

**ACCEPTABILITY AND NUTRITIONAL EVALUATION
OF PUMPKIN (*Cucurbita*) SEEDS FLOUR
INCORPORATED BAKERY PRODUCTS**

DHANASHRI SUDHAKAR SANGLE

B.Sc. (Hons) Home science

**MASTER OF SCIENCE
IN
HOME SCIENCE
(FOODS AND NUTRITION)**



**DEPARTMENT OF FOOD SCIENCE AND NUTRITION
COLLEGE OF COMMUNITY SCIENCE, PARBHANI
VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH
PARBHANI-431 402 (M.S.) INDIA**

2022

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BY

DHANASHRI SUDHAKAR SANGLE

B.Sc. (Hons) Home science

A thesis Submitted To

**Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani
In Partial Fulfillment Of The Requirement For The Degree Of**

**MASTER OF SCIENCE
IN
HOME SCIENCE
(FOODS AND NUTRITION)**



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VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH
PARBHANI-431 402 (M.S.) INDIA**

2022

DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled, “(Acceptability and Nutritional Evaluation of Pumpkin (*Cucurbita*) Seeds Flour Incorporated Bakery Products)”, submitted by me is based on the actual work carried out by me under the guidance and supervision of (Tasneem Naheed Khan). The extent of information derived from the existing literature have been duly cited and referenced. The existing research work or its any part is not submitted anywhere else for the award of any degree or diploma.

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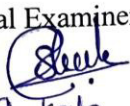
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()
Sunita Kate
External Examiner


Tasneem Naheed Khan
Research Guide & Chairman
Advisory Committee


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Member


S. G. Puri
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Member


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SA	Thesis,1-5, Ph.D.docx Document Thesis,1-5, Ph.D.docx (D112213408)	2
SA	COMPILED FOR PLAG.pdf Document COMPILED FOR PLAG.pdf (D111129379)	1
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SA	VNM Krishi Vidyapeeth / MIRA SHINDE MSc Thesis.pdf Document MIRA SHINDE MSc Thesis.pdf (D154645559) Submitted by: k_naheed@rediffmail.com Receiver: k_naheed.vnmkv@analysis.orkund.com	4
SA	Chapitre-final-05022022.doc Document Chapitre-final-05022022.doc (D127176228)	1
W	URL: https://doi.org/10.3390/FOODS8050147 Fetched: 1/4/2023 9:07:00 AM	4
SA	Full paper- PUMPKIN SEEDS.docx Document Full paper- PUMPKIN SEEDS.docx (D139451740)	1
W	URL: https://www.researchgate.net/publication/327474270_Preparation_of_pumpkin_powder_and_pumpkin_s... Fetched: 12/20/2019 7:24:46 AM	1
SA	VNM Krishi Vidyapeeth / JANHAVI PLAGARISM FILE.pdf Document JANHAVI PLAGARISM FILE.pdf (D154786930) Submitted by: k_naheed@rediffmail.com Receiver: k_naheed.vnmkv@analysis.orkund.com	11
SA	thesis-1.docx Document thesis-1.docx (D109891695)	1

ACKNOWLEDGEMENT

I take this opportunity to look back on the path traversed during the course of Endeavour and to remember the guiding faces behind the task with a sense of gratitude. At this moment, I praise my god who was redeemed me and strengthened me to do all things.

First of all I express my deep sense of gratitude and high indebtedness to my dynamic, dedicated, kind hearted and enthusiastic guide Dr. T. N Khan, Head and Professor, Dept. of Foods and Nutrition, College of Community Science, Vasantnao Naik Marathwada Krishi Vidyapeeth, Parbhani, for her valuable guidance, sympathetic approach to my personal being, sustained interest and constant encouragement till the final shaping of present investigation.

My sincere thanks to Dr. Jaya Bangale Associate Dean and Principal, College of Community Science, Vasantnao Naik Marathwada Krishi Vidyapeeth, Parbhani, for providing facilities in the college to carry out research work.

