"UTILIZATION OF BOTTLE GOURD PULP IN PREPARATION OF *BURFI*"

BY

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DISSERTATION

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(M.S.), INDIA

2012

Affectionately

Dedicated

To My Beloved

Parents

CANDIDATE'S DECLARATION

I hereby declare that the dissertation

or any part thereof has not been

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CERTIFICATE – I

This is to certify that **Mr. WAGHMARE VISHAL KARNA** has satisfactorily prosecuted his course and research for a period of not less than four semesters and that the dissertation entitled **"UTILIZATION OF BOTTLE GOURD PULP IN PREPARATION OF *BURFI*"** submitted by him is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination.

I also certify that the dissertation or part thereof has not been previously submitted by him for a Degree of any University.

Place : Parbhani

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Research Guide

CERTIFICATE – II

This is to certify that the dissertation entitled **"UTILIZATION OF BOTTLE GOURD PULP IN PREPARATION OF *BURFI*"** submitted by **Mr. WAGHMARE VISHAL KARNA** to the Marathwada Krishi Vidyapeeth, Parbhani in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (Agriculture)** in the subject of **ANIMAL HUSBANDRY AND DAIRY SCIENCE (DAIRY SCIENCE)** has been approved by the student's advisory committee after viva-voce examination in collaboration with the external examiner.

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Place: latur

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(Waghmare V.K)

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

ABBREVIATIONS

%	:	Per cent
/	:	Per
@	:	At the rate of
^{0}C	:	Degree Celsius
CD	:	Critical difference
cfu	:	Colony forming unit
cm	:	Centimeter(s)
et al.	:	*et alia* (and others)
etc	:	Etcetera
Fig.	:	Figure
g	:	Gram (s)
HPTLC	:	High Performance Thin Layer Chromatographic
i.e.	:	Id est (that is)
kg	:	Kilogram (s)
lit	:	Litre
min.	:	Minute
ml	:	Milliliter
NDDB	:	National Dairy Development Board
No.	:	Number
pH	:	Pussance de hydrogen
pp	:	Pages
ppm	:	Parts per million
rpm	:	Revolution per minute
Rs.	:	Rupees
SE	:	Standard Error

SNF	:	Solid not fat
SPC	:	Standard plate count
SSHE	:	Scraped Surface Heat Exchanger
viz.	:	Namely

Introduction

CHAPTER-I

INTRODUCTION

India is emerging as a highest milk producing country in the world with an annual growth rate of 4.53 per cent. The milk production of India is 121.8 million tonnes (NDDB Statistics 2010-11). Out of the total milk produced in India, 46.00 per cent is consumed as liquid milk and 54.00 per cent is utilized for conversion into different products.

It is estimated that about 6.5 per cent of total milk produced in India is converted into *khoa* and condensed milk.

Khoa contains all the milk solids in approximately four fold concentration, therefore the food and nutritive value of *khoa* is very high. It contains fairly large quantities of muscle building protein, minerals, health giving vitamins and furnishes energy giving lactose and milk fat. It also expected to retain most of the fat soluble vitamins A and D and also fairly large quantities of water soluble B vitamins contained in original milk.

Khoa is most important base material for the manufacture of variety of popular indigenous sweets like *peda, burfi, gulabjamun* etc. In India indigenous milk sweets have been an inseparable part of the socio-cultural life in our country since time immemorial. At child birth, wedding ceremony, job appointment, birthday, inauguration of new house, feasts, festivals, social or religious occasions milk sweets are always distributed.

Burfi has been favoured as one of the most popular *khoa* based sweets all over India. The unique adaptability of *khoa* in terms of its flavour,body and texture to blend with a wide range of adjuncts has permitted development of an impressive array of *burfi* varieties.The *burfi* is prepared with cashewnut as a katli, almond, coconut, mango,orange, woodapple, bottle gourd, potato and fig.

Burfi retains its quality for considerable long period at atmospheric storage temperature due to its low moisture content and higher concentration of sugar. The method of preparation also ensures the destruction of almost all micro organisms present in raw material. In post manufacturing contamination from undesirable micro organisms during preparation, handling, packaging and storage of final product is avoided.

Today's consumers are increasingly seeking functional foods for their health and well being as means of nutritional intervention in 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.

The demand for milk and value added dairy products in the domestic market has seen growing over 6 to 8 per cent per annum because of increasing incomes, rising aspirations.

In recent years a lot of interest has been generated in the development of milk and vegetable or fruit based delicacies. Some of many milk and vegetable based delicacies which are very popular. The blend of vegetable and milk in the product preparation improves acceptability of the product and blends the nutritional value for both milk and vegetables. For all the classes of people, the vegetables like bottle gourd, sugarbeet, carrot and ash gourd are very popular and regular consumed vegetables. The manufacture of value added like filled dairy products could be a better alternative.

Among the vegetables, bottle gourd (*Lagenaria siceraria*) is gaining very popularity in health conscious for urban people. It is also called as ghai kadu, dudhi bhopla. Bottle gourd is a rich source of vitamin and minerals. It contains higher concentration of dietary fibre,Vit. A, C, E, K, B_1, B_2 B_6, foliate, potassium, manganese, panthothenic acid, calcium, magnesium and phosphorus.

Bottle gourd pulp contains 96.3% water, 2.9% carbohydrates, 0.2% proteins, 0.5% fat. Fruit is easily digestible and also cooling, sedative and diuretic properties. Bottle gourd also acts as laxative fruit.

The bottle gourd is a common vegetable in India. It is yellowish green, having the shape of a bottle. It has white pulp, with white seeds embedded in spongy flesh. Bottle gourds has numerous health benefits. They are especially good for old aged

peoples. Lauki (Dudhi in Gujarati) have lot of medicinal value. Bottle gourd is used for diabetics, heart problems, blood pressure and so many other ailments. Those who do not have any problems can also use this juice as a health tonic (Anonymous, 2010).

Hence taking into accounts the medicinal and nutritional value of bottle gourd.It is therefore decided to undertake the research work on utilization of bottle gourd pulp in preparation of *burfi* with following objectives.

1. To standardize the process of manufacture of *burfi* blended with bottle gourd pulp.
2. To study the acceptability of *burfi* blended with bottle gourd pulp by sensory evaluation technique.
3. To study the chemical composition of finished product.
4. To study the microbial quality of fresh product.
5. To estimate the cost of production of finished product.

Review of Literature

CHAPTER-II

REVIEW OF LITERATURE

Burfi is the most popular *khoa* based sweet all over India. Different varieties of *burfi* like nut *burfi*, chocolate *burfi*, coconut *burfi*, saffron *burfi*, rava *burfi* etc are very much liked by the Indian population.

The work done so far on technology and chemical composition of *khoa* and *burfi* is reviewed as under.

2.1. Technology of *khoa*

2.2 Physical properties of *khoa*

2.3 Chemical composition of *khoa*

2.4 Technology of *burfi*

2.5 *Burfi* prepared using vegetables, fruits and nuts.

2.6 Chemical compositon of *burfi*

2.7 Microbial quality of *burfi*

2.8 Nutritional value and chemical composition of bottle gourd

2.9 Medicinal use of bottle gourd

2.1 Technology of *khoa*

Jadhav (1984) prepared *khoa* by dehydration of heat induced foam method, on chulah using iron *karahi*. The milk was taken in different proportions @ $1/12^{th}$ i.e. 1085 ml, $1/11^{th}$ i.e. 1185, $1/10^{th}$ i.e. 1300 ml, $1/9^{th}$ i.e. 1445 ml. In this method working of the product was done by indirect heating of milk by placing in an iron pan over the fire. Accordingly, excellent quality *khoa* of 1.445 liters of milk could be prepared in the iron *karahi* of 13 liters capacity with stirring of the milk.

Murale (1989) narrated that *khoa* prepared by dehydration of milk at low temperature was superior in quality and less nutrient losses were observed. The dehydration was carried out at a temperature of 73.9 ^{0}C. The specific benefit of this

method was that the *khoa* could be prepared with high protein content and less metal contamination as compared to the conventional method.

Singh and Rajorhia (1989) reported a standard method of *khoa* production by roller drying process. Standardized cow milk having 4 per cent fat and 8.5 per cent SNF was used. The total solids were raised to 50 per cent after vacuum concentration. *Khoa* prepared with a roller dryer was comparatively well in flavour, texture and chemical composition to that made with traditional method. It was concluded that the roller drier could be employed successfully for large scale production of *khoa.*

Chatterjee and Acharya (1990) prepared *khoa* by heat desiccation of whole milk in an open pan to semisolid consistency. It was usually for direct consumption or as base material for several indian dairy products.

Nawle (1992) used solar energy for *khoa* production. Different thicknesses of skim milk columns were kept in aluminum vessels inside the domestic solar cooker for dehydration. In this, concentrated milk cream was added and then such milk was worked in *karahi.* It was reported that the maximum total moisture was removed at 1.26 cm thickness of milk film in 7.33 hours and evaporation rate of 22.23 ml/hr was observed. The maximum moisture removed (ml/cm^2/hr) was 0.0959 at 1.52 cm thickness of milk film. The highest per cent of moisture removed was to the tune of 69.80 per cent at 0.63 cm thickness of milk film in seven hours. The solar *khoa* has less caramelized flavour and slightly salty in taste and overall acceptability was observed to be more in solar *khoa* as compared to conventional one.

Shahane (1996) studied solar energy utilization for *khoa* preparation. The maximum evaporation rate at 13 mm (ml/cm^2) was observed at 13 mm. The yield of *khoa* on per liter basis (g) was maximum in solar method. Solar dehydration method was superior over conventional method in respect of energy saving and maximum per cent recovery, superior sensory attributes and uniform product quality.

Bag *et al.* (2000) studied effect of rotor speed in SSHE (Scraped Surface Heat Exchanger) on the quality of *khoa* and reported that a speed of 200-250 rpm of rotor

with four numbers of blades proved to be the best suited for preparing a good quality *khoa.*

Abhitosh (2005) tested the continuous *khoa* making system for its industrial potential. Large amount of *khoa* was made by the system. The samples were analyzed for chemical and sensory attributes. The sensory reports indicated that scoring was better for continuous process compared to conventional method.

2.2 Physical properties of *khoa*

Ghatak and Bandopadhyay (1989) observed the chemical and physical quality of *khoa* marketed in Calcutta. The majority of *khoa* samples examined in this study were of good texture and organoleptic quality.

Table 2.1 physical quality of *khoa* marketed in Calcutta.

Quality attributes	*khoa* samples
Colour	Pale yellow (24), White (22), Gray(11)
Appearance	Moist surface (43), Dry surface (14)
Body and texture	Hard and granular (7), Soft and granular (11)
Flavour	Normal (52), Flat(3), Rancid (2)

(Figures in parentheses indicate the number of samples studied).

Gupta and Das (1990) studied the texture profile parameters of *khoa* prepared from milk standardized a fat and SNF ratio of 0.6 by using instron universal machine.They were suggested that an increased in total solid was accompanied by a considerable increase in hardness, gumminess and chewiness, but a decrease in cohesiveness of *khoa*. The resulting product contained 56.20 to 71.90 per cent total solids, 20.80 to 28.00 per cent fat and 14.90 to 18.90 per cent proteins.

De (1991) reported physical quality of cow and buffalo milk *khoa* as under:

Table 2.2 Physical qualities of *khoa* made from cow and buffalo milk.

Particulars	Cow milk *khoa*	Buffalo milk *khoa*
Colour	Straw/pale yellow with a tinge of brown	Whitish (dull light greenish, white with a tinge of brown)
Appearance	Moist surface	Slightly oily/ greasy surface soft
Body	Slightly hard	Smooth granular
Smell	Rich, nutty	Rich, nutty
Taste	Slightly salty	Slightly sweet
Suitability for sweets	Suitable	Highly suitable

Patel and De (1992) indicated the effect of concentration condition on the texture of *khoa*. It was mentioned that the steam kettle process for buffalo milk *khoa* manufacture produced a product that was significantly harder and more spongy, gummy and chewy but less adhesive than *khoa* produced using the traditional process.

Sindhu (1996) studied that large proportion of butyric acid containing triglycerides (50%) in buffalo milk fat than that of cow milk fat (37%) might be responsible for smooth and mellow texture of *khoa* made from buffalo milk.

Moulik and Ghatak (1997) reported that milk from different sources could not be used to manufacture *khoa*. It was generally prepared from cow milk, buffalo milk and from an admixture of cow and buffalo milk in ratio of 50:50. The cow milk with 3,4, 5 per cent fat and 8.5 per cent SNF was standardized for preparation of *khoa*. The composition of *khoa* was dependent upon the fat and total solids content of milk used for the preparation of product.

Verma and Dodeja (2000) showed that *khoa* produced by continuous system scored lower for flavour and higher in body and texture in comparison to traditional method. *Khoa* made by traditional method had hard and large sized grains which is undesirable for making sweets. *Khoa* produced by continuous process was very smooth and had uniform grains, which has potential for manufacture of *burfi* and other sweets.

2.3 Chemical composition of *khoa*

Rajorhia (1971) examined 55 samples of *khoa* prepared from cow milk and buffalo milk and found that cow milk *khoa* contained 20.10 to 23.55 per cent fat and 28.1 to 34.4 per cent moisture, while buffalo milk *khoa* contained 22.1 to 29.81 per cent fat and 26.4 to 33.5 per cent moisture.

Bhosale (1972) while studying chemical quality of *khoa* sold in Pune city, observed the following compositions of *khoa.*

Table 2.3 Chemical quality of *khoa* sold in Pune city.

Constituents %	Cow milk *khoa*	Buffalo milk *khoa*	Market *khoa*
Moisture	24.81	23.62	27.41
Fat	28.13	33.42	28.25
Protein	18.87	17.68	17.25
Lactose	24.30	21.56	22.87
Ash	3.90	3.70	3.80

Kumar and Shrinivasan (1984) measured the average composition of *khoa* from cow milk, buffalo milk and fresh market *khoa* as under.

Table 2.4 Average chemical composition of *khoa* from cow milk, buffalo milk and market.

Constituents %	Cow milk *khoa*	Buffalo milk *khoa*	Fresh market *khoa*
Moisture	30.9	22.3	28.4
Fat	20.0	32.2	24.6
Protein	19.1	17.7	19.0
Lactose	24.2	23.7	25.2
Ash	3.7	3.7	3.6

Ghatak and Bandopadhyay (1989) while studying chemical quality of *khoa* sold in Calcutta city, observed the chemical composition of *khoa* as under.

Table 2.5 Composition of *khoa* marketed in Calcutta city.

Constituents (%)	Minimum	Maximum	Average
Moisture	23.8	32.7	26.3
Fat	17.6	27.3	24.3
Protein	21.6	23.3	22.8
Lactose	19.4	21.2	20.8
Ash	3.57	3.85	3.71

De (1991) documented that *khoa* contained 25.60 and 19.20 per cent moisture, 25.27 and 37.1 per cent fat, 19.2 and 17.8 per cent protein, 25.5 and 22.8 per cent lactose, 3.8 and 3.6 per cent ash and 105 and 101 ppm iron in cow milk and buffalo milk *khoa*, respectively.

Kale (1992) reported average composition of cow milk *khoa* and sheep milk *khoa* as under.

Table 2.6 Composition of cow milk and sheep milk *khoa*.

