa* manufactured annually in India becomes almost double on its conversion into variety of popular indigenous *khoa* based sweets particularly *burfi*, *peda*, *gulabjamun*, milk cake, *kalakand* etc. which have become popular in India and neighbouring countries and amongst these, *burfi* is the most popular, nutritious *khoa* based sweet and has occupied a significant place in the hearts of consumers belonging to all age groups because of its rich flavour and palatability. Among various classes of society it is very popular because of its taste.

Burfi is a *khoa* based indigenous milk product of considerable economic and nutritional importance. It is one of the most popular milk based sweet in India. It is

prepared by heating a mixture of concentrated milk solids (*khoa*) and sugar to a near homogenous consistency followed by cooling and cutting into small cuboids. Beating and whipping operations prior to cooling are sometimes practiced to obtain a product with smooth texture and closely knit body. The most popular varieties of *burfi* are fruit, nut, chocolate, saffron and *rawa burfi*. These ingredients can be used single or in combination (Aneja *et al.,* 2002). Good quality *burfi* is characterized by moderately sweet taste, soft and slightly greasy body and smooth texture with very fine grains. Colour should be uniform, white or slightly yellowish depending on the type of the milk used **(**Pal and Raju, 2006). The shelf life of *burfi* is about 7–10 days under ambient conditions (Khan *et al.,* 2008).

Today's consumers are increasingly seeking functional foods for their health and well-being as means of nutritional intervention as well as disease prevention. Due to the today's upward consumer awareness and interest to follow healthy nutrition and dietary strategy in achieving health benefits from foods beyond their basic nutrition, the market for value added foods has expanded manifolds.

Guava (*Psidium guajava*) is a member of dicotyledon family *myrtaceae*. It is originated in Tropical America. It is considered important fruit because of its hardy nature, high vitamin C content and more income without much care and input; hence it is also regarded as "Apple of Tropics". Guava is a small tree or shrub, 2-8 m in height with wide spreading branches (Singh, 1988).

Guava (*Psidium guajava)* one of the effective edible plant, has long been used as traditional medicine. It has been demonstrated to have several biological activities such as anti-cough, antibacterial and anti-spasmodic action (Abdelrahim *et al.*, 2002). Recently, it has been reported high potential for antioxidant activity.

Guava is normally consumed fresh as a desert fruit. Being highly perishable in nature, guava fruits cannot be store for longer period and have to be sold in local market immediately after harvest. During harvest period, market glut may occur, resulting in low price and heavy losses to the producer. Moreover, considerable proportion of the produce is lost during post harvest linkages. It is, therefore, imperative to develop suitable technology for preservation and processing of such surplus produce.

Guava is highly perishable fruit after ripening the ripened guava fruit are mostly deteriorate before reaching to the market. Such a fully ripened guava fruits can be processed in to good quality value added products, like *burfi*, Jain and Asathi (2004) evaluated the different cultivars of guava for pulp, which can be used as a raw material for guava *burfi*. Thus preparation of guava pulp by simple technology and its utilization for *burfi* making has great scope. The present work, of guava *burfi* preparation undertaken with following objectives:

1. To optimize the levels of guava pulp in *burfi.*
2. To assess the sensory properties of guava *burfi.*
3. To assess the chemical properties of guava *burfi.*
4. To study the textural properties of guava *burfi.*

2. REVIEW OF LITERATURE

Research work on "STUDIES ON PREPARATION OF *KHOA BURFI* BLENDED WITH GUAVA (*Psidium guajava L.*) PULP" was reviewed. This chapter deals with review of research work carried out by different workers in relation to the *burfi* technology with the following heads:

2.1 Technology of *khoa*

2.2 Technology of *burfi* preparation

2.3 Utilization of Fruits, Fruits Pulp, Nuts etc. in *Burfi*

2.4 Nutritional properties of guava

2.5 Organoleptic / sensory evaluation of *burfi*

2.6 Chemical composition of *burfi*

2.7 Textural properties of *burfi*

2.1 Technology of *Khoa*

Khoa is an indigenous milk product and has significant market value. It occupies a place of prominence among the traditional Indian milk sweet mainly for the preparation of *burfi*, *peda* gulabjamun, etc.

Patel *et al.* (1992**)** reported that use of steam kettle process for *khoa* manufacture produced a product that was significantly harder, more springy, gummy and chewy but less adhesive than the *khoa* produced by using stimulated traditional process.

Sawhney *et al.* (2000) prepared *khoa* in an open steam-jacketed kettle with continuous stirring and scraping until the kettle contents started showing a tendency to move away from the surface of kettle and stick together. The temperature was lowered to $85^0 \pm 3^0$C when consistency (pat) obtained.

According to Khopade (2002) *khoa* was prepared by boiling 2 kg of milk in *karahi* over a brisk non-smokey fire. The milk was stirred vigorously and constantly with circular motion by a sarata. During this operation, all parts of pan with which the milk comes in contact were scrapped to prevent milk from scorching. Constant evaporation of milk took place and milk thickened progressively. The heating was continued with greater control and the speed of stirring cum scrapping was increase. Soon the viscous mass reached a semi-sold consistency and began to dry up. The final product

was ready when it shows sign of leaving the bottom and sides of *karahi* and non-sticking together to form a pat.

De (2008) explained the method of *khoa* production as: the milk was stirred vigorously and constantly with a circular motion by a khunti. During this operation all parts of the pan with which the milk comes into contact are lightly scrapped to prevent the milk from scorching. Constant evaporation of moisture takes place and the milk thickens progressively. The heating is continued with greater control hereafter and the speed of stirring-cum-scrapping increased till the viscous mass reaches a semi-solid/pasty consistency. The final product is ready when it shows signs of leaving the bottom and the sides of the *karahi* and sticking together.

Kumar (2010) stated that *khoa* is the product obtained from cow or buffalo (goat or sheep) milk, or a combination there of by rapid drying containing milk fat content not less than 30 per cent on dry weight basis of the final product.

Rajasekaran and Kumar (2014) reported the agitator and wiper design modification for milk *khoa* machine. Mixing is a very important unit operation in any dairy and food process industry. For instance, all operations involving blending homogenization, emulsion preparation, extraction, dissolution, crystallization, liquid phase reactions, etc., need mixing in one form or the other. This project was a dynamic mixer of a food processing industry particularly about milk *khoa* making process. To attain uniform mixing with the optimal product preparation time for the desired quality and to remove the drudgery of human folk this newly developed automated agitator was suggested.

Choudhary *et al.* (2015) studied on heat induced changes in *khoa*. *Khoa* is a partially dehydrated milk product, prepared by continuous heating and manual stirring-cum-scraping until it reaches a semi solid (doughy) consistency. Various physico-chemical changes occur in milk during *khoa* preparation. Heating results in denaturation of milk protein forming coagulated mass. Browning reactions *viz.*, maillard and caramelisation browning induced in milk during *khoa* preparation. Elevated temperature also results in formation of heat degraded products. Microstructure of *khoa* as revealed by scanning electron microscopy consisted of protein agglomerated protein mass and void spaces in matrices.

Bhosale (2017) prepared *khoa* from cow milk for bottle gourd *burfi* preparation. Fresh clean and standardized milk was taken and boiled in a *karahi* over a non-smoky fire. The milk was stirred vigorously and constantly with a circular motion by a kunthi. During this operation all parts of pan with which the milk comes in to contact were lightly scraped by kunthi to prevent the milk from scorching. Constant evaporation of moisture takes place and the milk thickens progressively. The heating was continued with greater control hereafter and the speed of stirring-cum-scrapping increase. Then the viscous mass reaches a semi solid pasty consistency and begins to dried up then the final product was ready to use.

2.2 Technology of *Burfi* Preparation

Sharma *et al.* (1992) described the process for preparation of besan *burfi* by using Bengal gram flour, condensed milk, vanaspati (hydrogenated fat), powdered sugar and cardamom. 1 kg of Bengal gram flour were roasted with 0.6 kg vanaspati in an aluminium pan with continuous mixing. The final temperatures of the roasts were allowed to rise up to 140-165ºC. The roasts were allowed to cool at 115ºC and condensed milk (250 g) was added and mixed thoroughly. The mixture was again heated till the temperature reached 120ºC and allowed to cool at 100ºC and mixed with powdered sugar (1 to 1.3 kg) and cardamom (5 g).

Rao *et al.* (1993) developed the process of cashew nut *burfi* by using cashew nut, sugar syrup, cardamom, whole milk powder and vanaspati (hydrogenated fat). The sugar syrup was brought to 80^0 Brix. The cashew nut paste was added and cooked to 85^0 Brix. At this stage, the milk powder and vanaspati paste were added and the cooling continued to get 82^0Brix. Cardamom powder, BHA (0.02 %) and citric acid (0.1685) was added at this stage. The mass was then poured into 10 x 10 cm pieces, each piece weighing about 50 g.

Nikam (1996) studied on preparation of mango *burfi*, from cow milk and buffalo milk by desiccating it, into *khoa* (24 to 28 % moisture for cow milk and 18 to 22 % moisture for buffalo milk *khoa*). To this *khoa*, sugar was added and heated on low flame when the *khoa* started to leave the sides of *karahi*. The mango pulp was added and further heated on low flame, till product started again to leave. Then the product was

taken off the flame and transferred to cool for about 6 to 8 hours and cut into uniform squares pieces.

Sakate (2000) prepared wood apple *burfi* and observed that most acceptable product was obtained when sugar was added to milk as it started boiling continuous heating till dough stage was reached and then wood apple pulp was added and stirred thoroughly. Heating on low flame till the product leaves the sides of *karahi*. During this operation vigorous and continuous stirring was very essential in order to avoid scorching. Then the content were transferred into a greasy tray and cut into squares pieces of desirable uniform size. It was concluded that *burfi* prepared with 20 per cent wood apple pulp and 45 per cent sugar was the most acceptable product.

Kolhe (2003) while preparing papaya pulp *burfi*, concentrated the cow milk (4 % fat) to a pasty consistency by way of evaporation in open pan on gentle fire. The papaya pulp to various (0, 10, 20, 30, 40, 50 and 60 per cent) levels by weight of *khoa* was blended with concentrated milk. The sugar at the rate of 30 per cent by weight of *khoa* was added to blended components then the mixture was heated on gentle fire with constant stirring until a solid mass was obtained. The mixture was spread in the tray for cooling. Afterwards it was cut into uniform rectangular pieces. He concluded that *burfi* prepared with addition of 40 per cent papaya pulp and 30 per cent sugar was the most acceptable product.

Prabha (2006) developed a technology for the preparation of dietetic *burfi* using alternative ingredients, *viz.,* whey protein concentrate (WPC), sorbitol, maltodextrin and sucralose and their optimal levels were found to be 1.2 per cent, 15 per cent 8.17 per cent and 0.0375 per cent respectively. The product was found to be more acceptable by consumers.

De (2008) described the procedure for the manufacture of plain, chocolate and coconut *burfi* with the proportion of various ingredients. He suggested that 250 g of *khoa* should be cut into bits and spread in a *karahi*, mixed with 75 g of sugar and mixed well by working vigorously. When all the sugar has been dissolved, a compact mass should be collected and spread over a well-greased plate and cut into desired shape and size. This is the plain *burfi*. For the preparation of chocolate *burfi* one-third portion of the mixture should be mixed with 10 gm chocolate. The compact mass should be spread

on well-greased plate with one layer of plain *burfi* and then one-third of the chocolate mixed portion should be applied all over it as a thin layer. For coconut *burfi* preparation, grated, fine or dried coconut (35 g) should be mixed with compact mass of plain *burfi*. Spread it on a greased tray, keeping aside a little. Mix colour, light pink or green, in the portion set aside. Put it back on the fire. Cook till it becomes creamy. Spread it on the top of the first layer. Then allow it to cool. Decorate with silver paper if desired and cut in to desired uniform shape shape.