I am sincerely thankful to the advisory committee members; Dr. S.K. Sadawarte Assistant Professor Dept. of Food Process Technology, College of Food Technology, Dr. S.G. Puri Assistant Professor & Head Dept. of Extension Education College of Community Science, Dr. M.S. Kulkarni Professor and Head Dept. of Resource Management & Consumer Science, College of Community Science for their cooperation and valuable suggestions during the period of this project.


I express my special thanks to Dr. Ashwini Madam, Teaching Associate , Dr. Kalpana Lahade, Teaching Associate, (Ms). Anushree R.K, DeepaliSangekar, Mr. Eknath Langote, PhD Student Dept. of Foods and Nutrition for their valuable guidance and inspiration during the period of research work.

Words are never sufficient to express my whole hearted sense of reverence to my parents. My way in this world paves through the path carved by my parents Mr. Sudhakar Sangle and Mrs. Manisha Sangle and my grandmother Goukarna Sangle, and my both uncles Mr. Prabhakar Sangle and Mr. Madhukar Sangle and also brother and sister's whom I wish to idolize throughout my life. I think words with me are insufficient to express the feelings of my heart to acknowledge them who have shaped my life and led me best.

Its my ecstasy to express my whole hearted sincere thanks to all my friends Mira, Pooja and Janavi and special thanks to my junior Sushama and Shivani for helping me in the completion of this study, continuous encouragement and co-operation. I am also thankful to all well wishers who helped me directly and indirectly during my research work

Place :Parbhani

Date : 24 / 03 / 2025


DhanashriSudhakarSangle
Registration .No: 2020CS-02M

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ABBREVIATIONS

- LDL – Low Density Lipoprotein
- HDL – High Density Lipoprotein
- NEFA – Non Esterification Fatty Acid
- PSO – Pumpkin Seed Oil
- TC – Total Cholesterol
- SBP – Systolic Blood Pressure
- DBP – Diastolic Blood Pressure
- PSF – Pumpkin Seed Flour
- CB – Cereal Bar
- FBC – Fasting Blood Sugar

ABSTRACT

THESIS ABSTRACT

1	Title of the thesis	: Acceptability and Nutritional Evaluation of Bakery Products Prepared by Incorporation of Pumpkin (<i>Cucurbita</i>) Seeds Flour)
2	Full name of the candidate	: Dhanashri Sudhakar Sangle
3	Full Name of the Research Guide	: Tasneem Naheed Khan
4	Department	: Food Science & Nutrition
5	College / University	: College of Community Science, VNMKV, Parbhani
6	Degree to be awarded	: M.Sc. Home Science (Foods & Nutrition)

ABSTRACT

Malnutrition is global problem which imposes high cost on society. Therefore more attention has been given to the use of agricultural waste to overcome the malnutrition. Pumpkin seeds are nutritionally dense by product of pumpkin but is neglected as waste. Thus the present study was carried out for utilization of pumpkin seeds flour in bakery products like sweet biscuits, salt biscuits, *nankhatai* and cupcake with 5,10, and 15 per cent incorporation of pumpkin seeds flour and its evaluated nutrient analysis of highly accepted bakery products also estimated. The highly accepted bakery products were stored in polyethylene zip lock bag at room temperature. The result of organoleptic evaluation showed that sweet biscuits, salt biscuits, *nankhatai* and cupcake were most accepted at 10 per cent level of incorporation of pumpkin seeds flour. Whereas, cupcake prepared with 15 per cent incorporation of pumpkin seeds flour was well accepted. Incorporation of pumpkin seeds flour help to improved protein, total ash, energy, fiber, phosphorus, magnesium, calcium, iron, copper and zinc content in prepared bakery products. Result of shelf life study indicated that sweet biscuits, salt biscuits and *nankhatai* can be stored up to 60 days. Whereas cupcake can be stored up to 8 days in polyethylene zip lock bag at room temperature.

Hence, it is concluded that utilization of pumpkin seeds flour in routine diet can improve the nutritional status of the individual and also prevent the malnutrition among the population of developing country.