Type of *khoa*	% composition					
	Total solids	Moisture	Fat	Protein	Lactose	Ash
Cow milk *khoa*	74.21	25.79	23.19	19.96	27.00	4.06
Sheep milk *khoa*	71.18	28.82	25.46	22.92	18.03	4.77

Katole (2002) prepared *khoa* by vacuum evaporation method and observed the chemical composition of *khoa*. He was also compared the chemical composition of *khoa* prepared by vacuum evaporation method and traditional method. He observed that the moisture 26.94, 26.54, fat 24.24, 24.00, protein 21.78, 22.65, lactose 23.34, 23.01, ash

3.70, 3.80 and total solids 73.06, 73.46 respectively in *khoa* traditional and vacuum evaporation method.

Aneja *et al.* (2002) reported chemical composition of *khoa*. The chemical quality of *khoa* varied considerably depending on many factors like quality of milk used, method of preparation, degree of heat treatment, method of handling, packaging and storage period. Various workers observed wide variation in total solids (minimum 63.45 and maximum 80.70), fat (minimum 22.20 and maximum 30.50), protein (minimum 14.80 and maximum 22.92), lactose (minimum 17.67 and maximum 33.50) and ash (minimum 3.0 and maximum 5.9) of *khoa* samples collected from market and also made in laboratory as is given in following table:

Table 2.7 Comparative composition of *khoa* made from different milk and market sample.

Source of sample	Chemical constituent (%)				
	TS	Fat	Protein	Lactose	Ash
Buffalo milk	78.4	30.5	17.7	23.9	5.9
Cow milk	80.7	25.2	15.8	33.5	4.1
Mixed milk	79.8	29.0	16.7	30.1	5.2
Market sample	71.6	24.6	19.0	25.2	3.6

Dewani and Jayaprakasha (2004) reported average composition of *khoa* as under.

Table 2.8 Average chemical composition of *khoa*.

Source of sample	% composition					
	Total solids	Moisture	Fat	Protein	Lactose	Ash
Laboratory sample	66.34	33.66	22.20	17.53	23.05	3.55

2.4 Technology of *burfi*

Date and Bhatia (1955) studied the technology of *burfi* preparation. They were mentioned that *khoa* should be added to hot syrup containing equal weight of cane sugar and the mixture was heated with constant stirring until it attained the consistency capable of forming a hard pat surface on spreading. A recommended sugar level was between 25-30% on the weight basis of *khoa*.

Hemavathy and Prabhakar (1973) suggested the method for *burfi* making. They prepared *khoa* in shallow stainless steel pan, 200 g of grated *khoa* and 80 g of sugar were mixed thoroughly, worked up with the stainless steel laddle. In few minutes, it become a pasty mass and the steam was then shut off. The plastic mass was worked up, further for a minutes and then poured on a wooden table and rolled with wooden rolling pin, and it was allowed to cool and cut into pieces.

Sachdeva (1980) standardized the process for the manufacture of *burfi* from standardized cow (4.5 % fat) and buffalo (6.0 % fat) milk. *Burfi* prepared from cow milk with 4.5% was found sticky and gummy due to less release of free fatty acid. A sugar level recommended was between 25-30% on the weight basis of *khoa*.

Bhatele and Balachandran (1983) was found that *burfi* with 30.00 per cent sugar was more acceptable. *Burfi* samples to which sugar was added at intermediate stage of *khoa* making (moisture 35.90 per cent) was mostly preferred.

Sachdeva and Rajorhia (1982) described the process for manufacture of *burfi* from cow and buffalo milk on small scale. *Burfi* prepared from buffalo milk was found to be scored more for sensory attributes whereas cow milk *burfi* was found to be sticky and gummy due to insufficient release of free fat. Sugar level at 30.00 per cent by the weight of *khoa* was found to be suitable for preparation of good quality *burfi*.

Ramanna *et al.* (1983) studied the conventional method for the preparation of *burfi* in which 6-10 litres of cow milk was heated using steam in stainless steel double jacketed upon kettle with constant stirring and scrapping to obtain a concentrated product of 66 to 68 °Brix (*khoa*). Sugar was added to *khoa* in the proportion of 1:2 to prepare

burfi. *Burfi* with desire texture and taste was obtained when the refractometer reading was 75-80 °Brix. *Burfi* was then spread evenly on stainless steel tray and cooled overnight and cut into desired size. In large scale preparation, concentration of milk was done under vacuum in a forced circular evaporator. The milk was concentrated at 40 °Brix at 620 mm Hg vacuum. Further, concentration was also done in SS jacketed kettle and *burfi* was prepared as per conventional method.

Arora*et al.* (2009) studied analysis of sucralose and its storage stability in *burfi*. Sucralose used at 0.025% 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.

2.5 *Burfi* prepared using different vegetables, fruits and nuts

Mathur (1991) described the traditional process of *burfi* manufacturing. *Khoa* was worked with constant stirring with sugar (25-35%) and added additives such as aromatic spices, shedded coconut, nuts, chocolate etc. depending upon the type of final product desired. The topping may be layered in special type of *burfi*.

Rao *et al.*, (1993) developed procedure of cashewnut *burfi* by using cashewnut, sugar syrup, cardamom, whole milk powder and vanaspati (Hydrogenated fat). The sugar syrup was brought to 80 °Brix, the cashewnut paste was added and cooked to 85 °Brix. At this stage, the milk powder and vanaspati paste were added and cooking continued to get 82 °Brix. The mass was then packed in aluminum moulds, pressed, cooled and cut into 10×10 cm pieces, each pieces weighing about 5 g.

Nikam (1996) prepared mango *burfi* from cow or buffalo milk by desiccating it into *khoa* (24 to 28% moisture for cow milk and 18 to 22 % for buffalo milk *khoa*). To this *khoa*, sugar was added and heated on low flame, when the product started to leave the sides of *karahi* (within 5 to 8 min.). The mango pulp was added and further heated on low flame till the product again started to leave the sides of *karahi* vigorous stirring was continued during this operation. Then the product was taken off the flame and transferred into a greasy tray to make a slab. It was allowed to cool, for about 6 to 8 hrs. and cut into square pieces of desirable size.

Wakchaure (1998) reported that the buffalo milk (6% fat) concentrated to a pasty consistency by way of evaporation in open pan on gentle fire. The sapota pulp in various levels i.e. 5, 7.5 and 10 per cent blended with concentrated milk on weight basis. The sugar at the rate of 15 per cent of *khoa* was added then the mixture was heated on gentle fire with constant stirring until a solid mass was obtained.

Sakate (2000) reported that most acceptable product was obtained when sugar was added to milk. As it started boiling, continued heating till dough stage was reached and the wood apple pulp was added and stirred thoroughly to mix the content uniformly by lowering the flame. Then the contents were transferred into greasy tray to make a slab. It was allowed to cool for about 10-12 hrs and cut into square pieces of desirable uniform size. It was concluded that *burfi* prepared with addition of 20 per cent wood apple pulp and 45 per cent sugar was the most acceptable product.

Khopade (2002) reported that the *burfi* prepared by blending *khoa* with 10, 15, 20 and 25 per cent mung flour by weight along with 20, 30 40 and 50 % sugar levels and found that the *burfi* prepared by using 25% mung flour with 50% sugar level was most acceptable.

Kolhe (2003) prepared *burfi* by using papaya pulp. The *burfi* sample prepared with different levels of papaya pulp and 30 per cent sugar by weight of *khoa*. *Burfi* prepared by using cow milk *khoa* with addition of 40 per cent papaya pulp and 30

per cent sugar was found to be superior as compared to other experimental samples of *burfi*.

Matkar (2006) prepared the fig *burfi* by using 2.50, 3.75 and 5.00 per cent fig paste (on weight basis) and 30 per cent sugar. She was observed that *burfi* prepared with addition of 3.75 per cent fig paste with 30 per cent sugar was most acceptable.

Deshmukh (2008) while preparing *burfi* by using honey as sweetening agent at 15 per cent level obtained good quality of *burfi*.

Wadewale (2010) reported that while preparing sweet orange *burfi*, *khoa* was blended with 5, 10 and 15 parts of mandarin orange juice. It was indicated that *burfi* prepared with 10 parts of orange juice was scored highest score for overall acceptability.

Kamble *et al.* (2010) prepared *burfi* using pineapple pulp. The *burfi* sample prepared with six level of pineapple pulp by weight of *khoa*. The sugar at the rate of 30 per cent as 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 at low flame till the product was taken of the flame and transferred into greasy tray and was allowed to cool and cut into desirable size. The overall acceptability of pineapple pulp *burfi* prepared with 15 per cent pulp was highest and superior.

Bankar (2011) described the preparation of *burfi* from buffalo milk with constant level of sugar (30 per cent weight of *khoa*) and different levels of pineapple pulp (5, 10 and 15 per cent by weight of *khoa*). It was observed that the overall acceptability score ranged in between 7.74 and 8.47. The *burfi* prepared by using 10 per cent pineapple pulp secured highest score for overall acceptability i.e. 8.47 and ranked at most acceptable product.

2.6 Chemical composition of *burfi*

Table 2.9 Chemical composition of market and laboratory-made *burfi*

Authors	Source of sample	Chemical constituents (%)					
		Fat	Protein	Lactose	Ash	Sucrose	Moisture
Market							
Date and Bhatia (1955)	NA	13.00	10.50	14.20	2.60	54.30	4.3
Rastogi *et al.* (1966)	NA	14.4-24.2 (17.46)	11.8-16.6 (14.4)	10.7-20.0 (16.18)	2.19-2.93 (2.56)	24.9-47.6 38.01)	11.0-31.4 (18.4)
Ghodekar *et al.* (1974)	India	4.1-13.2 (8.90)	12.1-20.3 (15.20)	6.6-10.7 (8.3)	1.6-3.2 (2.3)	48.1-55.7 (52.00)	5.4-18.4 (8.90)
Hemavathy (1974)	Bombay	15.49-24.42 (20.65)	11.50-15.20 (14.5)	14.80-20.78 (18.34)	--	24.76-47.40 (38.37)	14.17-16.80 (15.47)
	Bangalore	19.85-27.00 (22.75)	12.90-20.50 (15.13)	6.25-21.48 (15.39)	--	32.60-48.35 (37.99)	9.33-15.66 (11.69)
	Mysore	14.45-19.25 (16.85)	12.48-16.72 (13.82)	14.58-21.06 (16.79)	--	36.00-48.20 (43.31)	7.60-13.64 (10.71)
Sharma and Zariwala (1978)	Bombay	8.8-26.8	1.4-11.8	5.6-18.3	--	16.7-59.7	4.7-20.0

Sharma and Gupta (1982)	Agra	12.81+ 0.70	11.37+ 0.30	16.76+0. 58	2.71+ 0.11	41.20+13 .01	14.31+0. 58
Sachdeva and Rajorhia (1982)	Karnal	9.07- 19.65 (14.06)	6.07- 13.58 (8.82)	9.86- 16.58 (13.52)	1.62- 3.29 (2.27)	30.17- 58.62 (47.5)	12.17- 18.36 (14.8)
	Delhi	14.41- 21.1 (13.52)	9.14- 13.0 (10.82)	16.23- 21.0 (18.61)	1.52- 1.63 (1.55)	26.16- 38.43 (33.22)	16.23- 20.47 (11.77)
Garg and Mandokhot (1984)	Hisar	12.30- 28.01 (22.52)	8.71- 20.23 (12.88)	--	--	--	9.94- 19.37 (13.88)
Kamble *et al.* (2010)	India	15.81- 21.95	12.10- 14.81		2.50- 3.02		16.85- 19.26
Laboratory							
Bhatele and Balachandran (1983)	NA	20.48	14.92	15.82	2.75	30.46	15.67

Kathalkar (1995) reported that carbohydrate content in the range of 51.52 to 63.14 % in various combinations of milk ber pulp *burfi*, fat 22.0-24.0 % and ash 3.8-2.50 %.

Wakchaure (1998) conducted studies on preparation of milk sapota pulp *burfi*. The *burfi* contained moisture 9.67 to 12.16 %, total solids 90.31 to 87.70 %, protein 12.19 to 14.08 %, fat 15.31 to 15.32 % and ash 2.11 to 2.41 %.

Sakate (2000) reported chemical composition of wood apple *burfi* as moisture 14.04 to 19.70%, total solids 80.30 to 85.29%, fat 17.96 to 20.29%, acidity 0.25 to 1.20%, protein 10.42 to 13.50% and ash 2.72 to 2.90%.

Kolhe (2003) reported the chemical composition of papaya pulp *burfi* as moisture 14.13-18.73%, total solids 69.88-85.86%, fat 19.77-22.92%, protein 11.40-13.42% and acidity 0.26-0.4%.

Gargade (2004) reported chemical composition of orange *burfi* as moisture 20.23%, total solids 79.7% and acidity 0.40%.

Matkar (2006) reported chemical composition of fig *burfi* as moisture 14.18-18.49%, fat 13.-18.29%, protein 15.41-18.30%, carbohydrate 43.50-52.37%, and ash 2.13-2.17%.

Shelke (2007) also reported the chemical composition of mango *burfi* as moisture ranged from 16.32-17.72%, fat 26.39-28..52%, protein 11.95-13015%, ash 2.85-3.07%, carbohydrates 38.94-41.09%, total solids 88.28-83.68% and acidity 0.28-0.35%.

Deshmukh (2008) analyzed the honey *burfi* for its chemical composition and reported moisture 14.05-21.02, fat 22.29-24.26, protein 12.78-14.74, lactose 14.47-16.35, total solids 78.78-80.95 and ash 1.90-2.92 %.

Wadewale (2010) analyzed the mandarine orange *burfi* for its chemical composition as moisture 17.93-20.88, fat 15.61-18.51, protein 12.10-14.62, ash 3.12-2.94, total solids 79.12-82.07 and acidity 0.41-0.48 %.

Pawar (2011) reported the chemical composition of date *burfi* as moisture 15.8-17.8, fat 14.45-17.00, protein 13.20-15.00,total solid 82.20-84.20 and total sugar 47.00-53.00 %.

2.7 Microbial quality of *burfi*

Singh *et al.*(1975) determined SPC, coliform count, staphylococcus count, yeast and mould counts in 50 samples each of *burfi* and *peda* from Allahabad market and found the values as 216000, 30800, 360 and 490 per g in *burfi* and 4500000, 189000, 620000, 450 and 610 per g in *peda*, respectively.

Dwarakanatha and Srikanta (1977) studied the microbiological quality of fresh and stored dudh *peda* and dudh *burfi*. Dudh *peda* had maximum counts of aerobic *mesophilic* i.e. 5000/g, yeast and mould count as 94 x 10^3, coliform counts as 460 and

staphylococcal counts as 240 per g. In dudh *burfi*, *pedophillic* counts were about 520/g, yeast and mould count as 16.1×10^3 to 161×10^3 per g.

Garg and Mandokhot (1984) studied survival and growth of microorganisms in *burfi* and *peda* during storage. During storage of 144 hours at 28^0C or 37^0C with 80-95 per cent humidity, there was an increase in SPC and number of salt tolerant bacteria. *S. aureus* was shown to multiply both in *peda* and *burfi*. The high sugar content in *peda* and *burfi* favoured growth of *S. aureus*.

Misra and Kuila (1988) studied microbiological quality of 30 samples of *burfi* from Nadia (West Bengal). Initial total count ranged from 5×10^2 to 4.2×10^5 cfu/g. During storage for 72 hours at 30^0C, average total bacterial count increased to 1.3×10^7 cfu/g. Approximately 70 per cent samples were positive for presence of *Staphylococcus*. Initial coliforms count of *burfi* was 1.2×10^3cfu/g.

Reddy and Rajorhia (1992) reviewed the methods of manufacture, chemical and microbiological quality, packaging and shelf-life of *peda* and *burfi*. The large number of variety of microorganisms comprised mesophilles, acid producers, spore formers and *Staphylococci* in market samples of *burfi*.