Kamble *et al.* (2008) studied on comparative compatibility of ber pulp with milk at different proportions. The milk and ber pulp blended at different proportions and addition of sugar at the rate of 40 per cent by weight were thoroughly mixed as per treatment and slowly heated with constant stirring till it reached to the solid mass apparently appearing like *burfi* then it was sprayed in a tray and allowed to cool. Finally, it was cut into desirable rectangular pieces.

Arora *et al.* (2010) studied the analysis of sucralose and its storage stability in *burfi*. They reported sucralose used at 0.025 per cent level in *burfi* scored highest in sweetness perception and resembled control with sucrose. A simple method was developed for the isolation of sucralose from *burfi* for HPTLC (High Performance Thin Layer Chromatographic) analysis. Methods were also standardized for qualitative detection of sucralose over amino HPTLC plates and quantitative analysis over silica gel HPTLC plates. Sucralose sweetened *burfi* possessed the same desirable sweetness, colour, body and texture even after 7 days of storage at 6-8^{0}C. Titratable acidity was higher in sucralose sweetened *burfi* than in control sample.

Chetana *et al.* (2010) studied on effect of processing variables on quality of milk *burfi* prepared with and without sugar. The optimum conditions for *burfi* prepared with sugar were: TSS of 78°B and 2–3 days of storage. *Burfi* prepared at optimum conditions had a breaking strength of 13.3 N with a sensory over-all acceptability score of 9.5 on a 10 point scale. Similarly, for *burfi* prepared with sorbitol to obtain a product close to its sugar counterpart required a TSS of 77.5°B and storage for 5–6 days to obtain a breaking strength of 12.9 N and a sensory overall acceptability score of 9.1.

Kadam *et al.* (2010) prepared *burfi* by using honey as natural sweetener. The buffalo milk was (6.58 % fat, 3.92 % protein, 15.64 % total solids and 0.14 %

acidity) concentrated to a pasty consistency by evaporating in open pan on gentle fire. When the product started to leave the sides of *karahi* (within 5 to 8 minutes) or at the pat formation stage, the honey or sugar (30 %) was added and properly mixed. The product was taken off the flame and transferred into greasy tray and was allowed to cool and cut into desirable uniform size.

Kamble *et al.* (2010) evaluated effect of pineapple pulp on sensory and chemical properties of *burfi*. The cow milk concentrated to a pasty consistency by evaporating in open pan on gentle fire. The sugar at the rate of 30 per cent was added and heated gently till pat formation. When the product started to leave the sides of *karahi* within 5 to 8 minutes the pineapple pulp was added and further heated on low flame till the product again started to leave the side of *karahi*. This was taken off the flame and transferred into greasy tray and was allowed to cool and cut into desirable size.

Waghamare (2012) prepared bottle gourd *burfi* with the help of using buffalo milk. While preparing bottle gourd *burfi,* the buffalo milk standardized to 6 per cent fat and 9 per cent SNF was taken in an iron *karahi* and heated on gentle fire. At the time of boiling, milk was stirred with the help of a *khunti* in a circular manner. The stirring-cum-scrapping process was continued till a pasty consistency was reached. Then temperature was lowered upto 88-89^{0}C. At this stage, bottle gourd pulp as per treatment and sugar @ 30 per cent of *khoa* were added. Finally this mixture was heated on a low fire with stirring till the desired texture was obtained. It was then spread in a tray and allowed to cool. After setting, bottle gourd *burfi* was cut into desirable rectangular blocks.

Navale *et al.* (2014) prepared wood apple *burfi*. Buffalo milk was procured, filtered through muslin cloth and standardized to 6 per cent fat and 9 per cent SNF. The milk was heated in a pan for conversion to *khoa*. *Khoa* was fortified with 40 per cent sugar and wood apple at different concentration. The mixture was heated on low fire with stirring till the desired texture was obtained. The mixture was spread in an aluminium tray and allowed to cool and settle. After setting, the mass was cut into desirable rectangular blocks of 3.0 x 3.0 cm size.

Satav *et al.* (2014) studied on *burfi* by using walnut powder. Received milk was preheated at 35-40^{0}C before filtration. Then milk was filtered in order to

remove the visible dust and dirt particles. The buffalo milk standardized to 5.5 per cent fat and 9 per cent SNF was taken in an iron *karahi* and heated on gentle fire. At the time of boiling, milk was stirred with the help of a *khunti* in a circular manner. The stirring-cum-scrapping process was continued till a pasty consistency was reached. Then the temperature was lowered up to 88-89^{0}C. At this stage, walnut powder as per treatment and sugar at the rate 30 per cent of *khoa* were incorporated. Finally this mixture was heated on a low fire with stirring till the desired texture was obtained. It was then spread in a tray and allowed to cool. After setting, walnut *burfi* was cut into desirable rectangular blocks.

Bhutkar *et al.* (2015) prepared *burfi* by using elephant foot yam pulp. The buffalo milk was concentrated to a pasty consistency by evaporating in open pan of gentle fire. The sugar at the rate of 30 per cent was added and heated gentle till pat formation. When the product was started to leave the sides of *karahi* within 5 to 8 minutes and small amount of food graded orange colour was added in the sample. The elephant foot yam pulp was added and further heated on low flame till the product again started to leave the sides of *karahi*. The product was taken off the flame and transferred into greasy tray and was allowed to cool and cut into desirable uniform size.

Tawade (2015) prepared *burfi* by utilization of stevia liquid. The cow milk was concentrated to a pasty consistency by evaporating in an open pan on gentle fire and heated gently till pat formation. When the product started to leave the sides of *karahi* (within 5 to 8 min), the stevia liquid was added and further heated on low flame till the product again started to leave the sides of *karahi*. The product taken off from the flame and transferred into greasy tray and was allowed to cool and cut into a desirable uniform size.

Kadam *et al.* (2017) prepared *khoa burfi* blended with alphanso mango pulp and the highly acceptable mango *burfi* can prepared from buffalo milk utilizing 15 per cent mango pulp, 5 per cent sugar and 0.15 per cent turmeric powder (w/v of milk). Every time, for each treatment, 2 litres buffalo milk was concentrated to a pasty consistency by evaporating in open pan on gentle fire. As the product started leaving the sides of *karahi* (within 5 to 8 min) or at the pat formation stage, alphanso mango pulp and sugar were added and mixed properly. The product was taken off the flame and

transferred into a greasy tray and allowed to cooling/setting for 6-8 hrs. and cut into desirable size. The product is shelf stable up to 6 days at ambient storage temperature.

Dua *et al.* (2018) Studied on ghee residue *burfi* supplemented with corn flour. Initially on the basis of sensory parameters the ghee residue (40 %), *khoa* (60 %), and sugar 30 g was standardized. Further different level of corn flour *viz.,* 3, 6 and 9 per cent were added in the ghee residue *burfi*. The developed products were assessed for physico-chemical, Colour and sensory parameters. On the basis of that the ghee residue *burfi* prepared by using 6 per cent corn flour was appreciable for its physico-chemical properties and acceptability.

Pal *et al.* (2018) prepared *burfi* by using bottle gourd and carrot. The product was prepared by using *khoa* (6 % fat), bottle gourd along with carrot in the ratio of T_0 (100:00:00), T_1 (80:12:08), T_2 (80:08:12) and T_3 (80:04:16) sugar was added @ 20 per cent. The treatment T_2 (8 % bottle gourd and 12 % carrot) received highest score for colour and appearance, body and texture, flavour and overall acceptability on 9 point hedonic scale.

2.3 Utilization of Fruits, Fruit Pulp, Nuts etc. in *Burfi*

Sakate *et al.* (2004) prepared wood apple *burfi* using cow milk *khoa* and three different levels of wood apple pulp @ 20, 30 and 40 per cent and 30, 35, 40 and 45 per cent sugar and reported that most acceptable product was obtained when sugar (45 %) was added to milk as it started boiling, continued heating till dough stage was reached and then wood apple pulp (20 %) was added and stirred thoroughly to mix the content uniformly by lowering the flame. Heating on low flame and working was continued till the product showed signs of leaving the sides of *karahi*. Then the contents were transferred into greasy tray to make a slab. It was allowed for cooling for about 10-12 hrs and cut into square pieces of desirable uniform size.

Kadam (2008) prepared *khoa burfi* blended with alphanso mango pulp and the highly acceptable mango *burfi* can prepared from buffalo milk utilizing 15 per cent mango pulp, 5 per cent sugar and 0.15 per cent turmeric powder (w/v of milk). Every time, for each treatment, 2 litres buffalo milk was concentrated to a pasty consistency by evaporating in open pan on gentle fire. As the product started leaving the sides of *karahi* (within 5 to 8 min) or at the pat formation stage, Alphanso mango pulp and sugar were

added and mixed properly. The product was taken off the flame and transferred into a greasy tray and allowed to cooling/setting for 6-8 hrs and cut into desirable size. The product is shelf stable up to 6 days at ambient storage temperature.

Khan *et al.* (2008) prepared groundnut *burfi*, for that, 1 kg of groundnut powder was roasted in an aluminium pan with continuous mixing. The final temperature of the roast was allowed to rise up to 120 ± 2^0C. The roasts were allowed to cool to 100^0C, and condensed milk (500 g), milk powder (37.5 g) dissolved in water (200 ml), sugar (750 g) and cardamom powder (12.5 g) were added and mixed thoroughly. The mixtures was again heated till the temperature reached 96-98^0C and poured into aluminium trays, rolled to a thickness of 1 cm, allowed to cool and cut into slabs.

Gupta *et al.* (2010) developed the process for preparation of coconut *burfi*. Coconut gratings of 1-2 mm particle size and sugar were mixed in the ratio of 1:1 and the mixture was heated in a pan with constant stirring till a soft textured product was formed. Ghee (clarified butter) and cardamom powder were added and stirred well. The product was poured out to the pan and spread to form a sheet of 1.0-1.5 cm thickness on a plate greased with thin layer of ghee and allowed to set for 30 minutes. Then the *burfi* was cut into 4×4 cm square pieces and packed after cooling.

Wasnik *et al. (*2013) prepared santra *burfi* and found that the *burfi* prepared with addition of orange pulp (0, 5, 10, 15, 20 and 25 % w/w of *khoa*) and sugar was added @ 35 per cent of *khoa* popularly known as santra *burfi* in Maharashtra and it has great commercial potential owing to its typical taste. The sugar @ 35 per cent of *khoa* was added. They carried out their investigation with a view to generate technological data, which is requisite in product standardization and mechanization. The santra *burfi* was prepared by varying the rates of orange pulp.

Kamble and Patange (2014) optimized the process for preparation of Fig *burfi* wherein, the addition of sugar, dry Fig in chaffed rectangular form at pat formation stage of *khoa* produced a better-quality *burfi* from sensory point of view. In the optimization of compositional variables, Fig *burfi* samples were prepared by adopting optimized processing steps using three levels of Fig *viz.* 3, 4 and 5 per cent and two levels of sugar *viz.* 25 and 30 per cent. Out of six treatment combinations, the highest sensory score for overall acceptability was (score 8.10) obtained by Fig *burfi* having 4 per

cent Fig and 30 per cent sugar. The quality of *burfi* from the best combination of Fig and sugar was further evaluated for suitable fat level in milk *viz.* 5, 6 and 7 per cent. The product made from buffalo milk having 6 per cent fat significantly improved the overall acceptability body and texture over the product made from milk containing 5 per cent fat, whereas, the product prepared from buffalo milk containing 7 per cent fat did not differ significantly from that made with 6 per cent fat milk.