(Keywords : Pumpkin Seeds, Product Development, Sensory evaluation, Nutrient analysis, Shelf Life Study)

CHAPTER -I
INTRODUCTION

CHAPTER - I

INTRODUCTION

Pumpkin (*Cucurbita*) belongs to the family *Cucurbitaceae*, generally grown in the regions of the globe as a vegetable. They are grown in tropical and subtropical regions. It is a climber, monoecious and annual plant which persist certain period giving the impression of perennial plant. (Lee et al. (2003)) Pumpkin has been considered as beneficial to health because it contains various biologically active components such as polysaccharides, *para*-aminobenzoic acid, fixed oils, sterols, proteins and peptide (Murkoicet et al. 2002). The fruits are a good source of carotenoids and γ -amino butyric acid (Matus et al. 1993).

The world pumpkin production in 2012 was 25 million tons, and the crop is spread throughout the world, including the production of small farmers and large producers to supply local markets (FAO, 2012). The species offers, in addition to pulp, seeds, which can be used in foodstuffs (Moura et al. 2010).

Different parts of the pumpkin plant have been used in the form of various food regimens throughout the world. The flesh of different vegetables have found their way in the Indian diet for a time immemorial. The seeds have always been discarded as a waste in spite of having a great nutritive value. With increased public awareness in sustainable agriculture, clean and efficient energy and waste management technologies, pumpkin seed have the opportunity to a new and emerging market share in the snack food industry (Mishra et al. 2019).

Pumpkin seeds are considerable oval, flat shaped seeds and they are generally discarded as an agriculture residue. The pumpkin seeds are unique in flavored and nutty in taste and consumed salted and roasted as a snacks in few regions of Mexico, Canada, United States, China and Europe (Patel et al. 2013).

Pumpkin seeds have an important role as a source of lipids, proteins, carbohydrates and other nutrients in human diet which are necessary for maintaining proper health (Alfawaz et al.2004). Although the seeds of pumpkin is rich in oil and protein and the detailed study on their composition and properties of their oil is limited. Proximate compositions evaluation from the seed of pumpkin seed reveals protein (33.48%), carbohydrate (28.68%), lipid (30.66%), fiber (3.07%),ash (3.98%),

and available energy 524.58 K-cal (Karye et al. 2013).

Pumpkin seeds also contain relatively large amount of various essential micro-elements such as K, Cr and Na. Pumpkin seeds are a good source of Mg, Zn, Cu, Mo and Se, etc. From pumpkin leaves and germinated seeds, several phytochemicals such as polysaccharides, phenolic glycosides, NEFA (Non-Esterified Fatty Acid) and proteins have been isolated. (Nwokolo et al. (1987)), (Koike et al (2005)) D - *chiro*-Inositol in pumpkin seeds has been identified as an insulin secretor and sensitizer (Xiong et al.2000).

The total phenolic contents of pumpkin seed oil were determined by some investigators that were ranged between 25 to 51 mg/kg of pumpkin seed oil. The phenolic contents were vanillin, tyrosol, luteolin, sinapic acid and vanillic acid. There was the maximum antioxidant capacity calculated with the aid of the reduction of the DPPH (2,2-Diphenyl-1-Picryl- Hydrazyl-Hydrate) radical was 62 percent (Andjelkovic et al. 2010).

Nowadays, these pumpkin seeds are selling as fermented, sprouted, baked, concentrated form of protein. Pumpkin seeds are rich in iron, protein, manganese, magnesium, zinc, potassium, copper, phosphorous, PUFA (Polyunsaturated Fatty Acid), c-tocopherol and carotenoids. There is an emergent interest in unique formation of vegetable oil, and oil of the pumpkin seeds is a hopeful aspirant on this regard (Seema et al. 2013).

Pumpkin seeds are valued for their high protein content (Mansour et al. 1999) and useful amounts of the essential fatty acid, linoleic acid, Pumpkin seeds contain remarkably high proportions of essential amino acids (Glew et al. (2006)).