Kakar and Udipi (1997) studied the microbiological quality of *khoa*, *peda*, *gulabjamun* and *burfi* collected from railway stalls, small shops and streets of Bombay. They observed the total viable count as 4.53 and 8.76, total *Staphylococcal* count 3.42 and 2.81, total faecal coliform count 4.89 and 4.21 and total faecal *Streptococcal* count 3.31 and 3.00 for *burfi* and *peda*, respectively.

Hande (2004) studied on packaging and storage studies of *burfi* using various packaging materials. The results showed that *burfi* prepared had acceptable acidity, total solids and protein upto four days. So far microbial quality was concerned; the standard plate count (5.88×105 cfu/g), lipolytic count (9.93×10^3 cfu/ml), *E. coli* count (0.36×10^3 cfu/ml) and yeast and mould count (4.71×10^3 cfu/ml) were well within the limit upto four days except proteolytic count. Plastic trays followed by thermocol were found suitable for *burfi* packaging.

2.8 Nutritional value and chemical composition of bottle gourd

Choudhary (1967) reported nutritive value of bottle gourd. The 100 g of edible portion contains moisture 96.1 g, fibre 0.6g, iron 0.7mg, potassium 87 mg, thiamine 0.03mg, riboflavin 0.01 mg and ascorbic acid 6 mg.

Gopalan *et al.* (1986) reported proximate composition of bottle gourd as moisture 96.3 %, protein 0.2 %, fat 0.1 %, carbohydrate 2.9 %, mineral matter 0.5 %.

Modgil *et al.* (2004) studied the carbohydrate and mineral matter content of bottle gourd. They found every 100 g of edible portion of bottle gourd on dry weight basis contains 5.87 g total sugar, 5.22 g reducing sugar, 0.65 g non reducing sugar, 1.31 g starch, 4.45 g crude fiber, 80.20 mg calcium, 11.87mg iron, 240.33 mg phosphorus, 3320.00 mg potassium, 27.88 mg sodium, 3.77 mg zinc and162.33 mg magnesium.

Yawalkar (2004) described that bottle gourd is vegetable crop containing vitamin B, and has cooling effect, prevents constipation and easily digestible.

Salunke and Kadam (2005) reported bottle gourd fruit is a good source of carbohydrate (2.9 %), mineral matter (0.5%), moisture (96.3%), thiamine (0.044 mg), riboflavin (0.023 mg), niacin (0.33 mg) and ascorbic acid (13 mg/100 g).

Rumezan *et al.* (2006) studied proximate composition of bottle gourd. Every 100 g of edible portion of bottle gourd contains moisture 94.5 g, protein 1.2 g, fat 0.2g, carbohydrate 3.75 g, fibre 0.7 g, ash 0.5g, calcium 12mg, potassium 87mg, phosphorus 37 mg, iron 0.8 mg, sodium 1.7 mg, thiamine 0.03mg, riboflavin 0.05 mg, niacin0.3mg and ascorbic acid 12 mg.

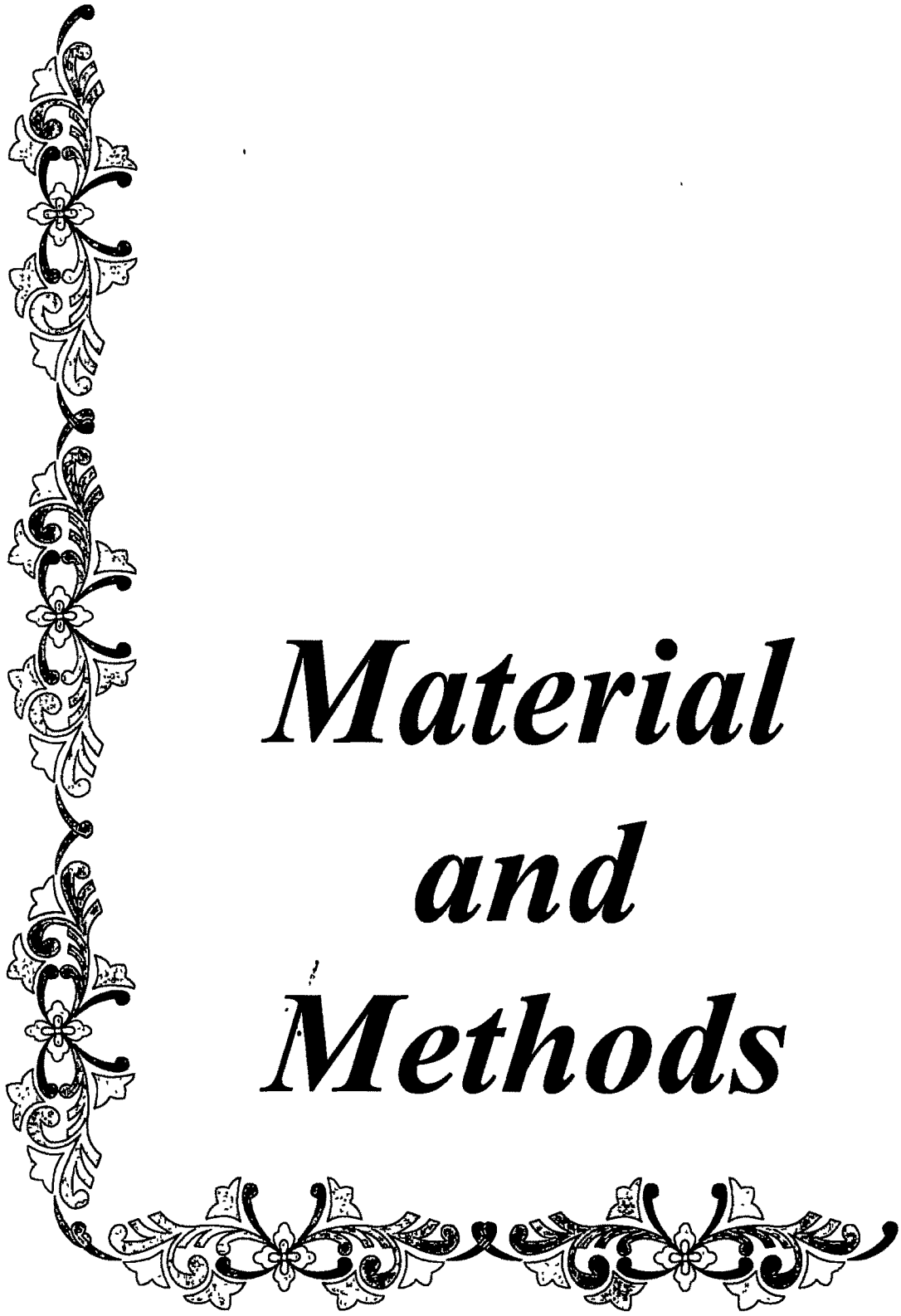
2.9 Medicinal use of bottle gourd

Chauhan (1972) reported that the pulp of bottle gourd is good for overcoming constipation, cough, night blindness and as an antitode against certain poisons.

Goyal (2000) reported the potassium content of bottle gourd (87 mg/100g) is higher than sodium content (1.7 mg/100g) like other vegetables. The high level of sodium is considered to raise the blood pressure, while potassium is considered to have antagonistic role. The ratio of K to Na plays crucial role in maintenance of blood pressure.

Deshpande *et al.*(2007) studied on free radical scavenging activity of bottle gourd. The fruit was collected and epicarp, mesocarp and pulp containing seeds were separated. Each of them was extracted with different solvents in increasing order of polarity. The maximum antioxidant activity was observed in the acetone extract of fruit epicarp. Chemical investigation revealed that radical scavenging activity may be due to the presence of ellagetanins present in the acetone extract of epicarp.

Jadhav (2007) observed that the incorporation of 10 to 15 parts of raw bottle gourd pulp in standardized buffalo milk for preparation of *kalakand* resulted into fairly acceptable product as compared *kalakand* with cooked bottle gourd pulp.



Material and Methods

CHAPTER-III

MATERIAL AND METHODS

The present study on "Utilization of bottle gourd pulp in preparation of *burfi*" was carried out at the Department of Animal Husbandry and Dairy Science, College of Agriculture, Marathwada Krishi Vidyapeeth, Parbhani. The material used and methods employed for conducting the experiment were as under:

3.1 Materials

3.1.1 Buffalo milk

The whole, fresh, clean buffalo milk was obtained from buffalo unit maintained at Department of Animal Husbandry and Dairy Science College of Agriculture, Marathwada Krishi Vidyapeeth, Parbhani. Milk was standardized to 6 per cent fat and 9 per cent SNF by pearson's formula.

3.1.2 Bottle gourd

Fresh bottle gourd was obtained from the local market of Parbhani.

3.1.3 Sugar

Sugar was used as sweetening agent for the preparation of bottle gourd*burfi* . It was purchased from local market of Parbhani.

3.1.4 *Karahi*

An iron *Karahi* having 31 cm diameter and 8.5 cm depth with a capacity to hold three litres of milk was used for the desiccation of milk.

3.1.5 *Khunti*

The *Khunti* having flattened end with a relatively sharp edge and long handle was used for stirring the milk.

3.1.6 Wooden *khunti*

Wooden *khunti* with half rounded end made of teak wood was used for the preparation of *burfi.*

3.1.7 Stainless steel trays

Stainless steel trays having 45cm length, 25cm width and 2 cm height was used for cooling of *burfi* blocks.

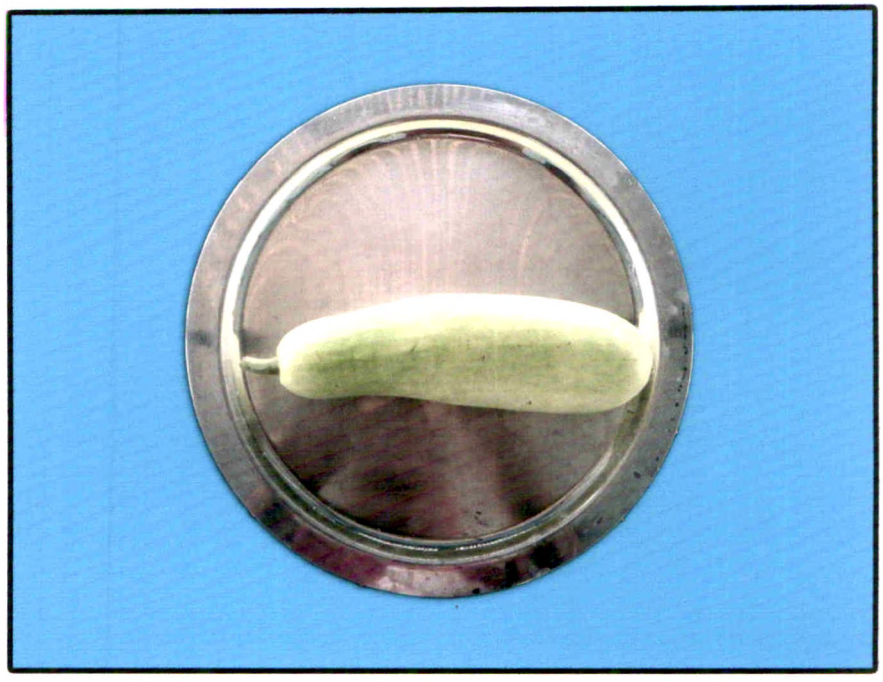


Plate 1: Bottle gourd fruit

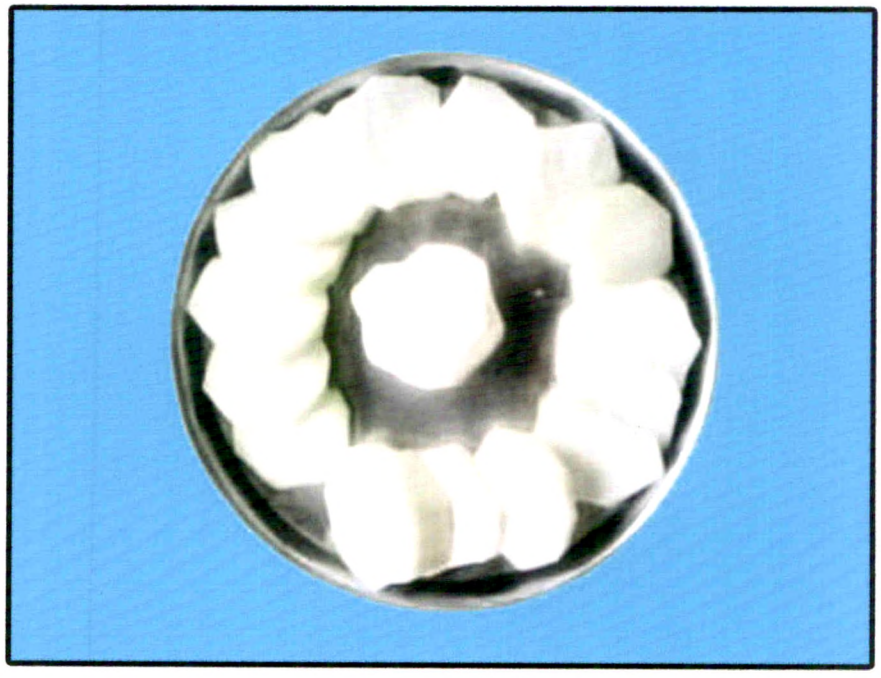


Plate 2: Slices of Bottle gourd fruit

3.1.8 Packaging materials

Cardboard boxes of rectangular shape with butter paper lining was used for packaging.

3.1.9 Mixer

Electric mixer-cum-grinder was used for grinding the bottle gourd pulp.

3.1.10 Chemicals

Analytical reagent grade chemicals were used for the chemical analysis.