Navale *et al.* (2014) prepared a wood apple *burfi*, where the pulp of ripe wood apple procured from local market was blended with buffalo milk *khoa* at 5 per cent, 10 per cent, and 15 per cent concentrations. *Burfi* prepared without adding wood apple pulp served as the control. The proximate composition, sensory characteristics and cost structure of different combination of the product were compared against normal *burfi* prepared from buffalo milk. Wood apple *burfi* had significantly higher moisture, total sugar and acidity per cent but lower protein, fat, ash, and total solids per cent than the control. The *burfi* with 10 per cent wood apple pulp and 40 per cent sugar are having highest sensory score.

Patil *et al.* (2015) prepared *burfi* using date paste for that they mix date paste @ 5, 10, 15 and 20 per cent of milk and sugar was used @ 5 per cent of milk. The most acceptable *burfi* can be prepared by using 10 per cent date. After receiving milk, it was filtered and kept for continuous heating at 55^0 to 60^0 C and then boiling with continuous stirring/scrapping. When viscous product with paste/semisolid consistency was obtained heat was reduced and recommended amount of sugar and date paste as per treatments were added and properly stirred and noticed to obtain *khoa burfi* mass. *Burfi* mass was then well spread in greasy tray and kept for cooling/setting for 6 to 8 hrs. The *burfi* was cut into desirable size and shapes of pieces and stored as per recommended packaging material

Mete *et al.* (2017) prepared *khajoor burfi* formulated by using *khoa* and *khajoor* in proportion of 80:20 with incorporation of 2, 4 and 6 per cent honey. The *khajoor burfi* added with 4 per cent honey score highest in sensory attributes. The nutritional composition of all treatment showed that the fat and carbohydrate content of *burfi* is reduced with increased level of honey. The fat, protein, total sugar and reducing sugar of selected treatment were found to be 16.42, 14.80, 42.43 and 35.52 per cent

respectively Further it can be concluded that honey can be utilized for *burfi* upto 4 percent

Patel *et al.* (2017) prepared a special anjeer, chicory, oat *burfi* with improved product characteristics and consumer acceptability. Levels of different component were optimized using Response Surface Methodology. Besides that, physico-chemical properties such as moisture, fat, carbohydrate, protein, ash and energy content were also analysed. Sensory evaluation of product was done on a 9-point hedonic scale by a panel of experts for colour, flavor, body and texture, sweetness and overall acceptability. Fat, Protein, carbohydrate and ash content was respectively 16.6, 11.55, 57.86 and 3.06 per cent. Per gram of *Burfi* provides 317 kcal of energy. The colour, flavor, body and texture, sweetness and overall acceptability of product were 81.25, 80.00, 82.5, 86.25 and 81.25 per cent respectively.

2.4 Nutritional properties of guava

The flavour is most distinguishing characteristic of the guava fruits. The flavour of guava has been attributed to the presence of several volatile constituents including hydrocarbons, alcohols and carbonyls. It is reported by Steavan *et al.* (1970**)** that about 22 different compounds play predominant role in the flavour and odour of guava fruits.

Chemical composition of guava given by Adsule and Kadam (1995) is as fallow.

Table 2.1 Chemical composition of guava pulp

Sr. No.	Constituent	Average
1.	TSS (Brix)	11.00
2.	Total sugar (%)	6.15
3.	Reducing sugar (%)	5.50
4.	Non-reducing sugar (%)	0.65
5.	Acidity (Percent citric acid)	0.70
6.	Ascorbic acid (mg/100g)	253
7.	pH	4.10
8.	Pectin (%)	2.15

Table 2.2 Nutritional value of guava

Sr. No.	Principle	Nutrient Value (Value per 100 gm)	Percentage of RDA
1.	Energy	68 Kcal	3.5 %
2.	Protein	2.55 g	5 %
3.	Carbohydrates	14.3 g	11.5 %
4.	Total fats	0.95 g	3 %
5.	Cholesterol	0 mg	0 %
6.	Dietary Fiber	5.4 g	14 %
	Vitamins		
1.	Folates	49 µg	12.5 %
2.	Niacin	1.084 mg	7 %
3.	Pyridoxine	0.110 mg	8.5 %
4.	Pantothenic acid	0.451 mg	9 %
5.	Riboflavin	0.040 mg	3 %
6.	Thiamin	0.067	5.5 %
7.	Vitamin-A	624 IU	21 %
8.	Vitamin-C	228 mg	396 %
9.	Vitamin-E	0.73 mg	5 %
10.	Vitamin-K	2.6 µg	2 %
	Electrolyte		
1.	Potassium	417 mg	9 %
2.	Sodium	2 mg	0 %
	Minerals		
1.	Calcium	18 mg	2 %
2.	Copper	0.230 mg	2.5 %
3.	Magnesium	22 mg	5.5 %
4.	Iron	0.26 mg	3 %
5.	Phosphorus	11 mg	2 %
6.	Manganese	0.150 mg	6.5 %
7.	Selenium	0.6 mcg	1 %
8.	Zinc	0.23 mg	2 %
9.	Phyto-Nutrients	-	-
10.	Carotene-β	374 µg	--
11.	Crypto-xanthin-β	0 µg	--

Anonymous 2009-www.nutrition-and-you.com

The content of organic acids has been reported to vary significantly in guava varieties.

Chang *et al.* (1971) noted that presence of malic, citric, glycolic, tartaric and lactic acid in guava fruits, first two of which bring prominent.

Gangwar (1972) reported that the fresh ripe fruits of winter season had TSS (10 ^{0}B), total sugar (9.4%), pectin (1.169), acidity (0.48 %), and ascorbic acid (268.0 mg/100g) and were superior to rainy season fruits in quality.

Chang and Kwok (1975) reported that the sugars *viz.,* glucose sucrose and fructose were present in guava in the proportion of 36.0, 5.0 and 59.0 per cent, respectively.

Dhingra *et al.* (1983) found that the winter season guava fruits contained higher amount of pectin with more jelly units than rainy season fruits.

Mitra *et al.,* (1984) reported considerable variation in physico-chemical parameters of some guava varieties in respect of length, diameter, weight, TSS, Total Sugar and ascorbic acid content of the fruits.

It was observed by Singh (1988) that the guava fruits which ripens during winter season (November-December) contained more ascorbic acid (325 mg/100g) than those ripened during rainy season i.e. July-August to be 140 mg/100g. Carbohydrates are the principle constituents of guava. Sugars constituted about 6 to 11 per cent of the fresh weight of guava.

Mitra and Bose (1999) reported that the guava contains about 83.0 per cent moisture and 17.0 per cent dry matter. Carbohydrates constitute about 6 to 11 per cent of the fresh weight of the guava. A sucrose, Glucose and fructose sugars were present in guava in the proportion of 5.00, 36.00 and 59.00 per cent, respectively. Guava is excellent source of vitamin C and it ranged from 37 to 1000 mg/100g in different varieties.

Coralia *et al.* (2011) reported that the guava fruit exhibits excellent nutritious, sensory and bio functional properties. Among them it is remarkable the high vitamin C content (269 mg /100 g) with dietary fibre, antioxidant compounds, its intense and pleasant aroma. Dietary fiber is largely composed of complex, carbohydrate that are beneficial to digestion, because they contribute to maintain the colonic micro flora and to

remove waste and toxins. A major component of soluble fibre is pectin, which is an anionic polysaccharide mainly composed of partially esterified D-galacturonic acid monomers linked by (1-4) bonds. To this, red guava exhibits high pectin content (1.04-1.74 g/100 g of fresh weight) in comparison with other fruits. Guava pectin has a high methoxy index that imparts viscous properties to guava purees or juices.

Jain and Neema (2011) evaluated the quality of papaya and guava fruit pulp as influenced by blending ratio and storage period. Papaya and guava are the most widely grown commercial fruits of India. Both the fruits are nutritive and may be used for processing. Then analysis of organoleptic characteristics (i.e., colour, flavor, taste, texture and overall acceptability) and qualitative characters (i.e., TSS, pH, acidity, ascorbic acid content) of Papaya and guava fruits was conducted for fresh fruit, prepared pulp and mixed pulp.

2.5 Organoleptic / Sensory evaluation of *burfi*

Gargade (2004) prepared orange *burfi* and reported that, the highest sensory score was obtained (91.13) when 10 per cent orange concentrate by weight of *khoa* was incorporated and found significant better from the point of taste flavour and colour of *burfi*.

Sabale (2005) reported the sensory qualities of besan (Gram flour) *khoa burfi* as, the average score obtained (out of 45) for the flavour of *burfi* under various treatment were in the range of 35.33 to 40.15 per cent the average score from (out of 35) for body and texture were 25.05 per cent to 30.55 per cent and average score from (out of 20) for colour and appearance were 13.97 per cent to 16.97 per cent.

Wankhede (2005) prepared mango *burfi*. The overall acceptability is (96.11) when 40 per cent mango pulp concentrate by weight of *khoa* was incorporated and found significant better from the point of flavour, body and texture, colour and appearance of *burfi*.

Thaware (2008) reported the sensory qualities of mango and orange pulp *burfi*, as the average score obtained (out of 45) for the flavour of *burfi* under various treatment were in the range of 36.96 to 43.40. The average score from (out of 35) for body and texture were 29.86 to 33.06 and average score from (out of 20) for colour and appearance were 15.26 to 18.20.

Arora *et al.* (2010) prepared *burfi* by using sucrose for all sensory quality attribute compared to *burfi* made by using sucralose. Sucrose helps to form a network and create a binding effect in the product. Hence, the inclusion of sugar improved the mouth feel of the product. On the contrary, sucralose had insufficient water binding and thus resulted in product with slightly low score.

Kadam *et al.* (2010) Prepared *burfi* with different levels of honey i.e. treatments T_1, T_2 and T_3 (4, 5 and 6 %) by weight of milk without addition of cane sugar and control sample (T_0) without addition of honey and with addition of recommended level of cane sugar (30 % by weight of *khoa*). There was no significant difference in score for colour, flavour, appearance, body and texture of *khoa burfi*. However, overall acceptability score showed significant variation due to treatments. The most acceptable *burfi* score 7.98 was for treatment (T_2) i.e. *burfi* prepared by blending of 5 per cent honey.

Kamble *et al.* (2010) prepared pineapple *burfi* and found that, the overall acceptability is (93.52) when 15 per cent pine apple concentrate by weight of *khoa* was incorporated and found significant from the point of colour and appearance, flavor, body and texture, of *burfi*.

Adani (2011) studied on utilization of date paste in preparation of cow milk *burfi*. *Burfi* was prepared by using different level of date paste i.e. treatment (T_1) 0%, (T_2) 2%, (T_3) 4%, (T_4) 6%, (T_5) 8% and stated that the treatment T_4 (6%) has a highest overall acceptability. Afterwards, he concluded that good quality *burfi* can be prepared from different level of date paste i.e., (T_1) 0%, (T_2) 2%, (T_3) 4%, (T_4) 6%, (T_5) 8 % date paste.

Borse (2011) prepared gulkand *burfi* and reported that, the overall acceptability is (96.4) when 4 per cent gulkand concentrate was incorporated by weight of *khoa* and found significant better from the point of colour and appearance, flavor, body and texture of *burfi*.

Datarkar (2012) evaluated the sensory qualities of singhara flour *burfi*, as the average score obtained (out of 45) for the flavour of *burfi* under various treatments was in the range of 39 to 41.35. The average score from (out of 20) for colour and

appearance were 16.57 to 18.75. And The average score from (out of 35) for body and texture were 28.34 to 32.23.