Fahim et al. (1995) reported that pumpkin seed oil significantly inhibited adjuvant- induced arthritis in rats, similar to a well-known anti-inflammatory substance called indomethacin. It was also considered that the supplementation of natural components with standard drugs might give synergistic, antagonistic and no-change effects during treatment of diseased conditions.

Zuhair et al. (2000) also suggested that pumpkin seed oil has a very good drug interaction with hypotensive drugs such as felodipine (Ca-antagonist) and captopril (an angiotensin-converting enzyme inhibitor), in regards to enhanced hypotensive potential in hypertensive animal models. The oil preparation could remarkably reduce

bladder pressure and reduce urethral pressure. Supplementation of pumpkin seed snacks showed a higher level of inhibitor of crystal formation or aggregation which will subsequently reduce the risk of urinary bladder stone disease in the Thailand population. (Suphiphat et al.1987).

Pumpkin may ease depression too, because the seeds contain L -tryptophan, which raises levels of 'happy' serotonin in the brain. The effect of water extracts of pumpkin seeds in the treatment of puppies experimentally infected with heterophyiasis gave promising results, and the combined extracts of areca nut and pumpkin seeds gave a better result than when either extract was given alone (Nakamura et al. 1998).

Isolation of oil has been reported from seed of several plants in order to make their utilization properly. The extracts of Pumpkin seed shows anti diabetic, anti-hyperlipidemia lowering both total cholesterol and triglyceride and at the same time increase HDL-cholesterol in STZ induced diabetic rats (Bisht et al. 2015).

An anti-helminthic effect was reported at the minimum inhibitory concentration of 23 g pumpkin seed in 100 ml distilled water in preclinical studies. The administration of pumpkin seed proteins after CCl₄ intoxication resulted in significantly reduced activity levels of lactate dehydrogenase, alanine transaminase, aspartate transaminase and alkaline phosphatase and hence this protein administration was effective in alleviating the detrimental effects associated with protein malnutrition. Analgesia and anti-inflammation activities were observed with the head of the pumpkin stem Protein isolate from pumpkin seeds could inhibit trypsin and activated Hageman factor, a serine protease involved in blood coagulation (Wang et al. 1999).

Pumpkin seed is used in the East in the preparation of breads, cakes and cereals; however, this is not enough to prevent the waste of this material, which can have a beneficial effect on metabolism, physiology and human nutrition since it is rich in fiber, natural source of protein and phytosterols. Therefore, the inclusion of waste seeds flour in the formulation of food products is an alternative to provide nutritional enrichment and to reduce costs. (Moura et al. 2010). some research reviews related to pumpkin seeds incorporated bakery products.

Kaur and Sharma, (2017) reported that iron and zinc content of cookies supplemented with 30 per cent raw and roasted pumpkin seeds powder as 2.36

mg/100gm and 1.28 mg/100 gm respectively.

Dhiman et al. (2018) revealed that the supplementation of both pumpkin flour and pumpkin seed flour enhance the nutritional value of weaning mixes and cookies.

Kumari et al. (2019) observed that incorporation of germinated pumpkin seeds flour improved the nutrient profile of cookies. Such developed products can be very useful in combating the micronutrients deficiency problems in population of all age groups.

Petrova et al. (2019) revealed that pumpkin seeds incorporation in sponge cake have good qualitative characteristics and they are suitable as intermediate products in confectionaries design for rational and functional nutrition.

Now a day's malnutrition imposes high cost on the society. Malnutrition comes in many forms and under nutrition is most prevalent form of malnutrition in developing countries. One out of every five children is stunted and around 165 million children in the world are malnourished (FAO 2013). Moreover, about 2 billion people in the world lack vitamins and minerals which are essential for healthy life (FAO/WHO 2004).