3.2 Methods

3.2.1 Treatment combination

For the preparation of bottle gourd *burfi*,the following treatment combinations were taken for study. :

T_1= 0 Parts ofbottle gourd pulp +100 parts buffalo milk *khoa* by weight

T_2= 5 Parts of bottle gourd pulp + 95 parts buffalo milk *khoa* by weight

T_3= 10 Parts of bottle gourd pulp + 90 parts buffalo milk *khoa* by weight

T_4= 15 Parts of bottle gourd pulp + 85 parts buffalo milk *khoa* by weight

3.2.2 Extraction of bottle gourd pulp.

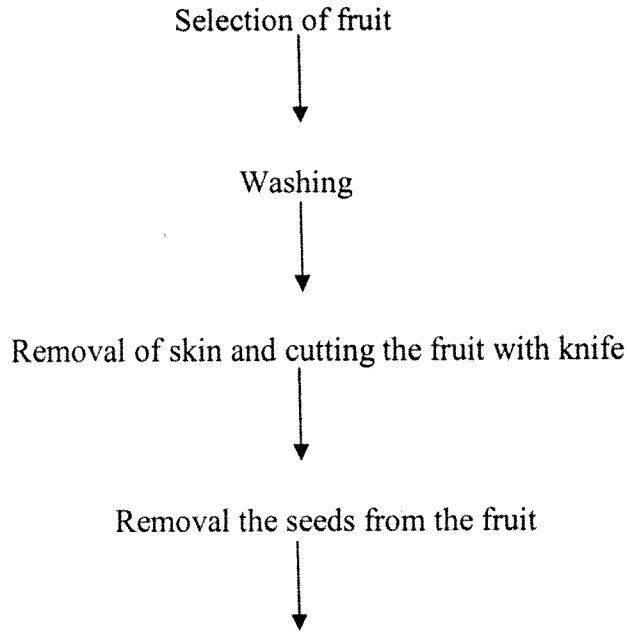


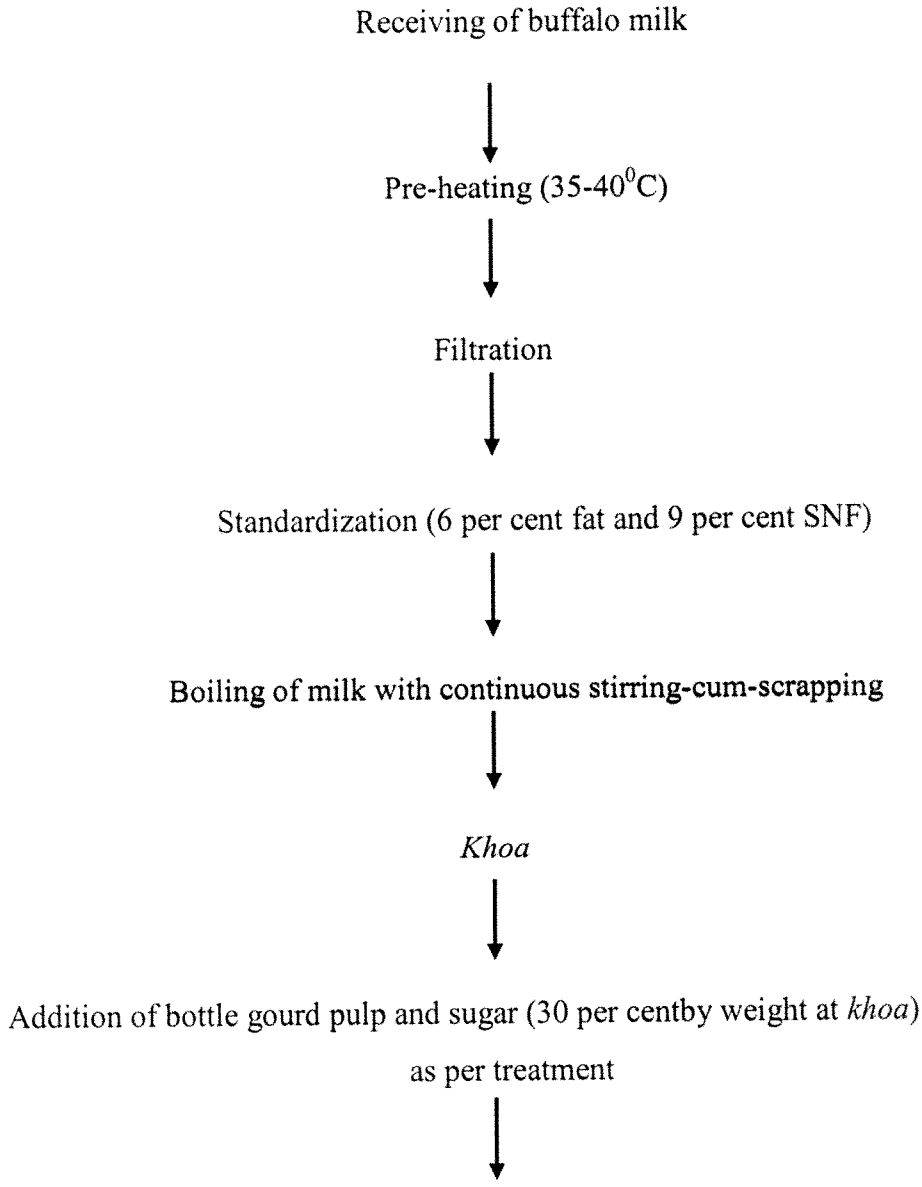
Plate 3: Pieces of bottle gourd fruit

Plate 4: Pulp of bottle gourd fruit

3.2.3 Procedure for manufacture of *burfi* with bottle gourd pulp.

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 rectangular blocks.

Fig. 1: Flow-diagram for manufacture of bottle gourd *burfi*.



Continuous stirring with wooden khunti on low flame up to solid mass stage

Spreading in tray and cooling

Setting

Cutting in to rectangular blocks

Packaging in butter paper

Store at room temperature

3.3 Sensory evaluation of bottle gourd *burfi*

Sensory evaluation of bottle gourd *burfi* was carried out by a panel of judges so as to grade the product and to know the acceptability. It was judged for colour and appearance, flavour, sweetness, body and texture and overall acceptability.

The scoring was done using 9-point Hedonic scale developed by Quarter Master Food and Container Institute, USA (Gupta 1976) the numerical, values were given from 1 to 9 as shown below

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

Plate 5: Ingredients used for bottle gourd *burfi*

Plate 6: Various treatment of bottle gourd *burfi*

The score of various treatments in respect of colour and appearance, flavour, sweetness and body and texture were pooled and mean score for overall acceptability was worked out.

3.4 Chemical analysis of bottle gourd *burfi*

3.4.1 Moisture

Moisture content of *burfi* was determined by standard procedure as described by (Anonymous,1959)

Two gram of *burfi* sample was weighed in the moisture dish. 2 to 3 ml of hot distilled water was added to make a paste, which was spread over entire bottom of the dish. The dish was then placed on a hot plate and heated till colour of the residue became light brown. The dish was then transferred to hot air oven maintained at 100° C where it was heated for 20 min. Finally, the dish was transferred to desiccator (containing calcium chloride) for cooling followed by subsequent weighing. The heating, cooling and weighing was continued till there was no difference in last two subsequent weights. The per cent moisture in *burfi* was calculated by using following formula.

$$\text{Moisture \% (by weight)} = \frac{\text{Loss in weight of } burfi}{\text{Weight of } burfi \text{ sample taken}} \times 100$$

3.4.2 Fat

Fat content of *burfi* samples was determined by Gerber's method described in IS:1224 (part II) 1977.

Exactly 3 gm of well mixed *burfi* sample was weighed in a glass beaker. 3 to 4 ml hot distilled water was added to make the paste. 10 ml dilute sulphuric acid (87:13, acid : distilled water) was then transferred into the same beaker. The contents of the beaker were quantitatively transferred into cheese butyrometer followed by washing the beaker content with 1 ml iso- amyl alcohol and 2 to 3 ml hot distilled water and then transferred it to cheese butyrometer. The butyrometer was lock stoppred and the contents were vigorously shaken to digest non fat substances. Liquid level in the butyrometers was brought to calibration by addition of required amount of distilled water. It was then centrifuged in Gerber centrifuge machine for 5

min. Fat column was noted after tempering butyrometer for 5 min in water bath maintained at 65°C.

3.4.3 Protein

Protein content of *burfi* was determined by the Microkjeldahl method as described in ISI (1981)

1.0 gm of *burfi* sample was transferred into clean and dry kjeldahl's flask having digestion mixture (98% potassium sulphate + 2% copper sulphate) and then 20 ml concentrated sulfuric acid was poured in the flask.

The contents of the flask were gently heated in an inclined position when the initial frothing was ceased. A paper shaped loose stopper in the top of the flask was fitted and the heating was continued strongly on electric coil burner taking care that the liquid boiled moderately. The flask was shaken time to time and heating was continued till liquid become clear or faint blue in colour. The contents were allowed to cool and the digested sample was poured into the distillation flask with 400 ml of distilled water. To the receiving flask 5 ml boric acid solution was added with 2 ml of bromocresol green and methyl red indicator. It was then connected with the distillation apparatus with the delivery tube clipping below the boric acid solution. The diluted digest was made alkaline with 40 per cent NaOH solution, 300 ml distillate was collected and titrated against N/10 sulphuric acid. A blank was run simultaneously.

$$\text{Nitrogen \% (by weight)} = \frac{\text{Sample burette reading-Blank burette reading}}{\text{Weight of sample}} \times 0.0014 \times 100$$

The per cent nitrogen was multiplied by factor 6.38 to obtain protein per cent in the sample.

Protein % (by weight) = % Nitrogen x 6.38

3.4.4 Ash

The total ash content of *burfi* sample was determined by method given by ISI : (1981).

About 5 g of sample was weighed in a previously weighed silica crucible and ignited in muffle furnace maintained at 550^0 C. The crucible was cooled in desiccators and then weighed. The process of ignition cooling and weighing was repeated at half hourly intervals until the differences between two successive weighing was less than 1 mg. The total ash was calculated by following formula.

$$\text{Total ash \% (by weight)} = \frac{W_1 - W}{W_2 - W} \times 100$$

Where,

W =weight of the empty crucible

W_1= weight of the crucible with ash

W_2= Weight of the crucible with sample in gram

3.4.5 Carbohydrate

Carbohydrate content was estimated by subtraction method i.e.

Carbohydrate =Total solids - (fat + protein + ash)

3.4.6 Total solids

Total solids was determined as per IS 1479 (Part-II) 1961 procedure.

A clean dry empty porcelain crucible was kept in hot air oven maintained at 100^0C for one and half hour cooled and weighted. Then 5 gm of *burfi* sample was weighted quickly. Crucible was placed in a hot water bath for 30 min. The crucible was removed and wiped, the bottom and transferred to oven maintained at 100^0C. After 2 to 3 hours crucibles was immediately removed to desiccators to cool for about 30 min. and weighted, the crucible again returned to oven and heated for one more hour and then transferred to desiccators, cooled and weighted as before. This process was repeated till difference between successive weights did not exceed by 0.5 mg.

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

3.5 Microbialquality

3.5.1 Standard plate count

It was determined by the method cited in ISI (IS: 5402) 1969 using tryptone dextrose agar medium.

Ingredients	Quantity
Tryptone	5.0 g
Yeast extract	2.5 g
Dextrose	1.0 g
Agar	15.0 g
Distilled water	1000 ml
Final P^H	7.0 $\pm$0.1

Medium was sterilized at a pressure of 15 lbs per square inch for 15 minutes. The 1 in 10000 dilutions were prepared aseptically using 9 ml sterile 0.9 per cent saline solution in a standard test tube.

The fourth (1:10000) dilution was plated in duplicate on tryptone dextrose agar medium. The plates were incubated at 37°C for 48 hours and colonies were counted on colony counter.

Total bacterial count = Number of colonies X dilution number

3.5.2 Yeast and mould count

Yeast and mould counts were determined by the method cited in ISI. (IS: 5403) 1969 using potato glucose agarhaving following composition.

Ingredients	Quantity
Infusion from 200 g of white potato	1000 ml (200g white peeled and sliced potatoes boiled in about 500 ml of water for 15 minutes or until soft, filtered through cotton pad and made upto 1000 ml.)
Glucose	20 g
Agar	15 g
P^H adjusted to	3.5 $\pm$ 0.1

The medium was sterilized at a pressure of 15 lbs per square inch for 15 minutes. The 1:10000 dilutions were prepared aseptically using 9 ml sterile 0.9 per cent saline solution in test tube.

The P^H of this medium was adjusted to 3.5 $\pm$ 0.1 with sterile 10 per cent tartaric acid. The fourth 1:10000 dilutions were plated in duplicate on potato glucose agar medium. The plates were incubated at 22$\pm$ 1°C for 3 to 5 days and well developed colonies were counted.

3.5.3 Coliform count

The presumptive coliform test was determined by the method recommended by (Chalmers, 1955).

The composition of McConkey's broth was as follows,

Ingredients	Quantity
Sodium taurochlorate	5.0 g
Peptone	20.0 g
Sodium chloride	5.0 g
Lactose	10.0 g
Andrades indicator	10 ml
Distilled water	1000 ml
P^H adjusted to	7.4

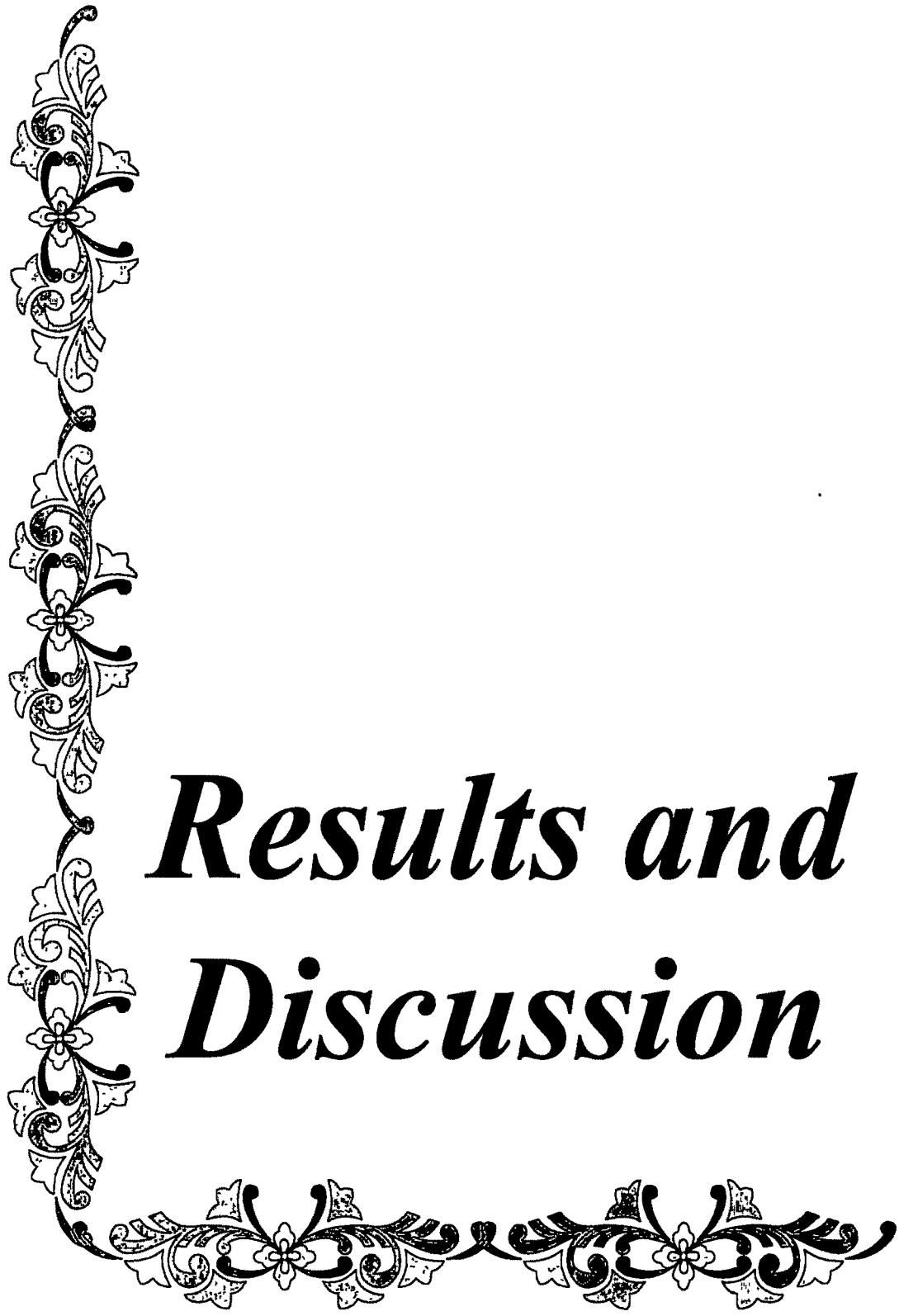
The mixture was steamed for 30 minutes and filtered through absorbent cotton. The p^H was adjusted to 7.4 by using 10 per cent sodium hydroxide. Introduced Durham's fermentation tube into required number of test tubes and 5 ml of broth was poured into each test tube. The tubes were plugged and autoclaved at a pressure of 10 lbs per square inch for 15 minutes. The samples were diluted to 1 in 100 and 1 ml of dilution was inoculated in triplicate, aseptically and incubated at 37^{0}C for 48 hours. The presence of coliform organisms was determined on the basis of pink colour of medium and presence of gas in the Durham's tube.