Watharkar *et al.* (2012) evaluate the nutritional value and consumer acceptance of *burfi* containing three different concentrations of finger millet flour (0, 10, 20 and 30 %) as partial replacement for Bengal gram flour. The results showed that, *burfi* samples enriched with whole ragi flour were rich in minerals content like calcium, iron and crude fibre as compared to the control sample. Sensory scores of *burfi* sample prepared with 90 per cent Bengal gram flour and 10 per cent whole ragi flour was approximately same as the control. The *burfi* prepared with 30 per cent whole ragi flour had highest mineral and fibre content, but the sensory score was low due to the loss in softness and increased intensity of brown colour. The *burfi* prepared with 20 per cent whole ragi flour had low mineral and fibre content than 30 per cent whole ragi flour, but the sensory score was high. These *burfi* may be beneficial for growing children, teenagers and pregnant and lactating women due to its high nutritive value.

Tanuja *et al.* (2017) evaluate the sensory and nutritional properties of *burfi* prepared by incorporation of apple pomace at three different levels *viz.*, 5, 10 and 15 per cent and compared with control. The result of sensory parameters exhibited highest scores for T_3 treatment for appearance and colour, flavour, texture and sweetness. The overall acceptability was highest for apple pomace *burfi* prepared with incorporation of 15 per cent apple pomace.

Kamble *et al.* (2019) evaluated sensory properties of green chickpea *burfi* prepared with three levels of green chickpea i.e. 2, 4 and 6 per cent and two level of sugar i.e 25 and 30 per cent in six treatment combination. Colour and appearance, flavour and overall acceptability score was recorded maximum for 4 per cent green chick pea and 25 per cent sugar.

More (2019) evaluated the effect of red pumpkin powder on sensory quality of *burfi.* They mix red pumpkin powder @ 15, 17 and 19 per cent by weight of *khoa*. They found that colour and appearance, flavour, body and texture and overall acceptability score was highest in *burfi* prepared with 17 per cent red pumpkin powder by weight of *khoa*.

Choudhary *et al.* (2019) evaluated the effect of aloe vera juice on sensory quality of *burfi.* They incorporated aloe vera juice @ 5, 10, 15 and 20 per cent by weight of *khoa*. They observed that aloe vera juice incorporation up to 20 per level cent did not affect the colour and appearance, texture and sweetness score but flavour and overall acceptability score were significantly decline after 15 per cent aloe vera juice addition in *burfi*.

Asati *et al.* (2019) studied the effect of orange rind on sensory quality of *burfi.* They added orange rind @ 0, 10, 15 and 20 per cent by weight of *khoa*. Overall acceptability score for treatment $T_{0,}$ $T_{1,}$ T_3 and T_4 were 7.88, 7.79, 8.00 and 7.83 recorded, respectively on 9 point hedonic scale.

2.6 Chemical Composition of *Burfi*

Research workers all over India have been incessantly attempting to prepare *burfi* using different ingredients with a wide variation in their composition. *Burfi* may contain 4.30-23.39 per cent moisture, 13.00-24.70 per cent fat, 10.37-19.29 per cent protein, 2.92-19.54 per cent lactose and 2.15-2.86 per cent ash. Wide variation was also observed in sucrose content of *burfi* made in laboratory sample, it was ranged from 29.58-54.30 per cent. Although there is a wide variation between the samples of plain fruits, nuts, cereal and pulse added *burfi* as reported by various workers (Table 2.3).

Table 2.3 Chemical composition of laboratory made *burfi samples*

References	Type of *burfi*	Chemical constituents (%)					
		Moisture	Fat	Protein	Lactose	Sucrose	Ash
Kotade (2001)	Papaya and sapota *burfi*	17.03	19.43	11.79	19.54	29.58	2.61
Sarkar *et al.* (2002)	Cow milk *burfi*	20.73	19.04	10.37	16.56	30.83	2.44
Sakate *et al.* (2004)	Wood apple *burfi*	14.49	19.53	12.26	18.57	23.84	2.86
Palit and Pal (2005)	Plain *burfi*	15.64	20.37	15.05	15.81	30.41	2.72
Ray *et al.* (2005)	Pulse *burfi*	19.23	21.70	11.05	14.68	09.03	2.62
Matkar (2006)	Fig *burfi*	14.18	15.10	17.30	-	-	2.15
Gajbhiye *et al.* (2007)	Doda *burfi*	9.2	19.5	12.37	-	-	2.10
Kadam (2008)	Mango *burfi*	23.39	22.86	10.41	19.02	-	-
Khan *et al.* (2008)	Groundnut *burfi*	7.1	2129	15.68	-	-	1.39
Kamble *et al.* (2010)	Pineapple *burfi*	18.12	17.13	13.09	-	-	2.77
Kamble and Patange (2014)	Fig *burfi*	16.12	20.25	14.41	19.58	27.16	2.42
Navale *et al.* (2014)	Wood apple *burfi*	19.17	18.10	13.52	-	-	2.69
Patil *et al.* (2015)	Date *burfi*	-	23.92	16.53	-		3.83

2.7 Textural Properties of *Burfi*

Raut (2014) studied on textural properties of *burfi* sold in Parbhani market and reported the value of textural parameters in following table.

Satav *et al.* (2014) studied the textural properties of walnut *burfi.* He reported the observation as hardness 0.462 to 1.193 kg, cohesiveness 0.108 to 0.183, adhesiveness 0.003 kg, springiness 14.727 to 15.201 mm, gumminess 0.058 to 0.126, chewiness 0.805 to 1.855 kg.

Table 2.4. Textural properties of market sample of *burfi* sold in Parbhani market

Sample	Hardness (kg)	Cohesiveness	Adhesiveness (kg)	Springiness (mm)	Gumminess	Chewiness (kg)
Plain *Burfi*	0.522	0.170	0.013	3.801	0.089	0.337
Mango *burfi*	0.265	0.110	0.001	4.481	0.029	0.123
Fig *Burfi*	0.318	0.223	0.004	3.696	0.071	0.262
Strawberry *burfi*	0.258	0.127	0.001	4.691	0.033	0.153

Tanuja *et al.* (2017) studied the textural properties of apple pomace incorporated in *burfi* and reported that hardness 3.97 to 1.87 N/cm^2, adhesiveness -45.17 to -80.36 N.sec, cohesiveness 0.39 to 0.25, gumminess 0.58 to 0.27 N/cm^2, springiness 0.39 to 0.84 cm, chewiness 0.36 to 0.24 N/cm, resilence 0.036 to 0.031.

Shrivas *et al.* (2018) evaluated the rheological properties of rava *burfi* during storage period. They observed hardness 19.71 to 31.28 N, cohesiveness 0.0027 to 0.0018, gumminess 0.30 to 0.71 N, chewiness 2.02 to 2.92 N.mm, adhesiveness 1.10 to 2.84 N.mm and springiness 1.27 to 1.03 mm.

Singh and Kumar (2018) studied the textural qualities of mango *burfi* prepared by natural sweetener (honey). The value of textural parameters as hardness 3.600 to 2.182 N, cohesiveness 0.261 to 0.148, adhesiveness 0.000 N, springiness 0.354 to 0.177, gumminess 0.739 to 0.207 N and chewiness 0.196 to 0.073 N.mm.

Tulavi *et al.* (2018) reported the effect of incorporation of inulin on textural properties of *burfi*, observed the hardness 3.045 to 5.058 kg, cohesiveness 1.738 to 2.305, adhesiveness 0.235 to 0.423 kg.sec, springiness 1.728 to 1.600 mm, gumminess 5.288 to 11.658 kg.sec and chewiness 9.135 to 18.660 kg.sec.

Choudhary *et al.* (2019) studied the textural properties of aloe vera incorporated *burfi* as hardness 1723 to 1457 gm, adhesiveness -18.16 to -39.29 gm, cohesiveness 0.206 to 0.134, and springiness 0.169 to 0.161 mm.

3. MATERIAL AND METHOD

The investigation entitled, "STUDIES ON PREPARATION OF *KHOA BURFI* BLENDED WITH GUAVA (*Psidium guajava L.*) PULP" was undertaken in the laboratory of Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) during the period from August 2019 to December 2020.

3.1 Materials

The following materials were used while performing the experiments.

3.1.1 Ingredients

3.1.1.1 Milk

The fresh crossbred cow milk samples were procured from Research-Cum-Development Project (RCDP) on Cattle, MPKV, Rahuri, Dist. Ahmednagar (Maharashtra) for preparation of *burfi* samples.

3.1.1.2 Sugar

Good quality sugar was procured from the local market.

3.1.1.3 Fresh Guava Fruit

Guava fruits of Cv. Sardar (L-49) were freshly harvested from the orchard of Horticulture Farm and Central Nursery, Department of Horticulture, MPKV Rahuri.

3.1.1.4 Skimmed milk powder

Good quality Skimmed milk powder brand name Govind was procured from local market.

3.1.2 Equipments

3.1.2.1 Vessels

Guava pulp and milk was kept in convenient sized stainless steel vessels before preparation of *burfi*.

3.1.2.2 *Karahi*

Iron *Karahi* with 31 cm diameter and 8.5 cm depth along with stainless steel laddle were used for preparation of *burfi*.

3.1.2.3 LPG Burner

It was the source of heating of milk during Preparation of our products.

3.1.2.4 Laddle/ Kunthi

Iron kunthi were used for continuously stirring cum scraping the milk during preparation of *burfi*.

3.1.2.5 Cutting Knife

Stainless steel cutting knife was used to cut *burfi* pieces of desirable size.

3.1.2.6 Tray

Rectangular stainless steel trays (size 28x23x3.5) were used to cool, flatten, and shape of *burfi.*

3.1.2.7 Glassware

Borosil and Corning glassware were used to analyse milk and *khoa*.

3.1.2.8 Weighing Balance

Electronic precision balance (BT 2245, Sartorious ISO 9001) was used for weighing samples and chemicals during research work.

3.1.2.9 Hot Air Oven

Hot air oven manufactured by Yorko Company was used for sterilizing the glassware and analysing moisture from milk and *burfi* throughout the study period

3.1.2.10 Muffle furnace

Muffle furnace was used for determination of ash in milk and *burfi* sample.

3.1.2.11 Chemicals

All the chemicals used in study for the analytical purpose were of analytical (AR) or guaranteed reagent (GR) grade by Merk, India Ltd and Glaxo India Ltd.

3.1.2.12 Textural profile analyser

The textural properties i.e. hardness, cohesiveness, springiness, adhesiveness, chewiness were determined with the help of TAXT2 textural profile analyser available at PHT laboratory, Dr. A.S. college of Agriculture Engineering and Technology, MPKV, Rahuri.

3.2 Methods

3.2.1 Chemical Analysis of Milk

3.2.1.1 Fat

The fat content was determined by Gerber method as described in IS: Kumar (Part-I), 1977.

3.2.1.2 Protein

The protein percentage of milk was determined as per the semi-micro Kjeldahl method as recommended in IS: 1479 part II (1961).

3.2.1.3 Total Solids

The total solid content was determined by gravimetric method as per IS: 1479 (part- II), 1961.

3.2.1.4 Ash

The ash percentage was determined as per the method recommended in B.I.S Handbook of food analysis IS: 1165, (1967).

3.2.1.5 Titratable Acidity

Acidity percentage in milk was determined as per the procedure recommended in BIS Handbook for Food Analysis Dairy products in SP: 18 Part XI (1981).

3.2.1.6 Moisture

Moisture content in the sample was determined by subtracting the total solids content from 100 in the sample.