Today's consumers are conscious of their diet, and many prefer eating healthy foods. Bakery products represent a fast growing segment of food in India because of consumer demands for convenient and nutritious food products. The consumers demand has increased for the quality food products with taste, safety, convenience and nutrition. Thus nutrition has emerged as an added dimension in the chain of food product development (Ahmad, 1999).

Taking into consideration the benefits of pumpkin seeds and its incorporation in the bakery products give convenience and nutritional healthy snacking for the community. The present study was planned with the following objectives.

Objectives:

1. To know the consumption pattern of pumpkin seeds among the people
2. To prepare bakery products by incorporating pumpkin seeds
3. To evaluate sensory qualities of prepared bakery products
4. To analyze the nutritional composition of highly accepted bakery products
5. To study shelf life of prepared bakery products.

CHAPTER -II
REVIEW OF LITERATURE

CHAPTER - II

REVIEW OF LITERATURE

Pumpkin seeds are considered as by product of pumpkin fruit. *Cucurbita maxima cucurbita pepo*, *cucurbita mixta* and *cucurbita moschata* are the most typical pumpkin species that are used for their seeds. In some areas seeds are utilized as uncooked, cooked or roasted, simply for the domestic purpose as they are rich in protein, fiber, minerals like iron, zinc, calcium, magnesium, manganese, copper and sodium, polyunsaturated fatty acid ,phytosterols and vitamins. They might be considered important for the food industries.(syad et al 2019). Therefore the present study was undertaken to utilize the pumpkin seeds flour in bakery products at varying the incorporation.

2.1 Botanical description of pumpkin seeds

2.2 Processing of pumpkin seeds

2.3 Nutritional and chemical composition of pumpkin seeds

2.4 Value addition of products by utilizing pumpkin seeds

2.5 Health benefits of pumpkin seeds

2.1 Botanical description of pumpkin seeds

Kingdom	Plantae- Plantes, Planta, Vegetal, plants
Subkingdom	Viridiplantae
Infrakingdom	Streptophyta- land plant
Superdivision	Embryophyta
Division	Tracheophyta- vascular plants, tracheophytes
Subdivision	Spermatophytia spermatophytes, seed plants, Phanérogames
Class	Magnoliopsida
Superorder	Rosanae
Order	Cucurbitales
Family	Cucurbitaceae- gourds, squashes, citrouilles, gourdes

Genus	Vuvurbita L.- gourd
Species	Cucurbita máxima Duschesce- Winter squash
Subspecies	(direct Children) Cucurbita máxima ssp. Andreana (Naudin) Filov- wintersquash
Subspecies	(direct Children) Cucurbita máxima ssp. Máxima Duchesne (Lemus-Mondaca et al. (2019)

2.2 Processing Of Pumpkin Seeds

Ali et al. (2016) studied oxidative stability and compositional characteristics of the pumpkin seed oil (PSO) exposed to microwaves during heating at 170°C. Study showed that after 9 hours of heating, the relative amounts of saturated fatty acids (SFAs) and polyunsaturated fatty acids (PUFAs) in the unroasted sample increased to 119.5 and 84.7 per cent, respectively. On the other hand, after 9 hours of heating, the relative amounts of SFAs increased to 102.6 per cent and PUFAs declined to 97.0 per cent in samples that were roasted for 12 minutes. It was conclude that microwave roasting of during heating, pumpkin seeds significantly improved the oils' oxidative stability.

Mujaffar et al. (2019) studied the drying behavior of untreated, whole pumpkin seeds in a fluidized bed dryer at 50–80 °C. However, to achieve a moisture content of 4-6 percent, seeds were dried for 135 minutes at 50 °C, 110 minutes at 60 °C, and 40 minutes at 40 °C, respectively (wb).The Moisture Ratio (MR) statistics for seeds dried at all temperatures were shown to be accurately predicted by the *Alibas* model. It was noted that the pertinent drying curves adequately described the drying behavior. Two distinct phases of drying between 60 and 80 °C were conducted, with drying progressing more quickly at higher temperatures. Result indicated that dried seed powders were discovered to have substantial quantities of protein, fibre, and lipids. All temperature-related data were displayed.