3.6 Cost of production of bottle gourd *burfi*

The ingredient required for preparation of bottle gourd *burfi* was calculated on the basis of prevailing market price and cost per kg was worked out.

3.7 Statistical Analysis

The results obtained during the course of investigation were subjected to statistical analysis of using completely randomized block design as described by Panse and Sukhatme (1967).



Results and Discussion

CHAPTER-IV

RESULTS AND DISCUSSION

In recent years a lot of interest has been generated in the development of milk and vegetable or fruit based delicacies. The blend of vegetable and milk in the product preparation improves acceptability of the product and blends. The nutritional value of both milk and vegetable are gaves synergesis effect in the final products. For all the classes of people the vegetable like bottle gourd, sugarbeet, carrot and ash gourd are very popular and regular consumed vegetables. The preparation of such products like filled dairy products could be a better alternative for increasing nutritional, physico-chemical and functional attributes of products.

Bottle gourd is gaining very popularity in health conscious for urban people. It is a rich source of vitamin, iron and minerals. Bottle gourd contains higher concentration of dietary fibre, Vit. A, C, E, K, B_6, foliate, potassium, magnese, thiamine, riboflavin, panthothenic acid, calcium, iron, magnesium and phosphorus.

Bottle gourd pulp contains 96.3% water, 2.9% carbohydrates, 0.2% proteins, 0.5% fat. Fruit is easily digestible and also cooling, sedative, diuretic and medicinal value. It also acts as laxative fruit (Anonymous, 2010).

Looking to above diversified benefits of bottle gourd, it was decided to prepare bottle gourd *burfi* using various treatment combinations. The treatment details were

T1= 0 Parts of bottle gourd pulp +100 parts buffalo milk *khoa* by weight

T2= 5 Parts of bottle gourd pulp + 95 parts buffalo milk *khoa* by weight

T3= 10 Parts of bottle gourd pulp + 90 parts buffalo milk *khoa* by weight

T4= 15 Parts of bottle gourd pulp + 85 parts buffalo milk *khoa* by weight

In the present study entitled, "Utilization of bottle gourd pulp in preparation of *burfi*" an attempt has been made to study the sensory, chemical and microbial evaluation of *burfi* at different treatment combinations.

Therefore the collected data were tabulated, statistically analyzed and are presented in this chapter. The results of the present study have been discussed under the following main headings.

4.1 Sensory evaluation of bottle gourd *burfi.*

4.2 Chemical composition of bottle gourd *burfi.*

4.3 Microbial quality of fresh bottle gourd *burfi.*

4.4 Cost structure of bottle gourd *burfi.*

4.1 Sensory evaluation of bottle gourd *burfi.*

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

The data obtained were analyzed using Completely Randomized Block Design (CRBD). The results obtained for sensory evaluation of control *burfi* and bottle gourd *burfi* are discussed as under.

4.1.1. Colour and appearance score of bottle gourd *burfi.*

The colour and appearance scores of the *burfi* as influenced by different levels of bottle gourd pulp have been depicted in table 4.1.

Table 4.1: Effect of different levels of bottle gourd pulp on colour and appearance score of *burfi*

Treatments/ Replications	Colour and appearance (Score)				Mean
	R-I	R-II	R-III	R-IV	
T_1	9.0	8.5	8.5	9.0	8.75^a
T_2	8.5	9.0	8.5	8.5	8.62^a
T_3	8.0	7.5	8.0	7.5	7.75^b
T_4	7.0	7.5	7.0	7.0	7.12^c
SE± 0.135			CD at 5% 0.415		
Values with superscripts are significantly different at P<0.05					

From table 4.1 mean it was observed that mean sensory scores for colour and appearance for treatments T_1, T_2, T_3 and T_4 were 8.75, 8.62, 7.75 and 7.12 respectively. The colour and appearance score for T_1 is higher than rest of treatments.

The non significant difference between T_1 and T_2 was observed for colour and appearance. The significant differences were observed in between the treatments T_2, T_3 and T_4. This might be due to increased level of bottle gourd pulp and their dull colour.

Jadhav (2007) reported that addition of bottle gourd pulp in *kalakand* decreased score for colour and appearance as compared to control *kalakand.*

Pawar (2011) reported that the colour and appearance score of *burfi* tended to decrease with increase in dried date level.

4.1.2. Flavour score of bottle gourd *burfi.*

The flavour score of the *burfi* as influenced by different levels of bottle gourd pulp have been depicted in table 4.2.

Table 4.2 : Effect of different levels of bottle gourd pulp on flavour score of *burfi*

Treatments/ Replications	Flavour (Score)				Mean
	R-I	R-II	R-III	R-IV	
T_1	8.5	8.5	9.0	8.5	8.62^a
T_2	8.0	8.5	9.0	8.5	8.50^a
T_3	7.5	7.0	8.0	7.5	7.50^b
T_4	7.0	6.5	7.0	6.5	6.75^c
SE± 0.173			CD at 5% 0.532		
Values with superscripts are significantly different at P<0.05					

It was observed from the table 4.2 that, the mean score for flavour for treatments T_1, T_2, T_3 and T_4 were 8.62, 8.50, 7.50 and 6.75 respectively. As the proportion of bottle gourd pulp level increased, the flavour score decreased as increasing level and due to the bitterness of bottle gourd pulp.

Non significant difference were observed between T_1 and T_2 treatments,while significant differences were observed in between the treatment T_2, T_3 and T_4.

Wakchaure (1998) reported that the addition of sapota pulp in *burfi* decreased score for flavour.

Kolhe (2003) observed that the addition of higher level of papaya pulp in *burfi* resulted in lower score of flavour.

4.1.3. Sweetness score of bottle gourd *burfi*.

The sweetness score of the *burfi* as influenced by different levels of bottle gourd pulp have been depicted in table 4.3

Table 4.3 : Effect of different levels of bottle gourd pulp on sweetness score of *burfi*.

Treatments/ Replications	Sweetness(Score)				Mean
	R-I	R-II	R-III	R-IV	
T_1	9.0	8.5	8.0	8.5	8.50^a
T_2	8.5	8.0	8.5	8.5	8.37^a
T_3	8.0	7.5	7.0	8.0	7.62^b
T_4	7.0	6.5	7.0	7.0	6.87^c
SE± 0.180			CD at 5% 0.555		
Values with superscripts are significantly different at P<0.05					

It was observed from table 4.3 that the average score for sweetness of finished product ranged between 6.87 to 8.50 for T_4 to T_1 respectively. The treatment T_1 was found to be higher score over the rest of the treatments. As the proportion of bottle gourd pulp level increased the sweetness score of *burfi* decreased. This might be due to the bitter taste of bottle gourd pulp.

The non significant differences were observed in between the treatment T_1 and T_2. The significant differences were observed in between the treatments T_2, T_3 and T_4.

The present results obtained are in agreement with Kathalkar (1995) and Wakchaure (1998), reported that sweetness decreases with increased level of milk ber pulp *burfi* and sapota pulp *burfi*, respectively.

4.1.4. Body and texture score of bottle gourd *burfi*.

The body and texture score of the *burfi* as influenced by different levels of bottle gourd pulp have been depicted in table 4.4.

Table 4.4 : Effect of different levels of bottle gourd pulp on body and texture score of *burfi.*

Treatments/ Replications	Body and texture (Score)				Mean
	R-I	R-II	R-III	R-IV	
T_1	8.5	8.0	8.5	8.0	8.25^a
T_2	8.0	8.5	7.5	8.5	8.12^a
T_3	8.0	7.5	7.0	7.5	7.50^b
T_4	7.0	6.5	7.0	6.5	6.75^c
SE± 0.187			CD at 5% 0.577		
Values with superscripts are significantly different at P<0.05					

It was observed that average body and texture score of bottle gourd *burfi* for treatment T_1, T_2, T_3 and T_4 were 8.25, 8.12, 7.50 and 6.75 respectively. The treatment T_1 was scored the highest body and texture score and the treatment T_4 had lowest body and texture score. Body and texture score decreased as the level of bottle gourd pulp increased. This might be due to crushy structure of pulp.

The difference recorded for T_1 and T_2 were found statistically non significant, where as the significant differences were observed in between the treatments T_2, T_3 andT_4.

Wadewale (2010) who recorded mean score for body and texture were 7.35 to 8.15 in preparation of *burfi* from mandarin orange, which was match with our results.

Jadhav (2007) also reported that increase in level of bottle gourd pulp in *kalakand* decreased score for body and texture of *kalakand.*

4.1.5. Overall acceptability score of bottle gourd *burfi.*

The overall acceptability score of the *burfi* as influenced by different levels of bottle gourd pulp have been depicted in table 4.5

Table 4.5 : Effect of different levels of bottle gourd pulp on overall acceptability score of *burfi.*

Treatments/ Replications	Overall acceptability (Score)				Mean
	R-I	R-II	R-III	R-IV	
T_1	8.75	8.37	8.50	8.50	8.53^a
T_2	8.25	8.50	8.37	8.50	8.40^a
T_3	7.87	7.37	7.50	7.62	7.59^b
T_4	7.00	6.75	7.00	6.75	6.87^c
SE± 0.081			CD at 5% 0.250		
Values with superscripts are significantly different at P<0.05					

It was observed from the table 4.5 that the mean score for overall acceptability for treatments T_1, T_2, T_3 and T_4 were 8.53, 8.40, 7.59 and 6.87 respectively. The maximum score was obtained for the treatment T_1 and the minimum score was obtained for the treatment T_4. This might be due to bitter taste and dull colour of bottle gourd pulp.

The non significant differences were observed in between the treatment T_1 and T_2. The significant differences were observed in between the treatment T_2, T_3 andT_4.

It was predicted from the sensory score of bottle gourd *burfi* that treatment T_1 and T_2were non significantly differ with each other with respect to all sensory parameters. Whereas treatment T_2, T_3 and T_4 differ significantly for these sensory parameters.

The above results for the decreasing overall acceptability due to increasing levels of bottle gourd pulp, of the present study are in confirmation with Kathalkar (1995) and Wakchaure (1998) in milk ber pulp *burfi* and sapota pulp *burfi* respectively.

4.2 Chemical composition of bottle gourd *burfi*

The bottle gourd *burfi* prepared under various treatments were subjected to analysis viz., moisture, fat, protein, ash, carbohydrate, total solids. The results are presented in the following table.

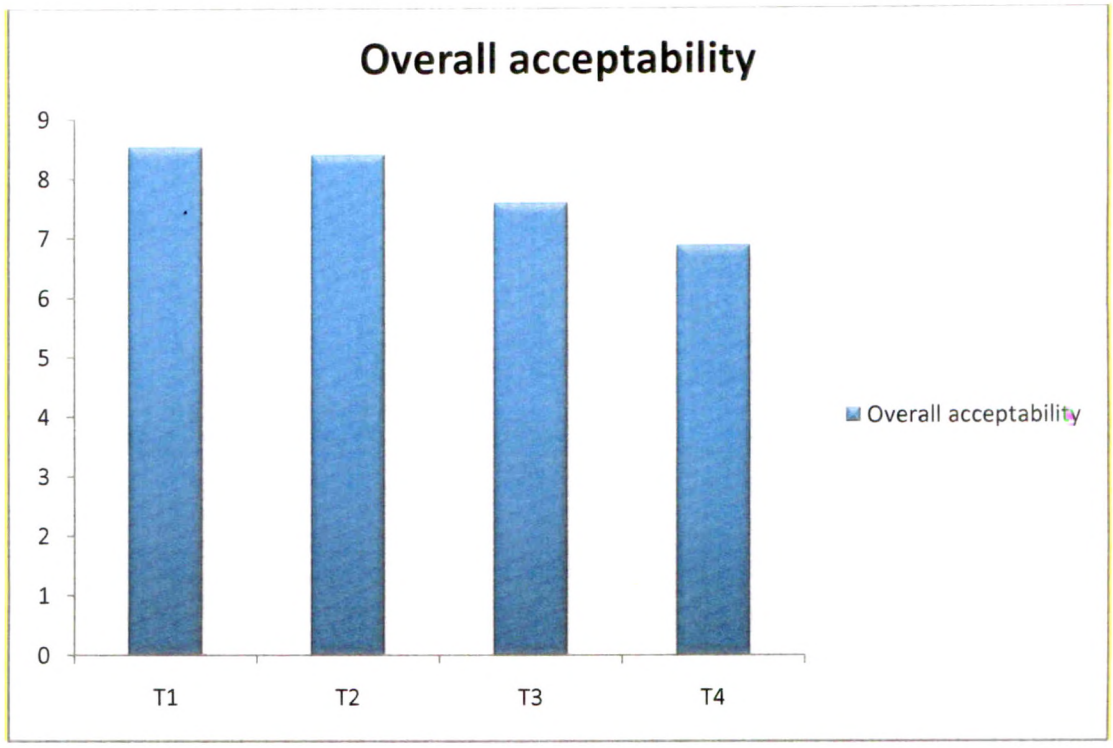


Fig.1 Overall acceptability of bottle gourd *burfi*

4.2.1 Moisture content of bottle gourd *burfi*

Moisture content in bottle gourd *burfi* varied due to incorporation of different levels of bottle gourd pulp and presented in table 4.6.

Table 4.6. Moisture content of *burfi* as influenced by different levels of bottle gourd pulp

Treatments/ Replications	Moisture content (per cent)				Mean
	R-I	R-II	R-III	R-IV	
T_1	15.96	15.82	15.66	15.80	15.81^d
T_2	18.63	18.83	18.91	18.99	18.84^c
T_3	21.37	21.23	20.87	20.98	21.11^b
T_4	24.26	23.23	24.44	24.55	24.12^a
SE ± 0.169		CD at 5% 0.520			
Values with superscripts are significantly different at P<0.05					

It was observed that the average moisture content in T_1, T_2, T_3 and T_4 were 15.81, 18.84, 21.11 and 24.12 per cent respectively. All the treatments showed the significant difference for moisture contents in bottle gourd *burfi*. As bottle gourd pulp increased in *burfi*, the moisture content in *burfi* was increased. This might be due to increased level of moisture in bottle gourd pulp.

The similar trend of increase moisture content in products due to increased level of fruit pulps have been found by Kolhe (2003), Matkar (2006) and Bankar (2011), reported moisture content in papaya *burfi*, fig *burfi* and pineapple *burfi*, respectively.

4.2.2 Fat content of bottle gourd *burfi*

The fat content of bottle gourd *burfi* under different treatment combinations were determined. The results obtained are presented in table 4.7.

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

Treatments/ Replications	Fat content (per cent)				Mean
	R-I	R-II	R-III	R-IV	
T_1	20.92	21.02	21.13	21.33	21.10^a
T_2	19.32	19.37	19.55	19.84	19.52^b
T_3	18.85	18.70	18.93	18.88	18.84^c
T_4	17.27	17.42	17.63	17.52	17.46^d
SE ± 0.086			CD at 5% 0.266		
Values with superscripts are significantly different at P<0.05					

From the table 4.7 it was observed that the mean fat content in bottle gourd *burfi* was 21.10, 19.52, 18.84 and 17.46 for treatment T_1, T_2, T_3 and T_4 respectively. It was also observed that maximum fat content was in T_1 and minimum fat content in T_4. The above observations indicate that the bottle gourd level increases the fat content of *burfi* decrease. This might be due to the less fat percent in bottle gourd pulp and less fat per cent in *khoa.*

The decreased fat content due to increase level of fruit pulps observed in the study is also confirmed by the reports made by Wadewale (2010), Bankar (2011) and Pawar (2011) in preparation of mandarin orange *burfi,* pineapple *burfi* and dried date *burfi* respectively.