Moisture (%) = 100 - Total solids (%)

3.2.2 Preparation of Guava Pulp

Take ripe guava fruit
↓
wash it with clean water
↓
Cutting into small slices
↓
Blend these slices in blender
↓
Filter the mixture
↓
Collect pulp in beaker
↓
Store in refrigerator

Flow diagram for preparation of guava pulp

3.3 Methodology

3.3.1 Phase –I Preliminary Trails

Preliminary trails were conducted to decide the levels of sugar, guava pulp and SMP in *burfi*. First, level of sugar is fixed by taking trials with 20, 25, 30 and 35 per cent sugar. After sensory evaluation 25 per cent sugar was fixed also the level of SMP were fixed by taking trial with 2, 3, 4 and 5 per cent, after sensory evaluation 4 per cent SMP was fixed. *Burfi* was prepared by addition of 5, 8, 11, 14, 17, 20 and 23 per cent levels of guava pulp on weight of *khoa* and constant 25 per cent sugar and 4 per cent SMP level. The control sample were also prepared without addition of guava pulp. The guava *burfi* prepared were subjected to sensory evaluation by five semi trained panel of judges.

3.3.2 Phase –II Experimental Trails

On the basis of results of sensory evaluation 11, 14 and 17 per cent guava pulp levels, 25 per cent sugar levels and 4 per cent SMP levels were selected for experimental trails.

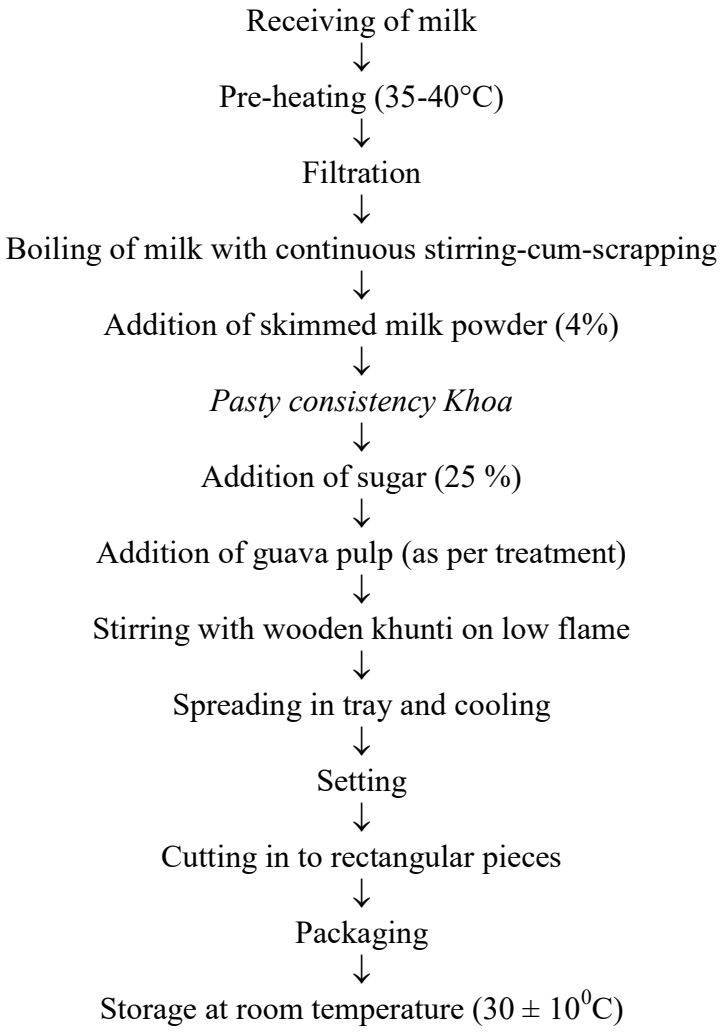
3.3.3 Treatment Details

T_0 (Control)	Khoa + 25 % Sugar + 0% guava pulp
T_1	Khoa + 25 % Sugar + 4% SMP + 11% guava pulp
T_2	Khoa + 25 % Sugar + 4% SMP + 14% guava pulp
T_3	Khoa + 25 % Sugar + 4% SMP + 17% guava pulp

3.4 Methodology

3.4.1 Preparation of Guava *Burfi*

The *burfi* samples were prepared by using standard procedure described by Aneja *et al*. (2002) with suitable modifications as per given in Preliminary trials.



Flow diagram for preparation of guava *burfi*

3.5 Sensory Evaluation

The sensory evaluation of guava *burfi* samples prepared under preliminary trails and experimental trails was done by using the method described by Nelson and Trout (1964) using 9 point Hedonic scale. A panel of five semi-trained judges was formulated for this purpose. The samples were coded every time to conceal their identity and were offered to the judges for evaluation of sensory attributes.

3.6 Chemical Analysis of *Burfi*

3.6.1 Fat

Fat content in *burfi* was determined by Mojonnier fat extraction apparatus method as prescribed in B.I.S. Handbook of food analysis. ISO 3889:1977.

Procedure:

1. Weighted 5 gm of *burfi* sample and taken into a small beaker.
2. Few drops of water was added in that beaker and rubbed to a smooth paste.
3. Added 9 ml of water the first few drops being used to wash the tip of the glass rod.
4. 10 ml of conc. hydrochloric acid was added into beaker and heated on a Bunsen burner.
5. The content was transferred to the Mojonnier fat extraction flask and added 10 ml of ethyl alcohol first to the beaker and later transfer the contents to the Mojonnier fat extraction flask.
6. The content was mixed well and added 25 ml of ethyl ether to the beaker when cooled and from beaker to the Mojonnier flask.
7. Flask was stoppered with cork or a stopper of synthetic rubber unaffected by usual fat solvents and shaked vigorously for one minute.
8. Added 25 ml of petroleum ether first to the beaker and then transfer it to the Mojonnier flask and repeated vigorous shaking for one minute.
9. Decant off the clear ethereal layer into a suitable flask or dish, washed the delivery end of the extraction tube with a little ether and added the washings to the flask.
10. Repeated two extraction of the liquid remaining in the extraction tube using 15 ml of each solvent every time.
11. Added the ethereal extract to the flask and evaporate off completely the combined ether extract.
12. Dried the flask in an air-oven at 100 ± 2^0C, cooled and weighed, heated the flask again for 30 minutes, cooled in desiccators and weighed.
13. Repeated the process of heating for 30 minutes, cooling and weighing until the difference between two successive weights was not exceed 1 mg.
14. Removed the fat completely from the flask with the aid of small portions of the petroleum ether, dry as before and weigh.

$$\text{Fat (\%) w/w} = \frac{w_1 \times w_2}{W} \times 100$$

Where,

w_1 = weight of dish with fat

w_2 = weight of empty dish

W = weight of material taken for test

3.6.2 Protein

Protein percentage of *burfi* was determined as per the procedure recommended in BIS Hand book of Food Analysis Dairy Products in SP: 18 part XI (1981).

Procedure

1. 10 g of *burfi* sample was taken accurately and transferred in to Kjeldahl flask.
2. Added 25 ml of concentrated sulphuric acid in such way as to wash down any *burfi* particles adhering to the neck of the flask.
3. Added 0.2 g of copper sulphate and 10 g potassium sulphate.
4. Digested the contents till the solution become clear.
5. Cooled the contents and add about 200 ml of distilled water. Glass beeds was added to avoid bumping.
6. Connected the flask to distillation assembly and condenser.
7. Placed 50 ml of 0.1 N H_2SO_4 solutions in a beaker and kept it bellow the condenser in such a way to dip the tip of condenser in this solution.
8. Added 5 to 6 drop of indicator solution to sulphuric acid.
9. Heated the contents of Kjeldahl flask to collect distillate up to a volume of 250 ml in the beaker.
10. Removed the beaker, stopped heating and washed tip of Condenser and collected washing in the beaker of distillate collected.
11. Titrate the distillate contents of beaker against 0.1 N sodium hydroxide solutions.
12. Determined amount of excess sulphuric acid by subtracting amount of 0.1 N sodium hydroxide used.
13. A blank determination was also carried out simultaneously and nitrogen was calculated as under.

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

Where,

A = Volume in ml N/10 NaOH in blank determination

B = Volume in ml of N/10 NaOH in the rest

W = Weight in mg of sample taken

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

Protein (%) = Per cent total nitrogen x 6.38

3.6.3 Total Solids

The total solid percentage in *burfi* was determined by using gravimetric method as per the procedure of IS: 1479 (Part II) (1961).

Procedure

1. A metal dish containing 25 g of prepared sand was heated in an oven at 98-100^{0}C for about 2 hours, cool in desiccator for 30-40 min and weighed.
2. Weighted accurately about 1.5 g of sample and added about 5 ml distilled water and thoroughly mixed with the sand. Place the dish on a boiling water bath for 20 min and then transferred into the oven adjusted at 100^{0}C for one to half hours.
3. After three hours, transferred the dish into a desiccator, cooled it to room temperature and weighed.
4. Repeated the process of heating, boiling and weighing until the loss of weight between two successive weighing' does not exceed 0.5 mg. Noted the lowest weight. The total solids were determined by following formula

$$\text{Total solid} = \frac{\text{Weight of residue obtained after drying}}{\text{Weight of } \textit{burfi} \text{ sample}} \times 100$$

3.6.4 Ash

Ash content of *burfi* was determined as per the procedure recommended in Handbook of Food Analysis Dairy Product in SP: 18 part XI (1981).

Procedure

1. Weighted 3 gm of *burfi* sample was taken accurately into crucible.
2. Crusible was previously cleaned and dried in hot air oven.

3. Heated the crucible gently on a flame at first and then strongly in a muffle furnace at $550^0 \pm 20^0$C till gray ash obtained.
4. Cooled the crucible in desiccator and weighted.
5. Heated the crucible again at $550^0 \pm 20^0$C for 30 min. and cooled in desiccator and weighted.
6. Repeated this process of heating for 30 min. Cooling and weighing until the difference between two successive weighing was less than one milligram.

Calculation

The ash percentage was calculated by the formula:

$$\text{Per cent of ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

3.6.5 Acidity

Acidity percentage of *burfi* was determined as per the procedure recommended in Handbook of Food Analysis Dairy Products in SP: 18 part XI (1981).

Procedure

1. 1 g of the *burfi* sample was taken in to each of two porcelain dishes.
2. Added 10 ml of boiling water to each dish stir with the flat end of a glass rod until a perfectly smooth liquid is obtain. Cooled to room temperature.
3. Used the contents of one dish as a blank by stirring in 2 ml of bench solution of Rosaniline acetate.
4. Added 1 ml of phenolphthalein indicator solution to the other dish followed by standard sodium hydroxide solution added drop by drop from burette until comparison the colour matches pink tint of blank solution.
5. Stirred vigorously throughout.
6. The time taken for complete titration was not exceeding 20 sec.

Calculation

$$\text{Acidity (\%)} = \frac{\text{Number of ml 0.1 N NaOH required} \times 0.009}{\text{Weight of } \textit{burfi}} \times 100$$

3.6.6 Moisture

Moisture content in the sample was determined by subtracting the total solids content from 100 in the sample. Moisture (%) = 100 - total solids (%).

3.7 Textural Properties of *Burfi*

The textural properties were evaluated using the TA.XT plus texture analyser of stable Micro system equipped with 50 kg load cell. The analyser is linked to a computer a computer that recorded the data via a software programme. *Burfi* sample of length 1 cm^3 was cut from the central portion of tofu cake with a stainless steel cutter. A stainless steel probe of 5 mm diameter with a flat end was used to determine the textural properties with following settings.