Berroukche et al.(2021) study was investigated the FID-Gas Chromatography of west-Algerian Pumpkin Seed Oil Extract. The extract obtained was characterized by the contents of sterols, unsaturated and saturated fatty acids. Wherever, the content of the bioactive compounds was determined by gas- chromatography FID method. Pumpkin seed oil extracts showed higher content of poly-unsaturated fatty acids

(49.10%) than that from saturated fatty acids (28%). It was observed that Algerian pumpkin seeds contain appreciable amounts of unsaturated fatty acids and sterols.

Vlaicu et al. (2021) evaluated the effect of dietary pumpkin (*Cucurbita moschata*) seed meal (PSM) on laying hens' performance, quality, fatty acids, cholesterol, antioxidant compounds and shelf life of eggs. However, at the age of 50 weeks, 80 Tetra SL laying hens were split into two equal groups, each of which contained 10 duplicates and four birds. For a period of six weeks, the experimental treatment received a diet containing 9 per cent PS while the control (CON) treatment received a basal diet. The results showed that PSM increased the amount of polyunsaturated fatty acids in the eggs, particularly linolenic acid (0.33 g/100 g versus 0.21 g/100 g) and linoleic acid (20.65 g/100 g), but it decreased arachidonic acid by 3.91 per cent and the n-6/n-3 ratio in PSM eggs compared to CON. It was found that the addition of 9 per cent PSM considerably (p 0.05) reduced cholesterol levels in yolk and egg by 11.31 per cent and 10.38 per cent, respectively, with regard to the CON samples. The shelf life of eggs stored at ambient temperature (21°C) and the refrigerator (5°C) for 28 days was improved by the considerably (p0.05) increased concentration of polyphenols and antioxidant chemicals found in PSM eggs. It was determined that the Dietary PSM supplementation considerably improved egg quality and average daily feed intake by raising certain fatty acids while reducing cholesterol concentration. It was also revealed that PSM demonstrated its efficacy in extending the egg's shelf life for a 28-day storage period.

Macedo et al. (2022) characterized the value-added compounds extracted from *Curcubita pepo* seeds using green methodologies, namely microwave-assisted extraction (MAE) and ultrasound-assisted extraction (UAE). It was revealed that DPPH values varied between 4.35 mg TE/g DW (UAE condition 1) and 5.08 mg TE/g DW (MAE condition 1), FRAP scavenging activity ranged from 45.80 to 71.09 mol FSE/g DW (UAE condition 2 and MAE condition 1, respectively) (MAE condition 2). It was found in the study that employing MAE technology, higher sample-to-solvent ratios can result in the extraction of more phenolic chemicals.

2.3 Nutritional and chemical composition of pumpkin seeds

Stevenson et al. (2007) investigated the twelve varieties of the Iowa- grown pumpkin (*Cucurbita maxima* D.) They were examined for their tocopherol content, seed oil concentration, and fatty acid composition. Oil made up between 10.9 and 30.9 percent of the overall weight. Unsaturated fats made up between 73.1 and 80.5 percent of the total fats. The various oils tocopherol content is indicated. The composition was dominated by linoleic, oleic, palmitic, and stearic fatty acids. Significant differences were found in the oil's stearic, oleic, linoleic, and gadoleic acid compositions between cultivars. All 12 pumpkin seed oil cultivars tested were shown to have outstanding oxidative stability, making them suitable for usage in both food and non-food applications.