4.2.3 Protein content of bottle gourd *burfi*

The protein content in the finished product was determined and the results obtained are presented in table 4.8.

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

Treatments/ Replications	Protein content (per cent)				Mean
	R-I	R-II	R-III	R-IV	
T_1	14.88	14.85	14.72	14.75	14.80^a
T_2	14.22	14.31	14.13	13.98	14.16^b
T_3	13.63	13.46	13.62	13.53	13.56^c
T_4	12.80	12.63	12.81	12.64	12.72^d
SE ± 0.051			CD at 5% 0.157		
Values with superscripts are significantly different at P<0.05					

From table 4.8 it was observed that the protein content of the finished product varied between 14.80 to 12.72per cent for treatment T_1 to T_4. The differences were statistically significant among the various treatments. It was also observed that as the addition of bottle gourd pulp level increases the protein content of the product decreases. This might be due to low per cent of protein in bottle gourd pulp.

The present results obtained are in agreement with Shelke (2007), Wadewale (2010) and Bankar (2011) however, they used mango pulp, mandarin orange pulp and pineapple pulp respectively.

4.2.4 Ash content of bottle gourd *burfi*

The ash content of bottle gourd *burfi* under different treatment combinations were determined. The results obtained are presented in table 4.9.

Table 4.9. Ash content of *burfi* as influenced by different levels of bottle gourd pulp

Treatments/ Replications	Ash content (per cent)				Mean
	R-I	R-II	R-III	R-IV	
T_1	2.89	2.76	2.73	2.74	2.78^a
T_2	2.80	2.68	2.66	2.66	2.70^a
T_3	2.65	2.53	2.59	2.35	2.53^b
T_4	2.50	2.45	2.40	2.33	2.42^b
SE ± 0.045			CD at 5% 0.138		
Values with superscripts are significantly different at P<0.05					

The data presented in table 4.9 indicate that the ash content in treatment T_1, T_2, T_3 and T_4 were 2.78, 2.70, 2.53 and 2.42 respectively. The difference was statistically significant among the treatment T_2 and T_3. As the bottle gourd pulp level increase the ash content level of the product decreased.

Above findings are agreement with Kolhe (2003) reported that ash content in *burfi* was inversely proportional to increased level of bottle gourd pulp.

4.2.5 Carbohydrate content of bottle gourd *burfi*

The carbohydrate content in bottle gourd *burfi* formulated under different treatment combination was determined. The results are presented in table 4.10.

Table 4.10. Carbohydrate content of *burfi* as influenced by different levels of bottle gourd pulp

Treatments/ Replications	Carbohydrate content (per cent)				Mean
	R-I	R-II	R-III	R-IV	
T_1	45.32	45.52	45.83	45.25	45.48^a
T_2	44.30	44.13	44.45	44.16	44.26^b
T_3	42.92	43.86	42.81	43.89	43.37^c
T_4	42.87	43.01	42.54	42.54	42.74^d
SE $\pm$ 0.175			CD at 5% 0.537		
Values with superscripts are significantly different at P<0.05					

It was observed from table 4.10 that the average carbohydrate content of finished product were found to be 45.48, 44.26, 43.37 and 42.74 for treatment T_1, T_2, T_3 and T_4 respectively. All treatments were significantly differed from each other. The highest carbohydrate was recorded for treatment T_1 i.e. 45.48 and the lowest carbohydrate was recorded for treatment T_4. It was also observed that as the addition of bottle gourd pulp level increase the carbohydrate content in final product decreased. This might be due to the low sugar content in bottle gourd.

Sakate (2000) was studied preparation of wood apple *burfi* and found that carbohydrate content of the *burfi* was in the range of 44.93 to 52.41 per cent.

Bankar (2011) found that carbohydrate content in *burfi* was in the range of 43.39 to 47.21.

4.2.6 Total solids content of bottle gourd *burfi*

The total solids content of bottle gourd *burfi* under different treatment combinations were determined. The results obtained are presented in table 4.11.

Table 4.11. Total solids content of *burfi* as influenced by different levels of bottle gourd pulp

Treatments/ Replications	Total solids content (per cent)				Mean
	R-I	R-II	R-III	R-IV	
T_1	84.01	84.15	84.41	84.07	84.16^a
T_2	80.64	80.49	80.79	80.64	80.64^b
T_3	78.05	78.55	77.95	78.65	78.30^c
T_4	75.44	75.51	75.38	75.03	75.34^d
SE ± 0.116			CD at 5% 0.357		
Values with superscripts are significantly different at P<0.05					

From the table 4.11 it was observed that the average total solids content of finished product were found to be 84.16, 80.64, 78.30 and 75.34 for treatment T_1, T_2, T_3 and T_4 respectively. The highest total solids content was recorded for treatment T_1 and the lowest total solids content was recorded for treatment T_4. All treatments were significantly differed from each other. It was also observed that as the addition of bottle gourd pulp level increases the total solids content of product decreases. This might be due to the low total solids content of bottle gourd pulp.

The decreased total solids content due to increased level of fruit pulps observed in study is also confirmed by the report made by Golande (2007), Wadewale (2010) and Bankar (2011) in preparation of sweet orange *burfi*, mandarine orange *burfi* and pineapple *burfi* respectively.

4.2.7 Mean chemical composition of bottle gourd *burfi*

The data obtained on mean chemical composition of treatments T_1, T_2, T_3 and T_4 is tabulated in Table 4.12.

Table 4.12 : Mean chemical composition of finished product.

Sr. No.	Chemical constituents	T_1	T_2	T_3	T_4
1.	Moisture (%)	15.81	18.84	21.11	24.12
2.	Fat (%)	21.10	19.52	18.84	17.46
3.	Protein (%)	14.80	14.16	13.56	12.72
4.	Ash(%)	2.78	2.70	2.53	2.42
5.	Carbohydrate(%)	45.48	44.26	43.37	42.74
6.	Total solids (%)	84.16	80.64	78.30	75.34

It was observed that the T_1, T_2, T_3 and T_4 content 15.81, 18.84, 21.11 and 24.12 per cent moisture, 21.10, 19.52, 18.84 and 17.46 per cent fat, 14.80, 14.16, 13.56 and 12.72 per cent protein, 2.78, 2.70, 2.53 and 2.42 per cent ash , 45.48, 44.26, 43.37 and 42.74 per cent carbohydrate and 84.16, 80.64, 78.30 and 75.34 per cent total solids, respectively.

4.3 Microbial quality of fresh bottle gourd *burfi*

The fresh product prepared was subjected to microbial analysis with respect to standard plate count, yeast and mould count and coliform count.

4.3.1 Standard plate count of bottle gourd *burfi*

Table 4.13 - Standard plate count of fresh bottle gourd *burfi*

(cfu x10^3 per gm)

Treatments	Replications				Mean
	R-I	R-II	R-III	R-IV	
T_1	8	10	10	8	9^d
T_2	13	12	11	12	12^c
T_3	16	14	16	14	15^b
T_4	19	18	20	19	19^a
SE $\pm$ 0.512			CD at 5% 1.547		
Values with superscripts are significantly different at $P < 0.05$					

From the table 4.13 it was observed that the standard plate count of fresh samples were ranged in between 9 to 19cfu x 10^3 per gm for treatment T_1 to T_4.There is

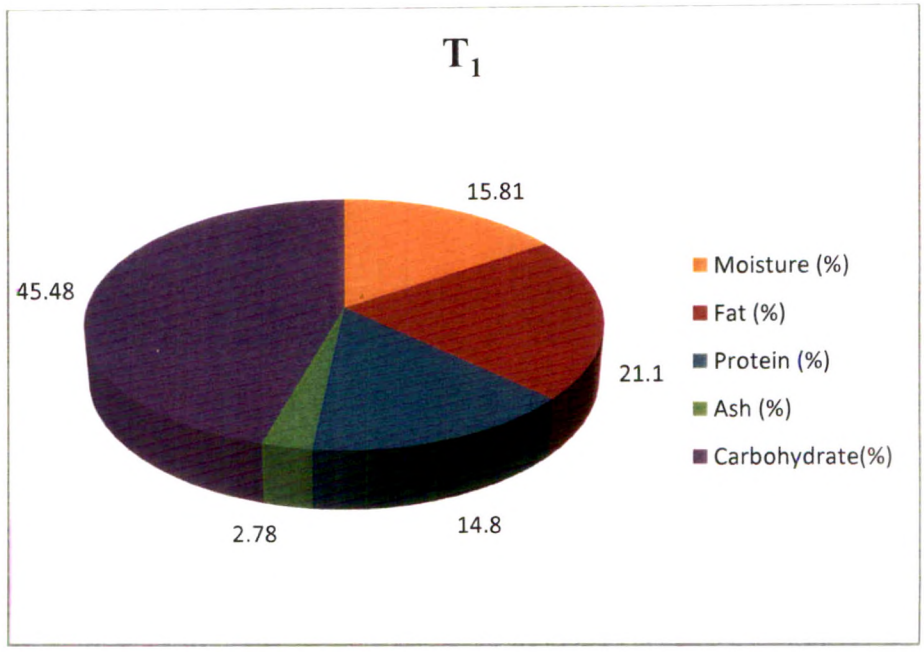


Fig.2 Mean Chemical Composition of Treatment (T_1)

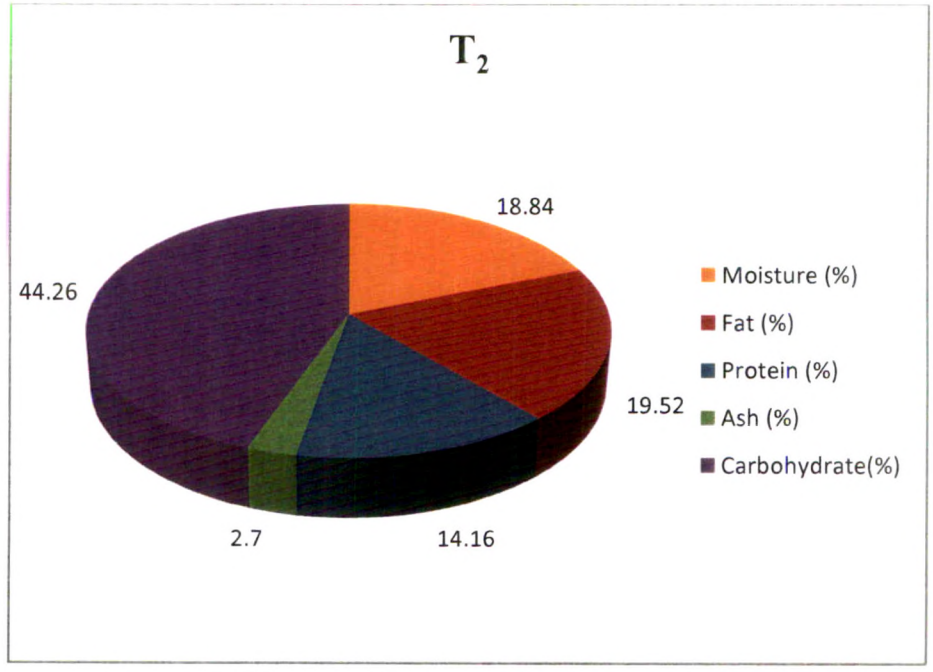


Fig.3 Mean Chemical Composition of Treatment (T_2)

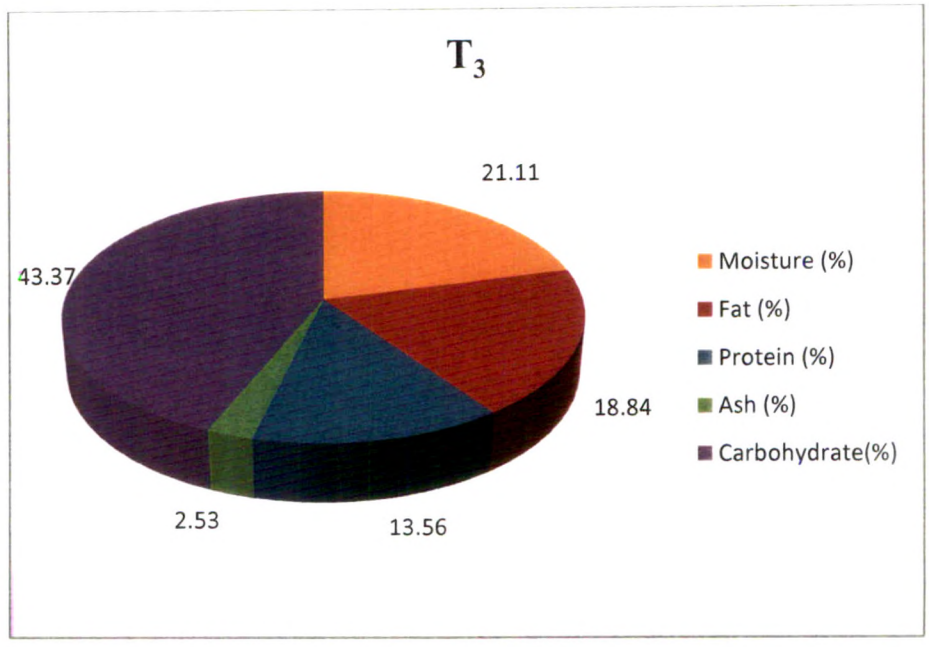


Fig.4 Mean Chemical Composition of Treatment (T_3)

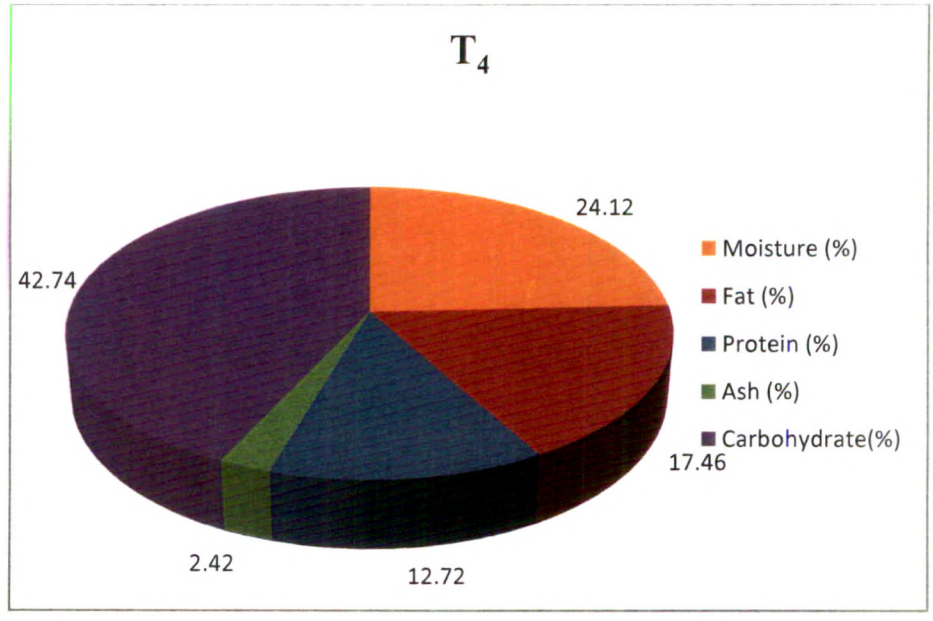


Fig.5 Mean Chemical Composition of Treatment (T_4)

significant difference observed in between treatments. As the bottle gourd pulp increased in *burfi* the spc count in *burfi* was increased. This might be due to increased level of moisture in bottle gourd pulp.

Deshmukh (2008) observed the SPC count of honey *burfi* in the range of 0.73 to 8.33 x 10^{-4} cfu per g. Kumbhar (2011) prepared ginger juice *burfi* and observed that SPC count ranged between 0.46 to 19.20 x 10^{5} cfu per g.