Test mode	:	Compression
Pre-test mode	:	1 mm/ sec
Test speed	:	1 mm/ sec
Post-test speed	:	5 mm/ sec
Target mode	:	Distance
Distance	:	5 mm
Count	:	2 count

3.7.1 Typical Textural Profile Curve

The data obtained in the compression test were used for determination of the following textural parameters.

3.7.1.1 Hardness

It is defined as the value of the peak force of the first compression of the product.

Hardness, g (H) = maximum force of first compression.

3.7.1.2 Cohesiveness

Extent to which a material can be deformed before it ruptures depending on the strength of internal bonds (Ratio of the positive force areas under first and second compressions).

$$\text{Cohesiveness} = \frac{\text{Area under the } 2^{nd} \text{ compression (A2)}}{\text{Area under the } 1^{st} \text{ compression (A1)}}$$

3.7.1.3 Adhesiveness

The energy required to overcome attractive force between the food and any surface it is in contact.

Adhesiveness, g.mm (A_3) = Negative area in the graph.

3.7.1.4 Springiness

The elastic recovery that occurs when the compressive force is removed.

Springiness = D_1.

3.8 Statistical Design

The data were analysed as per the Completely Randomized Design in which four treatments were replicated four times. Data was analysed by giving the statistical treatments to the findings describe by Gomez and Gomez. (1984).

4. RESULT AND DISCUSSION

In order to determine the quality as well as acceptability of guava *burfi,* a sensory evaluation has been carried out. Similarly, the chemical quality and textural properties were studied.

The results of present research work are tabulated, presented and discussed under following main heads.

4.1 Chemical Composition of Milk

4.2 Chemical composition of guava

4.3 Sensory Quality/ Evaluation of *Burfi*

4.4 Chemical composition of *burfi*

4.5 Textural properties of *burfi*

4.1 Chemical Composition of Milk

The composite cow whole milk was used throughout the study. The milk was collected from the cross-bred cow herd maintained at Research – Cum – Development Project on Cattle, Dept. of Animal Husbandry and Dairy Science, M.P.K.V., Rahuri.

The milk samples were subjected to chemical analysis. The average chemical composition of milk used during research work is presented in Table 4.1.

Table 4.1 Chemical Composition of milk

Parameter	Replication				Mean
	R_1	R_2	R_3	R_4	
Water	87.51	87.45	87.00	87.64	87.40
Fat (%)	3.94	3.92	3.90	3.95	3.92
Protein (%)	3.81	3.87	3.85	3.84	3.84
Lactose (%)	4.15	4.13	4.20	4.17	4.16
Ash (%)	0.59	0.63	0.57	0.45	0.56
Total Solids (%)	12.49	12.55	13.00	12.36	12.60
Acidity (%)	0.16	0.15	0.18	0.16	0.16

The data obtained from the above Table no 4.1 show that milk which was used for preparation of guava *burfi* had an average composition 3.92 per cent milk fat, 3.84 per cent protein, 4.16 per cent lactose, 87.40 per cent moisture, 12.60 per cent total solids, 0.56 per cent ash and 0.16 per cent acidity. The figures obtained were resembles to the study of Tawde (2015).

4.2 Chemical Composition of Guava

Chemical composition of guava pulp used throughout the experimental trial is given under Table 4.2.

Table 4.2 Chemical composition of guava pulp

Sr. No.	Parameter	Percentage (%)
1.	Moisture	85.34
2.	Fat	2.6
3.	Protein	4.5
4.	Total solid	14.66
5.	Acidity	0.47
6.	pH	4.7
7.	Ash	0.6

Anonymous 2009-www.nutrition-and-you.com

4.3 Sensory Quality/ Evaluation of *Burfi*

The various treatment combinations of *burfi* were subjected to sensory evaluation for colour and appearance, flavour, body and texture and overall acceptability attributes by panel of judges using a 9-point hedonic scale.

4.3.1 Colour and Appearance

Sensory score for colour and appearance of *burfi* prepared under different treatments is presented in Table 4.3 and graphically in Fig.4.1.

Table 4.3 Effect of different levels of guava pulp on colour and appearance score of *burfi*

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	7.80	7.75	7.70	7.60	7.71^c
T_1	8.06	8.15	7.93	8.20	8.08^b
T_2	8.40	8.55	8.46	8.60	8.50^a
T_3	7.50	7.45	7.39	7.44	7.44^d
S.E. $\pm$	0.044				
CD at 5%	0.138				

The perusal of Table 4.3 shows that the *burfi* prepared by using 14 per cent guava pulp (T_2) was superior amongst all the treatments in colour and appearance which secured the maximum score of (8.50) followed by T_1 (8.08) and T_0 (7.71). The lowest score was obtained by the product T_3 (7.44) with 17 per cent guava pulp because in this treatment the colour of finished product was dull yellow to green which were not liked by the judges.

The mean sensory score of colour and appearance ranged from 7.44 to 8.50. The colour and appearance score of *burfi* was significantly influenced by the level of guava pulp, which is in agreement with the studies of Kolhe (2003) indicated change in colour and appearance up to desired level due to addition of 40 per cent papaya pulp in *burfi*. However, he indicated deterioration of colour with increased level of papaya pulp above 40 per cent.

Wankhede (2005) prepared mango *burfi*, who indicated change in colour and appearance up to desired level due to addition of 35 per cent mango pulp. However, he indicated deterioration of colour with increased level of mango pulp above 40 per cent.

Patil (2012) indicated change in colour and appearance up to desired level due to addition of 15 per cent dried date in *burfi*. However, she indicated deterioration of colour with increased level of dried date above 20 per cent.

Mohod *et al.* (2020) observed that high score for colour and appearance was obtained (8.95 out of 9) by the *burfi* prepared with 85:15 (T_3) finger millet flour while lowest score was (7.33 out of 9) by the *burfi* prepared with 75:25 (T_4) finger millet flour.

From the results, it was observed that the guava *burfi* with 14 per cent guava pulp showed pale yellow to green colour with clear and clean appearance which was liked very much by the judges.

4.3.2 Flavour

Flavour is an important criterion for acceptance of any food article. Flavour is combined effect of "taste" and "smell". Every milk product has its typical flavour.

The observation on flavour of the *burfi* as influenced by different levels of guava pulp have been recorded and statistically analysed are presented in Table 4.4 and graphically in Fig. 4.2.

Table 4.4. Effect of different levels of guava pulp on flavour score of *burfi*

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	7.57	7.50	7.60	7.65	7.58^c
T_1	8.20	8.00	8.33	8.25	8.19^b
T_2	8.53	8.45	8.60	8.50	8.52^a
T_3	7.50	7.45	7.40	7.35	7.42^d
S.E. $\pm$	0.045				
CD at 5%	0.139				

It is evident from above Table 4.4 that the effect of various treatment combinations on flavour of the product was statistically significant. Score for flavour of guava *burfi* under different treatment combinations are 7.58, 8.19, 8.52, 7.42 for T_0, T_1, T_2, T_3 treatments respectively.

As levels of guava pulp goes on increasing the flavour of the product goes on increasing upto certain level. But at T_3 score suddenly goes on decreasing (7.42) as it gives sour flavour to the product. T_2 (8.52) obtained highest score. Treatment T_3 secured lowest score i.e. 7.42 with 17 per cent guava pulp. These results are in close agreement

with the results obtained by Patil (2012) prepared date *burfi* and observed that, the flavour increased with increase in proportion of dried date (20 %) in *burfi*.

Sabale (2005) prepared besan (Gram flour) *khoa burfi* and observed that, as the level of besan (Gram flour) increased above 15 per cent there was decrease in flavour.

Kamble *et al.* (2010) prepared pineapple *burfi* and observed that, the flavour increased with increase in proportion of pineapple pulp in *burfi*.

Datarkar (2012) prepared singhara *khoa burfi* and observed that, as the level of singhara flour increased above 15 per cent there was decrease in flavour of *burfi*. Same results was observed by Mohod *et al., (*2020) who prepared finger millet (Eleusine coracana) *burfi*.

4.3.3 Body and Texture

Body and texture is another most important criteria to judge acceptability of the product. Smooth texture is the desirable feature of *burfi*.

The body and texture score of the *burfi* was influenced by different levels of guava pulp. The results are presented in Table 4.5 graphically in Fig. 4.3.

Table 4.5. Effect of different levels guava pulp on body and texture score of *burfi*

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	8.90	8.85	8.87	8.88	8.87^a
T_1	8.44	8.46	8.47	8.45	8.45^b
T_2	8.21	8.19	8.22	8.18	8.20^c
T_3	7.49	7.51	7.48	7.52	7.50^d
S.E. $\pm$	0.009				
CD at 5%	0.028				

From the above Table 4.5 it was revealed that, the effect of various treatment combinations on body and texture of the product was statistically significant.

The highest score was obtained by the T_0 (8.87) followed by T_1 (8.45), T_2 (8.20). Lowest score secured by treatment T_3 (7.50). Increase in level of guava pulp show loose body and sickness which was not like by judge Hence in case of body and texture treatment T_0 was liked very much by judges.

Wakchaure (1998) indicated that, the *burfi* without adding sapota pulp had given the highest score as compared to rest of the treatments. It might be due to addition of sapota pulp directly proportional to deterioration of body and texture of *burfi*.

Golande *et al.* (2012) also reported that the increased the level of sweet orange juice, lower rating was observed due to, increased level of added sweet orange juice above certain level (10 parts of sweet orange) which formed granular texture in the *burfi* by increasing acidity which was disliked by the judges.

Lahankar *et al.* (2018) who observed that high score for body and texture was obtained (8.63 out of 9) by the burfi prepared without green peas (T_1) while lowest score was (6.93 out of 9) by the burfi prepared with 10 parts of green peas (T_4).

Kamble *et al.* (2019) reported that score for body and texture is goes on decreasing with increasing the level of sugar and green chickpea.

4.3.4 Overall Acceptability

The observation of overall acceptability of the guava *burfi* as influenced by different levels of guava pulp have been recorded and statistically analysed. The observation on colour and appearance, body and texture and flavour are considered, for overall acceptance and are presented in Table 4.6 and graphically in Fig. 4.4.

Table 4.6. Effect of different levels of guava pulp on overall acceptability score of *burfi*

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	8.09	8.03	8.05	8.04	8.05^c
T_1	8.23	8.20	8.24	8.30	8.24^b
T_2	8.38	8.39	8.42	8.42	8.40^a
T_3	7.49	7.47	7.42	7.43	7.45^d
S.E. $\pm$	0.016				
CD at 5%	0.049				

From the Table 4.6 it was seen that, effect of various treatment combinations on overall acceptability score of the product was statistically significant. *Burfi* prepared by using 14 per cent guava pulp (T_2) scored highest score (8.40) followed by treatment T_1 (8.24), lowest score given to T_3 (7.45) with 17 % guava pulp.

On the basis of overall sensory parameter score the treatment T_2 secured highest score and was liked very much by judges. The result were already discussed in individual table.

4.4 Chemical Composition of *Burfi*

The chemical analysis of guava pulp added *burfi* was carried out for fat, acidity, protein, ash, total solid and moisture.

4.4.1 Fat

The fat is the major constituent in *burfi* composition which gives characteristic body and texture to the *burfi*. The fat content of guava pulp added *burfi* was estimated and results obtained are tabulated in Table 4.7 and Fig. 4.5.

Table 4.7. Fat content of *burfi* as influenced by different levels of guava pulp

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	18.86	18.80	19.04	18.98	18.92[a]
T_1	16.74	16.75	16.72	16.71	16.73[b]
T_2	16.34	16.33	16.36	16.37	16.35[c]
T_3	16.01	16.04	16.02	16.05	16.03[d]
S.E. $\pm$	0.028				
CD at 5%	0.089				

From Table 4.7 indicated that the average fat content in the *burfi* was significantly affected due to addition of guava pulp. The mean score of fat in *burfi* was 18.92,16.73,16.35 and 16.03 per cent for treatments T_0, T_1, T_2 and T_3 respectively.