Achu et al. (2011) carried out the chemical evaluation of protein quality and phenolic compound contents of some *Cucurbitaceae* (egusi) oilseeds from different areas in Cameroon. These seeds include *Lagenaria siceraria*, *Cucumis sativus*, *Cucurbita maxima*, *Cucurbita moschata*, and *Cucumeropsis mannii*. Cleansed, dried, powdered, and part of the powder defatted, the seeds were then. The undefatted seeds were examined for the presence of phenolic compounds, while the defatted cakes were examined for total and soluble nitrogen, true proteins, and amino acids. The defatted cakes had a lot of total protein. Due to the post-harvest treatment of the seeds, the trichloroacetic acid soluble fraction of these proteins ranged from 25 per cent (*C. maxima* from North West) to 94 per cent of total proteins (*C. sativus* from Adamawa and South West). Result revealed that the high concentration of the majority of essential amino acids, resulting protein digestibility score for *C. sativus* and *C. mannii* of 0.67 and 0.48 respectively. It was estimated that lysine was only one amino acid present in that seeds in the absence of tryptophan and methionine and there were few phenolic chemicals present in these seeds (0.34 to 0.43%). It was concluded that defatted *C. mannii* might be beneficial to create newborn formula, particularly when combined with soybean to boost the lysine level.

Petkova and Antova (2014) conducted a study to know Phospholipid composition of three species of *Cucurbitaceae* family (*Cucurbitamoschata*, *Cucurbita pepo* and *Cucurbita maxima*) grown in the southern Bulgaria investigated. There was a large amount of oil in the seeds of *Cucurbita moschata*, *Cucurbita pepo*, and *Cucurbita maxima*: 45.1 percent, 46.8 percent, and 51.5 percent, respectively.

Spectrophotometric analysis was used to determine the presence of phospholipids after separation by two-dimensional thin layer chromatography. Total phospholipid contents for the seed oils of *Cucurbita moschata*, *Cucurbita pepo*, and *Cucurbita maxima* were 0.5 percent, 1.1 percent, and 1.0 percent, respectively. Phosphatidylinositol(19.7–29.4%), phosphatidylcholine (34.8–48.6%), and phosphatidylethanolamine (16.0–23.7%) made up the majority of the phospholipid fraction. It was found that phosphatidic acids were present in concentrations ranging from 2.1 to 5.5 percent. Each individual phospholipid's fatty acid composition was determined through the use of gas chromatography. The primary fatty acids present in phospholipids were palmitic, stearic, oleic, and linoleic acids. It was established that the phospholipid content of pumpkin seed oils also helps a full assessment of their nutritional importance.

Ogunbusola et al. (2017) investigated three species of Cucurbitaceae for fatty acid, sterol and spectroscopic analysis. White melon (*Cucumeropsis mannii*) and two varieties of *Lagenaria siceraria* (calabash and bottle gourd) seeds were ground into flour, defatted, and then the oils were extracted and examined using infrared spectroscopy, proton and ¹³C NMR, and fatty acid and sterol content analysis. The majority of the fatty acid content in the seed oils was made up of unsaturated fatty acids. Cis-linoleic acid was found to be the most common fatty acid in the seed oils (59.47–60.40 percent). Phytosterols such campesterol (12.20 -50.58 mg/100g), stigmasterol (4.47-5.98 mg/100g), and -sitsterol (205.81 -300.04 mg/100g) were present in the seed oils despite the absence of cholesterol. The amounts of monounsaturated, polyunsaturated, and saturated acyl groups were predicted based on the frequency of specific IR bands.

Yunusa et al. (2017) investigated the effectiveness of *Cucurbita pepo* seed powders for the removal of turbidity in river water using Alum as a standard. Water samples were taken from the Gara River in Nigeria's Kano State. However produced powders with alum and *C. pepo* seed concentrations of 100, 200, 300, and 400 ppm. The samples' pH, turbidity, total dissolved solids, electrical conductivity, total suspended solids, and temperature were assessed both before and after treatment. It was showed that Turbidity and pH decreased significantly (p<0.05) at various concentrations of alum and *C. pepo* seed powder and Temperature and TSS dropped after Alum treatments at varied dosages (p < 0.05). Alum was found to raise TDS,

whereas *C. pepo* seed powders were found to lower it. It was concluded that the powder made from the seeds of *Cucurbita pepo* may be a less expensive substitute for the pricey chemicals used to lessen the turbidity of river water.