4.3.2 Yeast and mould count of bottle gourd *burfi*

Table4.14- Yeast and mould count of fresh bottle gourd *burfi*

(cfu per gm)

Treatments	Replications				Mean
	R-I	R-II	R-III	R-IV	
T_1	3	4	3	2	3^{d}
T_2	5	6	7	6	6^{c}
T_3	9	8	9	10	9^{b}
T_4	12	14	11	15	13^{a}
SE $\pm$ 0.585CD at 5% 1.771					
Values with superscripts are significantly different at P < 0.05					

From table 4.14 observed that the yeast and mould count of *burfi* ranged between 3 to 13 cfu per gm for treatment T_1 to T_4. The highest count was observed in T_4 followed by T_3, T_2 and T_1. It also observed that significant difference between the various treatments. As the bottle gourd pulp increased in *burfi* the yeast and mould count in *burfi* was increased. This might be due to increased level of moisture in bottle gourd pulp.

Deshmukh (2008) prepared honey *burfi* and recorded that yeast and mould count ranged between 0.34 to 1.03 x 10^{-3} cfu per g. Kumbhar (2011) recorded that yeast and mould count of ginger juice *burfi* in the range of 0.00 to 7.00 x 10^{3} cfu per g.

4.3.3 Coliform count of bottle gourd *burfi*

Coliform in any dairy product indicate the hygenic condition maintained during production and packaging. In the present study coliform are found to be absent in bottle gourd *burfi.*

4.4 Cost structure of bottle gourd *burfi*

The cost of production of bottle gourd *burfi* from buffalo milk *khoa* with and without addition of bottle gourd pulp was calculated and is presented in Table 4.15.All the ingredients used for preparation of bottle gourd *burfi* was rated according to the prevailing prices in the market (2011-2012).

The cost of production of *burfi* under treatment T_1, T_2, T_3 and T_4 were Rs. 159.6, Rs. 155.12, Rs. 150.64 and Rs.146.16 per kg respectively. It could be seen from the Table 4.15 that the cost of production of one kg *burfi* prepared from plain *khoa* was higher (Rs. 159.6) as compared to the cost of production of *burfi* from treatment T_2 (Rs. 155.12), T_3 (Rs.150.64) and T_4 (Rs. 146.16). From the above cost of production it could be concluded that as the proportion of bottle gourd pulp level in the *burfi* increased the cost of production decreased considerably.

The study indicated that good quality *burfi* could be prepared from buffalo milk *khoa* blended with bottle gourd pulp, comparatively of lower cost compared to the traditional *burfi.* It could be suitable for the common consumer as far as purchasing power is concerned

Table 4.15 : Cost of production of bottle gourd *burfi* (Rs./Kg)

Sr. No.	Particulars	Cost (Rs./kg)	T_0		T_1		T_2		T_3	
			Qty. (per kg)	Amt. (Rs)	Qty. (per kg)	Amt. (Rs)	Qty. (per kg)	Qty. (per kg)	Amt. (Rs.)	Amt. (Rs.)
1.	*Khoa* (kg)	120	1	120	0.950	114	0.900	108	0.850	102
2.	Bottle gourd pulp (kg)	40	--	--	0.050	2.00	0.100	4.00	0.150	6.00
3.	Sugar (kg)	32	0.300	9.60	0.285	9.12	0.270	8.64	0.255	8.16
4.	Labour charges	--	--	15.00	--	15.00	--	15.00	--	15.00
5.	Fuel charges	--	--	5.00	--	5.00	--	5.00	--	5.00
6.	Miscellaneous charges	--	--	10.00	--	10.00	--	10.00	--	10.00
7.	Total cost per kg	--	--	159.6	--	155.12	--	150.64	--	146.16

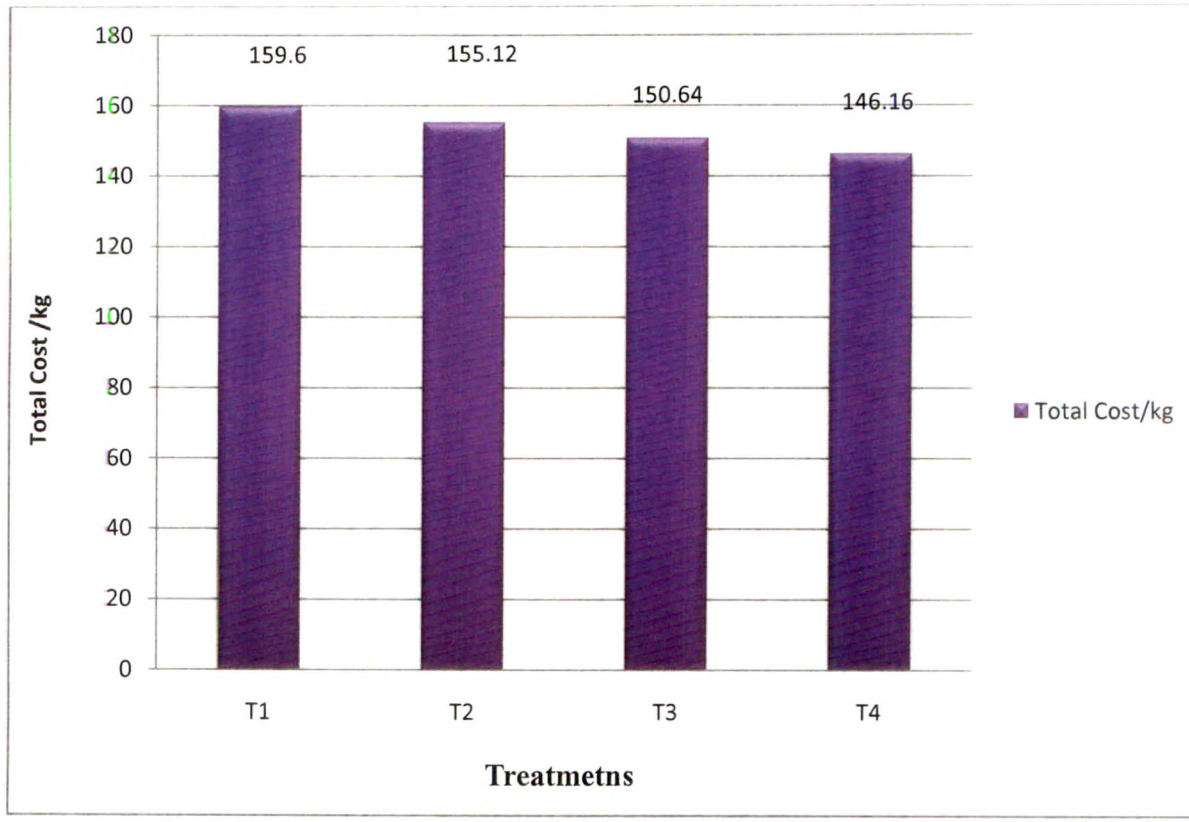
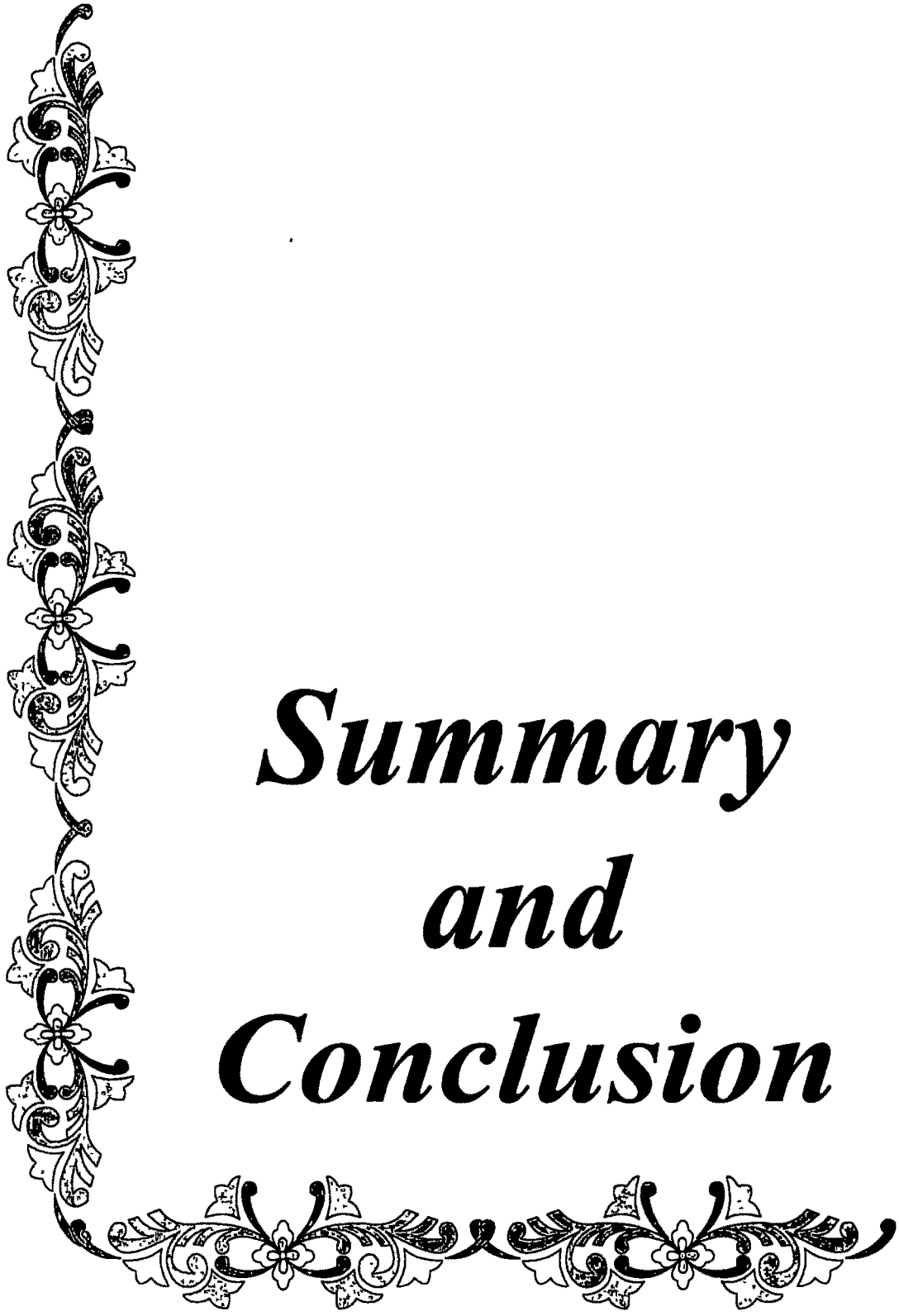


Fig.6 Cost of production of bottle gourd *burfi*



Summary and Conclusion

CHAPTER- V

SUMMARY AND CONCLUSION

The research work entitled "Utilization of bottle gourd pulp in preparation of *burfi*"was undertaken at Department of Animal Husbandry and Dairy Science, College of Agriculture, Marathwada Krishi Vidyapeeth Parbhani. The main objective of the project was to standardize the process of manufacture of bottle gourd *burfi* which would be nutritious, comparatively cheaper and highly acceptable by the consumer.

The results obtained are summarized in the following headings.

5.1 Sensory evaluation of bottle gourd *burfi.*

5.2 Chemical composition of bottle gourd *burfi.*

5.3 Microbial quality of fresh bottle gourd *burfi.*

5.4 Cost structure of bottle gourd *burfi.*

5.1 Sensory evaluation of bottle gourd *burfi.*

5.1.1 Colour and appearance

The colour and appearance score of the treatments T_1,T_2,T_3, and T_4were8.75, 8.62, 7.75 and 7.12 respectively. The maximum score 8.75 was recorded for the treatment T_1 followed T_2(8.62), T_3 (7.75) and T_4(7.12).

5.1.2. Flavour

The average flavour score of bottle gourd *burfi* for the treatment T_1, T_2, T_3 and T_4 were 8.62, 8.50, 7.50 and 6.75 respectively. The maximum score 8.62 was for treatment T_1 followed by T_2, T_3, T_4.

5.1.3. Sweetness

It was observed that the sweetness score of bottle gourd *burfi* for treatments T_1, T_2, T_3 and T_4 were 8.50, 8.37, 7.62 and 6.87, respectively. The highest score was recorded in T_1 (8.50) followed by T_2, T_3, T_4.

5.1.4. Body and Texture

The body and texture score for different treatments T_1, T_2, T_3 and T_4 were 8.25, 8.12, 7.50 and 6.75, respectively. The highest score was recorded in T_1 (8.25) followed by T_2, T_3, T_4.

5.1.5. Overall acceptability

The overall acceptability score ranged in between 6.87 to 8.53. The treatment T_1 scored highest score (8.53) amongst all the treatments, whereas treatment (T_4) showed lowest acceptability (6.87) over all the treatments.

5.2 Chemical composition of bottle gourd *burfi*

5.2.1. Moisture content of bottle gourd *burfi*

The moisture content in bottle gourd *burfi* were found to be 15.81, 18.84, 21.11 and 24.12 per cent for treatments T_1, T_2, T_3 and T_4, respectively. The moisture content of bottle gourd *burfi* increases with increasing the level of bottle gourd pulp. This might be due to the higher moisture content in bottle gourd pulp.

5.2.2. Fat content of bottle gourd *burfi*

It was recorded that the average fat content for treatment for T_1, T_2, T_3 and T_4were 21.10, 19.52, 18.84 and 17.46 percent respectively. The fat content in control (T_1) *burfi* was highest as 22.10 per cent and that of lowest observed in treatment T_4 (17.46). It might be due to the less amount of *khoa* and less amount of bottle gourd pulp.

5.2.3 Protein content of bottle gourd *burfi*

The protein content was found higher in treatment T_1 (14.80) followed by treatment T_2 (14.16), T_3 (13.56) and T_4 (12.72). The protein content of bottle gourd *burfi* decreases with increasing the level of bottle gourd pulp. This might be due to the lower protein content in bottle gourd pulp.

5.2.4. Ash content of bottle gourd *burfi*

The ash content of *burfi* for different treatments T_1, T_2, T_3 and T_4were 2.78, 2.70, 2.53 and 2.42, respectively. The ash content was highest in T_1 followed by T_2 T_3 and T_4. The ash content of bottle gourd *burfi* decreases with increasing level of bottle gourd pulp.

5.2.5. Carbohydrate content of bottle gourd *burfi*

The carbohydrate content of bottle gourd *burfi* for different T_1, T_2, T_3 and T_4 treatments found as 45.48, 44.26, 43.37 and 42.74, respectively. The highest carbohydrate content was in treatment T_1 i.e. 45.48.

5.2.6. Total solids content of bottle gourd *burfi*

The score for total solids content was ranged in between 84.16 to 75.34 per cent. The highest total solids content was in T_1 (84.16) per cent, whereas lowest total solids content was in treatment T_4 i.e. 75.34.

5.3 Microbial quality of fresh bottle gourd *burfi.*

5.3.1 Standard plate count of fresh bottle gourd *burfi*

It was observed that the standard plate count of fresh samples were ranged in between 9 to 19 cfu x 10^3 per gm for treatment T_1 to T_4.The highest count was observed in T_4 followed by T_3, T_2 and T_1.As the bottle gourd pulp increased in *burfi* the spc count in *burfi* was increased. This might be due to increased level of moisture in bottle gourd pulp.