The fat content of *burfi* without addition of guava pulp T_0 (18.92) was the highest over all the treatments and lowest fat content observed 16.03 per cent in T_3. Fat content in *burfi* was decreased with increase the proportion of guava pulp in *burfi* preparation. This is might be due to low fat content in guava pulp than khoa.

The above results are comparable with the findings of following research workers.

Bankar *et al.* (2013) studied the fat content of plain *burfi* is higher T1 (20.11 %) and it was decreased with the addition of pineapple pulp. (It was 18.37 per cent in *burfi* samples with 15% pineapple pulp).

Navale *et al.* (2014) reported that fat content in *burfi* decreased with the increase in wood apple pulp level in preparation of *burfi* i.e. 20.41 per cent in plain *burfi* to the 17.00 per cent (15% wood apple pulp).

Patil *et al.* (2015) observed that, the fat content was lowest 14.76 per cent in T_4 (20%) and highest 16.96 per cent in T_1 (0%) in dried date *burfi*.

Tanuja *et al.* (2017) observed fat content of Apple pomace burfi with different proportions of 0 % (T_1), 5 % (T_2), 10 % (T_3) and 15 % (T_4) apple pomace to *khoa* as 24.65, 19.43, 18.24 and 17.42 per cent, respectively.

Deshmukh (2020) reported that, the fat content was highest 18.92 per cent in T_0 (0 %) and lowest 15.15 per cent in T_3 (30 %) in orange *burfi*.

4.4.2 Protein

The data presented to the protein content of *burfi* affected by different levels of guava pulp was presented in Table 4.8 and graphically represented in Fig. 4.6.

Table 4.8. Protein content of *burfi* as influenced by different levels of guava pulp

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	13.90	13.87	13.92	13.91	13.90^a
T_1	13.73	13.74	13.77	13.76	13.75^b
T_2	13.49	13.5	13.50	13.53	13.51^c
T_3	13.28	13.30	13.27	13.31	13.29^d
S.E. $\pm$	0.009				
CD at 5%	0.030				

From the Table 4.8 it was revealed that the influence of guava pulp on protein content of *burfi* was statistically significant. The mean value of protein content of treatments T_0, T_1 T_2 and T_3 were 13.90, 13.75, 13.51 and 13.29 per cent respectively. The highest value was reported for the treatment T_0 (13.90) per cent which contain no guava pulp. Lowest value (13.29) per cent observed for T_3 which contain 17 per cent guava pulp.

It was observed from the present study that, as the level of guava pulp increased there was decreased in the protein content in *burfi*. It may be due to low protein content in guava pulp than khoa.

The above results are comparable with the findings of following research workers.

Navale *et al.* (2014) analysed the protein content of *burfi* prepared in different proportion of 100:0 (T_1), 95:05 (T_2), 90:10 (T_3) and 85:15 (T_4) *khoa* to wood apple pulp were 14.88 per cent, 14.37 per cent, 13.52 per cent and 12.67 per cent, respectively.

Bhutkar *et al.* (2015) observed that, the average protein content was highest 14.91 per cent in T_1 (0 %) and 12.18 in T_4 (20 %) elephant foot yam pulp *burfi*.

Gadekar *et al.* (2018) prepared wood apple *burfi* and observed that, protein content was highest 13.50 (T_1) lowest 10.42 (T_4) in *burfi* prepared with wood apple.

The results are also confirmed with the findings Kamble *et al.* (2010), Bankar *et al.* (2013) and Mohod *et al.* (2020) who reported that, with the increased in the levels of fruit pulp and cereals there was proportionate decreased in the levels of protein content in *burfi*.

4.4.3 Total Solids

The observation on total solids content of the *burfi* as influenced by different levels of guava pulp have been recorded and statistically analysed to arrive at definite conclusion.

The total solids content of *burfi* were determined and tabulated in Table 4.9 and Fig. 4.7.

Table 4.9 Total solid content of *burfi* as influenced by different levels of guava pulp

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	86.70	86.50	86.90	86.75	86.71^a
T_1	81.10	81.18	81.22	81.06	81.14^b
T_2	79.47	79.51	79.45	79.53	79.49^c
T_3	77.81	78.01	77.87	77.95	77.91^d
S.E. $\pm$	0.050				
CD at 5%	0.154				

It was revealed from Table 4.9 that total solid content of *burfi* ranges between 77.91 to 86.71 per cent and noted the significant difference between the treatments. The decreasing trend in total solids of *burfi* was observed with increase in guava pulp levels it may be due to low total solid content in guava pulp.

The above results are comparable with the findings of following research workers.

The result obtained in present study are in agreement with the results reported by Borse (2011) who noted that, with the increased in the levels of gulkand, there was significantly decreased in the levels of total solids content in *burfi*.

Bankar *et al.* (2013) reported that, average value of total solids in the *burfi* under treatments of 100:0 (T_0), 95:5 (T_1), 90:10 (T_2) and 85:15 (T_3) *khoa* to pineapple pulp were 83.74, 82.57, 82.17 and 81.58 per cent, respectively.

Navale *et al.* (2014) reported that, average value of total solids in the burfi under treatments of 100:0 (T_0), 95:5 (T_1), 90:10 (T_2) and 85:15 (T_3) *khoa* to wood apple pulp as 83.04, 81.90, 80.83 and 79.70 per cent, respectively.

The results are also in agreement with the results obtained by Tanuja *et al.* (2017), Girase (2016), Bhutkar *et al.* (2015), Dhande (2014). Bhosle (2017) and Deshmukh (2020), who noted that, with the increased in fruit pulp level there was proportionately decreased in total solids content of burfi.

4.4.4 Ash

The ash content of guava *burfi* were determined and tabulated in Table 4.10 and graphically in Fig. 4.8.

Table 4.10 Ash content of *burfi* as influenced by different levels of guava pulp

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	3.09	3.07	3.11	3.05	3.08^a
T_1	3.04	3.05	3.02	3.01	3.03^b
T_2	2.95	2.97	2.94	2.98	2.96^c
T_3	2.90	2.92	2.89	2.93	2.91^d
S.E. $\pm$	0.010				
CD at 5%	0.032				

It was seen from Table 4.10 that, ash content in *burfi* sample was decrease significantly when guava pulp added at different levels. Ash content in the *burfi* prepared with addition of guava pulp at 0 % (T_0), 11 % (T_1), 14 % (T_2) and 17 % (T_3) were 3.08, 3.03, 2.96 and 2.91 per cent, respectively. The ash per cent was highest (3.08 %) in *burfi* prepared without addition of guava pulp (T_0) while, ash content was lowest (2.91 %) in *burfi* prepared with addition of 17 per cent guava pulp (T_3) it may be due to low total solid content in guava pulp.

The results of present study are in agreement with Bankar *et al.* (2013) who reported that, the level of pineapple pulp increased with the ash content of *burfi* decreased from 3.03 to 2.71 per cent.

Chaudhary *et al.* (2019) noticed that, ash content in the *burfi* was decrease with increase in levels of aloe vera juice but decrease was non-significant.

The results of present study agreed with the findings of Bhutkar *et al.* (2015), Girase (2016), Tanuja *et al.* (2017)**,** noted that, with the increased in the levels of fruit pulp there was proportionate decreased in the levels of ash content in burfi.

4.4.5 Acidity (% LA)

The data pertaining to the acidity content of *burfi* affected by addition of different levels of guava pulp was presented in Table 4.11 and graphically represented in Fig. 4.9.

Table 4.11 Acidity content of *burfi* as influenced by different levels of guava pulp

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	0.28	0.25	0.30	0.29	0.28^{d}
T_1	0.38	0.35	0.36	0.33	0.35^{c}
T_2	0.39	0.38	0.42	0.41	0.40^{b}
T_3	0.44	0.45	0.42	0.41	0.43^{a}
S.E. $\pm$	0.010				
CD at 5%	0.031				

It was observed from Table 4.11 that the mean value of different *burfi* were 0.28, 0.35, 0.40, 0.43 per cent of acidity in treatment T_0, T_1, T_2, T_3 respectively.

Also, it was revealed that the average titrable acidity per cent in the *burfi* was significantly affected due to addition of guava pulp. The acidity content highest was noticed in treatment T_3 (0.43) with addition of 17 per cent guava pulp and lowest acidity per cent was observed in control T_0 treatment (0.28).

The acidity per cent in *burfi* significantly increased with increase in the different level of guava pulp in *burfi* preparation it may be due to high acidic nature of guava fruit.

Similar findings were observed in Bankar (2013) reported that the acidity of pineapple *burfi* was significantly increased with the increasing the level of pineapple pulp in the *burfi* i.e. T_0 (0.29) control sample, T_1 (0.42) (5% pineapple pulp), T_2 (0.44) (10 % pineapple pulp), T_3 (0.48) (15% pineapple pulp).

Navale *et al.* (2014) reported that the control sample T_0 having acidity (0.31) and it increases with the increasing the wood apple pulp in the *burfi* and acidity goes upto (0.62) T_3 with 15% wood apple pulp.

Patil *et al*. (2015) was reported the titrable acidity of date burfi increased with increase in level of date.

This finding are in accordance with Kadam (2008), Navale *et al.* (2014) and Deshmukh (2020) who reported that increase in level of mango pulp, wood apple pulp and orange pulp the acidity was increased in burfi, respectively.

4.4.6 Moisture

The moisture content in *burfi* varied due to incorporation of different levels of guava pulp were determined and tabulated in Table 4.12 and graphically presented in Fig. 10.

Table 4.12. Moisture content of *burfi* influenced by different levels of guava pulp

Treatment	R_1	R_2	R_3	R_4	Mean
T_0	13.30	13.50	13.10	13.25	13.29^d
T_1	18.90	18.82	18.78	18.94	18.86^c
T_2	20.53	20.49	20.55	20.47	20.51^b
T_3	22.19	21.99	22.13	22.05	22.09^a
S.E. $\pm$	0.051				
CD at 5%	0.159				

From Table 4.12 it was revealed that, mean moisture content in *burfi* sample was significantly affected due to the addition of guava pulp at different levels. Moisture contents in the *burfi* prepared with addition of guava pulp at 0 % (T_0), 11 % (T_1), 14 % (T_2) and 17 % (T_3) recorded as 13.29, 18.86, 20.51 and 22.09 per cent, respectively.

The highest moisture was noticed in treatment T_3 (22.09) with 17 per cent guava pulp and lowest moisture was in control T_0 (13.29) treatment. The moisture content in *burfi* significantly increased with increase in the different levels of guava pulp. This might be due to the fact that guava contain more moisture.

The above results are also closely similar with the findings of following research workers.

Kamble *et al.* (2010) noticed that, moisture content in the burfi was highest in treatment T_6 (19.26 %) and lowest in T_1 (16.85 %). The moisture content in burfi was significantly increased with different levels of pineapple pulp.

Tanuja *et al.* (2017) reported that moisture content of Apple pomace burfi with different proportions of 0 % (T_1), 5 % (T_2), 10 % (T_3) and 15 % (T_4) apple pomace to *khoa* as 13.04 per cent ,14.42 per cent ,15.16 per cent and 16..24 per cent, respectively.

Chaudhary *et al.* (2019) noticed that, moisture content in the *burfi* was highest in treatment T_5 (17.02 %) and lowest in T_1 (8.72 %). The moisture content in *burfi* was significantly increased with different levels of aloe vera juice.