5.3.2Yeast and mould count of fresh bottle gourd *burfi*

The yeast and mould count of *burfi* ranged between 3 to 13 cfu per gm for treatment T_1 to T_4. The highest count was observed in T_4 followed by T_3, T_2 and T_1. As the bottle gourd pulp increased in *burfi* the yeast and mould count in *burfi* was increased.

5.3.3 Coliform count of fresh bottle gourd *burfi*

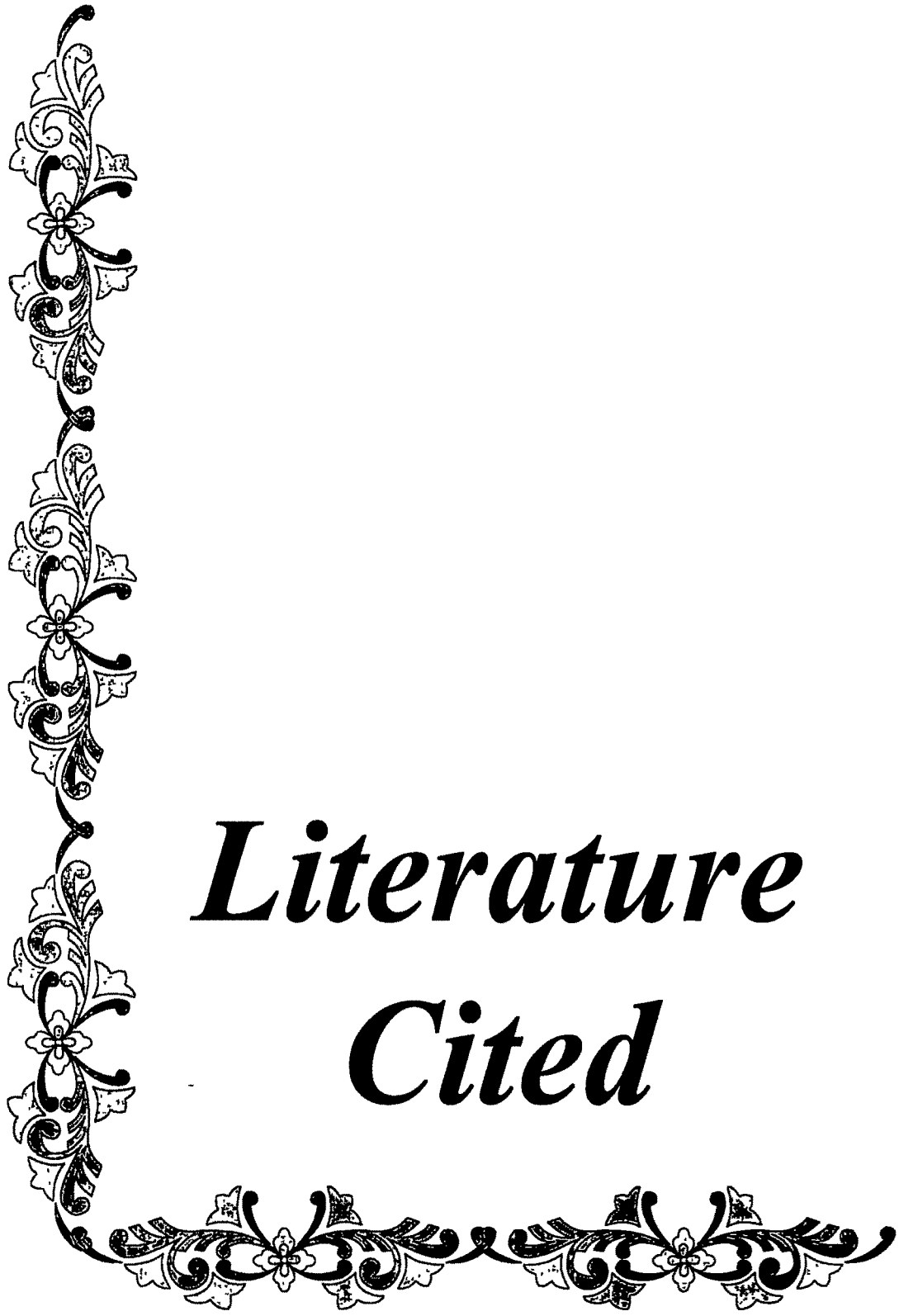
Coliform in any dairy product indicate the hygenic condition maintained during production and packaging. In the present study coliform are found to be absent in bottle gourd *burfi.*

5.4 Cost structure of bottle gourd *burfi*

The total cost on account of processing of the *burfi* prepared from buffalo milk *khoa* blended with different proportions of bottle gourd pulp ranged in between Rs. 159.6to146.16for T_1 to T_4 treatments. The cost of production for bottle gourd *burfi* for the best liked combination T_2 occurred at Rs. 155.12 per kg.

CONCLUSION

1. Control *burfi* scored highest score for all sensory attributes as compared to *burfi* blended with 5 per cent, 10 per cent and 15 per cent bottle gourd pulp.
2. In general sensory score of control sample and *burfi* with 5 per cent bottle gourd pulp was comparable and recommended for people.
3. Addition of bottle gourd pulp in *burfi* increased moisture content significantly in finished product as compared to control.
4. Per cent fat, protein, carbohydrate, ash and total solids content decreased significantly in treated product as compared to control.
5. Addition of bottle gourd pulp in *burfi* increased standard plate count, yeast and mould count significantly in finished product as compared to control and coliform count was found to be absent.
6. Cost of *burfi* blended with bottle gourd pulp was lower than control.



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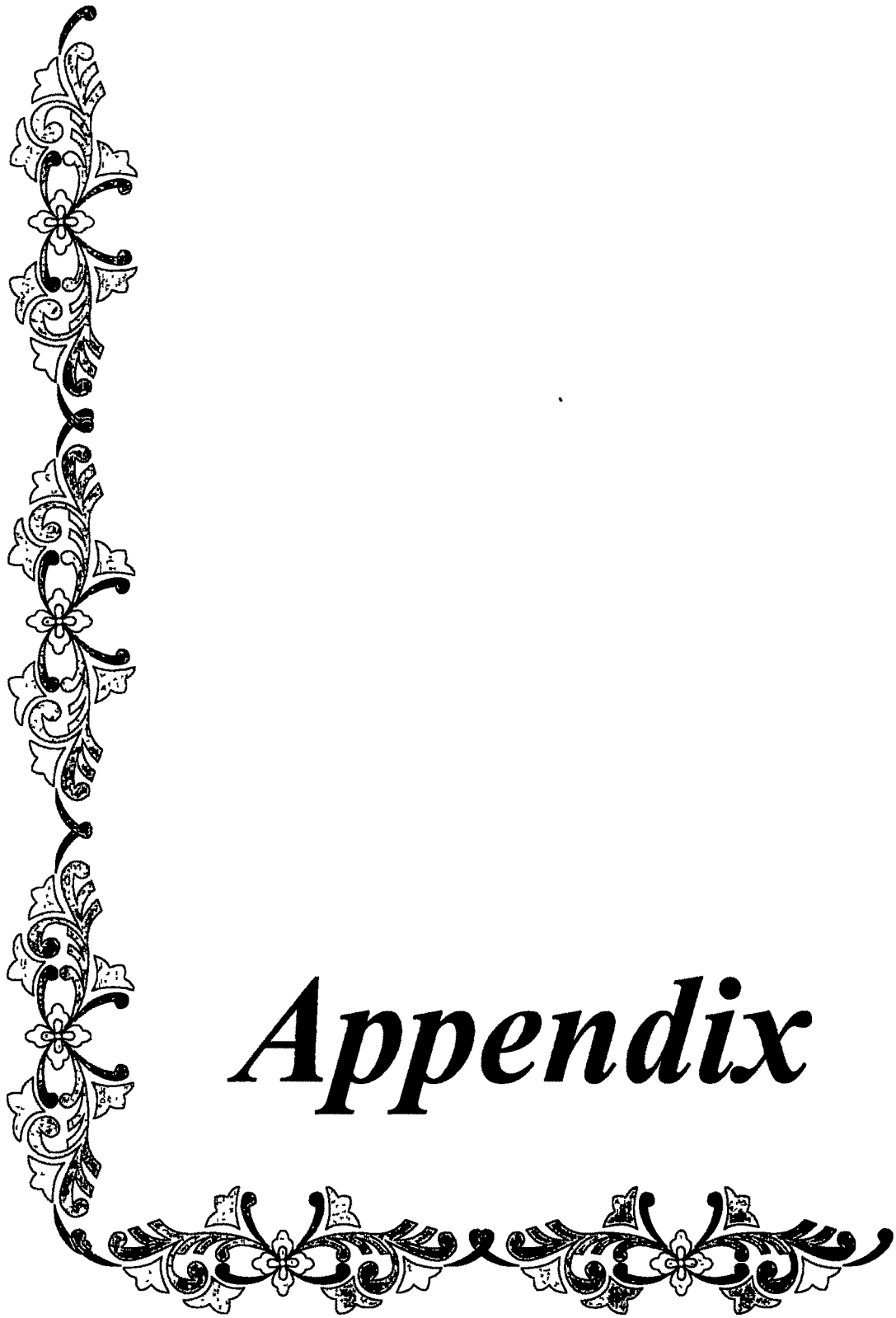


Appendix

APPENDIX-I

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE

College of Agriculture, Latur

Date :

Utilization of bottle gourd pulp in preparation of *burfi*

(9-point hedonic scale)

Name of evaluator :

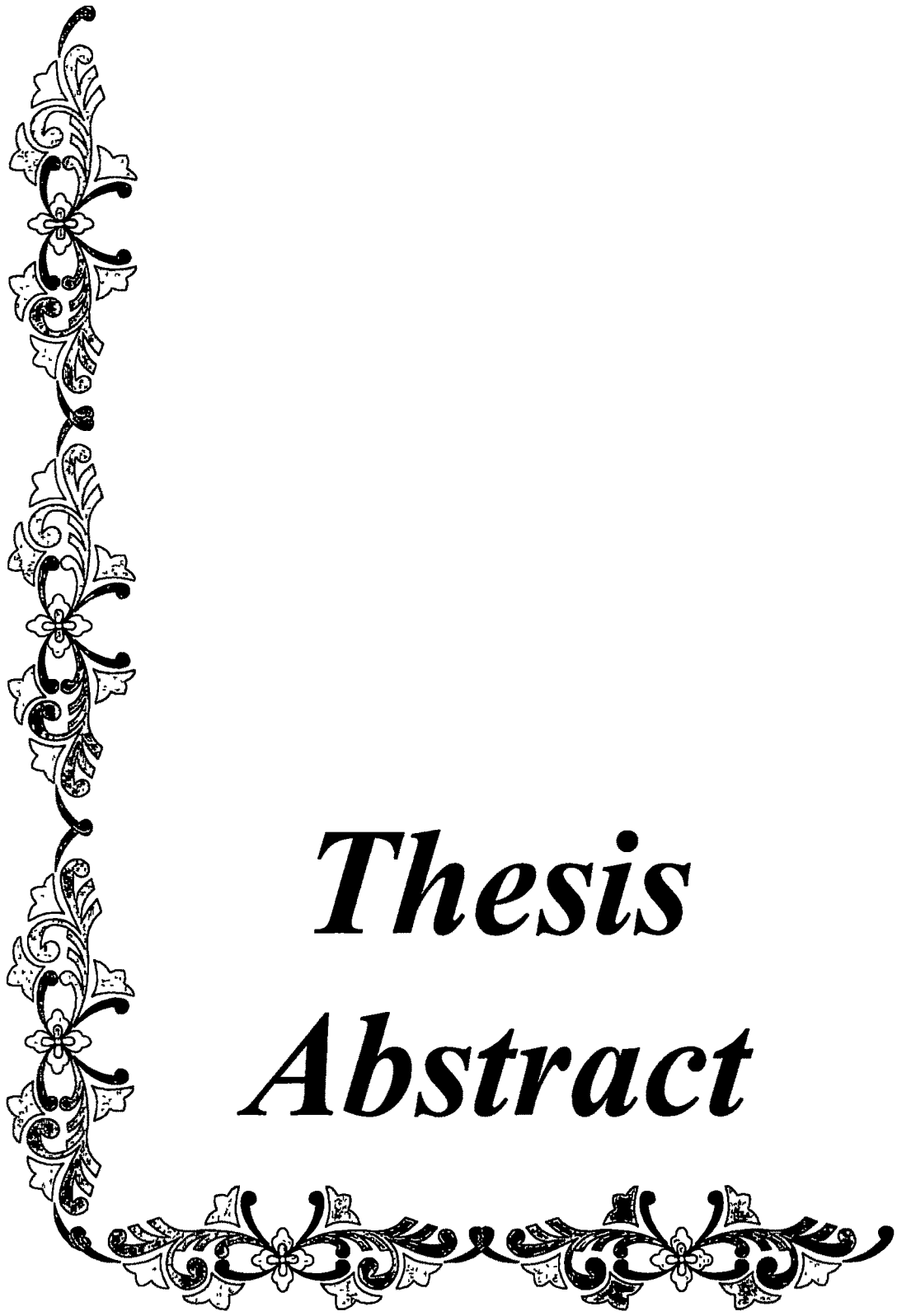
Designation :

Treatment	Colour and Appearance	Flavour	Sweetness	Body and texture	Overall acceptability
T_1					
T_2					
T_3					
T_4					

Remark : Signature

The numerical values of the score card as under (9-point Hedonic Scale).

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



Thesis Abstract

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE
COLLEGE OF AGRICULTURE, LATUR

Research Title : " Utilization of bottle gourd pulp in preparation of *burfi*"

Research Guide: Dr. S.G.Narwade
Assistant Professor

Name : Mr. Waghmare V.K.
Reg. No. : 2010A / 24ML

ABSTRACT

The present study was carried out on "Utilization of bottle gourd pulp in preparation of *burfi*". The research was conducted in the laboratory of Department of Animal Husbandry and Dairy Science, College of Agriculture, MKV, Parbhani during the year 2011-12. *Burfi* was prepared from buffalo milk with constant level of sugar (30 per cent by weight of *khoa*) and different levels of bottle gourd pulp (5, 10 and 15 per cent by weight of *khoa*). It was observed that the overall acceptability score for treatment T_1, T_2, T_3 and T_4 were 8.53, 8.40, 7.59 and 6.87 respectively. As the level of bottle gourd pulp in *burfi* increases the overall acceptability score decreases. The highest score for overall acceptability was found to be 8.53 (like very much) and lowest score was found to be 6.87 (like slightly). On an average bottle gourd *burfi* of treatment T_1, T_2, T_3 and T_4 contained moisture 15.81, 18.84, 21.11 and 24.12 per cent; fat 21.10, 19.52, 18.84 and 17.46 per cent; protein 14.80, 14.16, 13.56 and 12.72 per cent; ash 2.78, 2.70, 2.53 and 2.42 per cent; carbohydrate 45.48, 44.26, 43.37 and 42.74 and total solids 84.16, 80.64, 78.30 and 75.34 per cent, respectively.

The fresh product prepared was subjected to microbial analysis with respect to standard plate count, yeast and mould count and coliform count. The standard plate count of fresh samples were ranged in between 9 to 19 cfu x 10^3 per gm for treatment T_1 to T_4, the yeast and mould count of *burfi* ranged between 3 to 13 cfu per gm for treatment T_1 to T_4 and coliform count was found to be absent in bottle gourd *burfi*.

The cost of control *burfi* was found to be highest for T_1 as Rs. 159.6 per kg. The lowest cost was recorded for treatment T_4 as Rs. 146.16 per kg. The cost for treatment T_2 and T_3 were Rs.155.12 and Rs. 150.64 per kg, respectively. As the level of bottle gourd pulp in *burfi* increases the cost of production decreases.