4.5 Textural Properties of *Burfi*

The quality of product is monitored not only by the sensory properties but also by their textural profile. The instrumental method of texture assessment aims at quantifying objectively the textural characteristics to the maximum extent possible. The textural characteristics of *burfi* are greatly influenced by its composition and manufacturing practices/parameters followed type of *burfi* etc. the textural profile of *burfi* was measured in terms of hardness, cohesiveness, chewiness adhesiveness and springiness. The results pertaining to textural analysis of *burfi* is presented in following Table 4.14.

Table 4.13 Effect of different levels of guava pulp on textural properties of *burfi*

Treatment	Hardness (kg)	Cohesiveness	Adhesiveness (kg)	Springiness (mm)
T_0	0.571	0.206	0.181	0.169
T_1	0.564	0.199	0.198	0.167
T_2	0.550	0.187	0.211	0.165
T_3	0.530	0.143	0.228	0.164

4.5.1 Hardness

Hardness is the most commonly evaluated characteristics in determining the textural property of *burfi*. The change in hardness due to addition of different levels of guava pulp presented in Table 4.13 and graphically in Fig. 4.11. The supplementation of guava pulp decreases the hardness of burfi from (0.571 to 0.530) kg the hardness of sample T_0 was found highest compared to other samples. This represents that addition of guava pulp decreases the hardness of *burfi*. Highest hardness of T_0 control sample may be due to no guava pulp content of *burfi* and lower moisture content of sample. Hardness of *burfi* depends upon various factors including moisture content.

Arora *et al.* (2010) observed variation in textural properties of *burfi* made from sucrose and artificial sweeteners. The compositional changes contribute towards total solid. Total solids affect hardness of *burfi*, hardness increased with increased total solids content.

Tanuja *et al.* (2017) reported that moisture content of apple pomace incorporated *burfi* had direct relationship with hardness. The obtained result justify the lower content of moisture per cent in *burfi* sample increases the hardness.

4.5.2 Cohesiveness

Cohesiveness refers to the extent to which a material can be deformed before it ruptures. In other words, it refers to how a food product stays together after deformation. It is the ratio of the area under the second peak to that under the first peak and it is unit less.

From the Table 4.13 and Fig. 4.12 it was indicated that there was decrease in cohesiveness due to the effect of increase in moisture content as level of guava pulp increases in *burfi*. Highest cohesiveness was found in T_0 sample whereas lowest cohesiveness was found in T_3 sample. The cohesiveness of experimental sample ranged from 0.143 (T_3) to 0.206 (T_0).

The obtained results justify the increase in moisture per cent in *burfi* sample decrease the cohesiveness.

Chaudhary *et al.* (2019) reported that decrease in the cohesiveness of aloe vera *burfi* with increases concentration of aloe vera juice in *burfi*.

Kapare (2017) studied same analysis for cohesiveness in case of burfi prepared by blending finger millet

4.5.3 Adhesiveness

Adhesiveness is related to the sensory stickiness and indicated by a negative peak following the first peak. T_3 treated sample had highest (0.228 kg) and T_0 control has lowest (0.181 kg) increase in adhesiveness in treated sample is due to more moisture and sickness nature of guava pulp which affect the adhesiveness of *burfi*. The change in Adhesiveness due to addition of different levels of guava pulp presented in Table 4.13 and graphically in Fig. 4.13

Chaudhary *et al.* (2019) reported increase in the adhesiveness of aloe vera *burfi* with increase in concentration of aloe vera juice (0 to 50 %).

4.5.4 Springiness

It is the ratio of the peak positive distance of 2^{nd} cycle to the peak positive distance of 1^{st} cycle.

From the Table 4.13 and Fig. 4.14 it was observed that the springiness was not much affected by guava pulp as evident by little difference exist among control and treated sample value of springiness in mm obtained for T_0 sample was highest among all other experimental *burfi* sample. The value of springiness (mm) in experimental sample was 0.169, 0.167, 0.165 and 0.164 mm. This could be due to level of total solid content of guava pulp incorporated *burfi* decreased with increase in guava pulp result in decrease in springiness value.

Chaudhary *et al.* (2019) reported decreases in the springiness of aloe vera *burfi* with increase in concentration of aloe vera juice (0 to 50 %).

Tulavi *et al.* (2018) studied that springiness of inulin fiber added *burfi* decreases from 1.7264 to 1.6388.

The overall textural profile of *burfi* showed that sample T_0 was superior to that of T_1, T_2 and T_3 treatments.

5. SUMMARY AND CONCLUSION

The research work entitled "STUDIES ON PREPARATION OF *KHOA BURFI* BLENDED WITH GUAVA (*Psidium guajava L.*) PULP" was undertaken at Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri. The purpose of present investigation was to standardize the optimum level of guava pulp on the basis of physico-chemical properties, sensory and organoleptic evaluation and textural properties of *burfi*. The results obtained are summarized in the following headings.

5.1 Chemical composition of cow milk

5.2 Sensory Quality/ evaluation of *burfi*

5.3 Chemical composition of *burfi*

5.4 Textural properties of *burfi*

5.1 Chemical Composition of Cow Milk

The cow milk used in present study for preparation of *burfi* contain on average 3.92 per cent fat, 3.84 per cent protein, 12.60 per cent total solid, 87.40 per cent moisture, 0.16 per cent acidity and 0.56 per cent ash.

5.2 Sensory Quality/ Evaluation of *Burfi*

5.2.1 Colour and Appearance

It was observed that the average colour and appearance score of *burfi* for treatment T_0, T_1, T_2 and T_3 were 7.71, 8.08, 8.50 and 7.44 respectively. The treatment T_2 (8.50) was scored highest colour and appearance score and the treatment T_3 (7.44) had lowest colour and appearance score.

5.2.2 Flavour

It was observed that the average flavour score of *burfi* for treatment T_0, T_1, T_2 and T_3 were 7.58, 8.19, 8.52, and 7.42 respectively. The treatment T_2 (8.52) was scored highest flavour score and the treatment T_3 had lowest flavour score.

5.2.3 Body and Texture

The average body and texture score of *burfi* for treatment T_0, T_1, T_2 and T_3 were 8.87, 8.45, 8.20 and 7.50 respectively. The treatment T_0 was scored the highest body and texture score (8.87) and the treatment T_3 had lowest body and texture score (7.50).

5.2.4 Overall Acceptability

The mean score for overall acceptability of *burfi* for treatment T_0, T_1, T_2 and T_3 were 8.05, 8.24, 8.40 and 7.45 respectively. The maximum score (8.40) was obtained for the treatment T_2 and minimum score (7.45) was obtained for the treatment T_3.

5.3 Chemical Composition of *Burfi*

5.3.1 Fat

It was recorded that the average fat content for the mean fat content in *burfi* was 18.92, 16.73, 16.35 and 16.03 per cent for treatment T_0, T_1, T_2 and T_3 respectively. It was also observed that maximum fat content was in T_0 (18.92) and minimum fat content in T_3 (16.03). The fat percentage of *burfi* was decreases continuously with increase in the levels of guava pulp.

5.3.2 Protein

It was observed that the protein content of the product ranged between 13.90, 13.75, 13.51 and 13.29 per cent for treatment T_0, T_1, T_2 and T_3. The differences were statistically significant ($P < 0.05$) among the various treatments. It was also observed that as the addition of guava pulp level decreases the protein content of the product was decreased.

5.3.3 Total Solid

The total solid content of product was found to be 86.71, 81.14, 79.49 and 77.91 per cent for treatment T_0, T_1, T_2 and T_3 respectively. The highest total solid content was recorded for treatment T_0 and lowest total solid content was recorded for treatment T_3.

It was observed that, total solid per cent decreased as increase in level of guava pulp.

5.3.4 Ash

It was observed that the average ash content in T_0, T_1, T_2 and T_3 were 3.08, 3.03, 2.96 and 2.91 per cent respectively. All the treatments showed the significant difference for ash contents in guava pulp added *burfi*. As the guava pulp level increases the ash content level of the product decrease.

5.3.5 Acidity (% LA)

It was observed that the average acidity in T_0, T_1, T_2 and T_3 was 0.28, 0.35, 0.40 and 0.43 per cent respectively. All the treatment showed the significant difference for acidity in guava pulp added *burfi*. It was observed that, acidity per cent was increased significantly as level of guava pulp goes on increasing treatment T_0 contain (0.28) per cent acidity and treatment T_3 contain highest (0.43) per cent acidity.

5.3.6 Moisture

The moisture content in *burfi* samples of treatments T_0, T_1, T_2 and T_3 were 13.29, 18.86, 20.51 and 22.09 per cent respectively. All treatments showed the significant difference for moisture contents in guava *burfi*. As guava pulp level increased in *burfi*, the moisture content in *burfi* was also increased. This might be due to the high moisture content in guava pulp than *khoa*.

5.4 Textural Properties of *Burfi*

Burfi sample was evaluated for textural qualities *viz.*, hardness, cohesiveness, adhesiveness and springiness of the treatment T_0 was 0.571kg, 0.206, 0.181 kg and 0.169 mm for treatment T_1 was 0.564 kg, 0.199, 0.198 kg and 0.167 mm, for treatment T_2 was 0.550 kg, 0.187, 0.211 kg and 0.165 mm, for treatment T_3 was 0.530 kg, 0.143, 0.228 kg, 0.164 mm.

5.5 Conclusion

1. Sensorily best quality guava *burfi* can be prepared by using 14 per cent guava pulp ,25 per cent sugar and 4 per cent skimmed milk powder.
2. *Burfi* prepared with addition of 14 per cent guava pulp (T_2) was found superior over the rest of all the treatment.
3. The most preferred guava *burfi* sample (14% guava pulp) had the physico-chemical composition 16.35 per cent fat, 13.51 per cent protein, 79.49 per cent total solids, 2.96 per cent ash 0.40 per cent acidity, and 20.51 per cent moisture.
4. The textural properties of *burfi* i.e., hardness, cohesiveness, and springiness, were decreases with increase in level of guava pulp while adhesiveness was increase with increase in guava pulp.

Hence, it is concluded that best quality guava *burfi* can be prepared by using 14 per cent of guava pulp, 25 per cent sugar and 4 per cent skimmed milk powder.

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7. APPENDIX

SCORE CARD FOR SENSORY EVALUATION OF "STUDIES ON PREPARATION OF *KHOA BURFI* BLENDED WITH GUAVA *(Psidium guajava L)* PULP"

9 Point Hedonic Scale

Name of product : Studies on preparation of *khoa burfi* blended with Guava *(Psidium guajava L.*) pulp

Date : Time:

Name of judge :

Please, score the sample

Treatment	Colour and appearance	Flavour	Body and texture	Overall acceptability
T_0				
T_1				
T_2				
T_3				

Signature of Judge

Scoring guides according to 9 point Hedonic scale

Maximum score 9 for each parameter

9	**Point Hedonic scale**	**Score**
1.	Liked extremely	9
2.	Liked very much	8
3.	Liked moderately	7
4.	Liked slightly	6
5.	Neither liked nor disliked	5
6.	Disliked slightly	4
7.	Disliked moderately	3
8.	Disliked very much	2
9.	Disliked extremely	1

Remarks

8. VITAE

MR. RAHATE SUMIT MAHADEORAO

MASTER OF SCIENCE (AGRICULTURE)

IN

DAIRY SCIENCE

2021

Title of thesis		**:**	STUDIES ON PREPARATION OF *khoa BURFI* BLENDED WITH GUAVA *(Psidium guajava L.)* PULP
Major field		**:**	Dairy Science
Biographical information			
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Educational	**Bachelor Degree Obtained**	**:**	Bachelor of Science (Agriculture) from Samarth Agriculture College, Deulgoan Raja
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