Akin et al. (2018) study was carried out to determine the compositions and contents of fatty acids, phytosterols, squalene, tocopherols, phenolic acids, carotenoids and phenolic bioactives, and the free radical scavenging as well as antioxidant activities of cold-pressed pumpkin (*Cucurbita pepo* L.) seed oils. Oil samples from unroasted pumpkin seeds cultivated in four different central Anatolia regions of Turkey were produced using a lab screw-pressing machine. PSOs' nutritive value and stability are indicated by their essential fatty acid concentration and well-balanced fatty acid profiles (ratios of SFAs, MUFAs, and PUFAs). These oils' high bioactive content may help preserve them resistant to oxidation reactions and provide high-quality oil for use as culinary oil. The findings demonstrate the high concentration of polyunsaturated fatty acids and exceptional quality of cold-pressed pumpkin seed oils (PSO).

Akintade et al. (2021) studied the nutritional evaluation of fermented, germinated and roasted pumpkin (*cucurbita maxima*) seed flour. Pumpkin seed was processed into flour namely unroasted (RPSF), fermented (FPSF), germinated (GPSF), and raw (ROPSF). Various batches of pumpkin seed flour were examined for nutritional value using accepted techniques. The fermented flour (35.85%) had a greater protein level, but the roasted flour (46.31%) had the highest fat content. The most prevalent amino acid and fatty acid, respectively, in processed pumpkin seed flour were glutamic acid (10.45–13.02 g/100g) and linoleic acid (134.72–419.70 g/ml). Study revealed that Processed pumpkin seed flour had significant mineral content and excellent functional qualities. It was concluded that processing pumpkin seeds in different ways improved their nutritional value and may have applications in the food business.

Prommaban et al. (2021) the study was carried out to compare chemical compositions, antioxidant, and pharmacological activities of pumpkin seed oils extracted from *Cucurbita moschata* Duch Ex Poir. (PSO1) and *Cucurbita moschata* (Japanese pumpkin) (PSO2) were obtained by aqueous enzymatic extraction. Fatty acid methyl ester/gas chromatographic-mass spectrometry was used to evaluate the fatty acid composition of the oils. Stable free radical diphenylpicrylhydrazyl, radical

cation 2, 20-azinobis-(3-ethylbenzothiazoline-6-sulfonate), ferric reducing/antioxidant power, and ferric thiocyanate assays were used to assess antioxidant activity. Investigations were made into the inhibition of the enzymes responsible for skin whitening and ageing. Result it was estimated that all pumpkin seed oils contained a significant amount of linoleic acid. Oleic acid, palmitic acid, and stearic acid were also identified in large amounts. Compared to PSO1, commercial pumpkin seed oils, and PSO2, PSO2 had the strongest antioxidant activity (COM1 and COM2). PSO1 and PSO2 both revealed more inhibitory effects than the advertisements on hyaluronidase, collagenase, and tyrosinase. As a result, aqueous enzymatic extraction might provide pumpkin seed oils with enhanced antioxidative, anti-aging, and whitening properties.

2.4 Value addition of products by utilizing pumpkin seeds

Lyimo et al. (2012) studied Physico-chemical properties, storage stability and sensory evaluation of pumpkin seed oil. Using conventional techniques, the seeds' approximate composition was confirmed. By monitoring the physical-chemical properties of oil for 15 weeks while maintaining the standards, storage stability was evaluated. However, a five point hedonic scale was used to rate the oil's acceptability. It was estimated that Pumpkin seeds had (34.7%), (15.9%), (3.85%), and (44.7%), respectively, of protein, fat, fibre, and carbohydrates. Moreover, the oil had an acid value of 0.5 mg KOH/g, a specific gravity of 0.92, a peroxide value of 4.6 meq/kg, an iodine value of 108.4 and a saponification value of 173.0. Organoleptic evolution revealed that the flavour, taste, and odour of the pumpkin seed oil were all satisfactory. It was concluded that Pumpkin seed oil is impressively comparable to other frequently used edible vegetable oils in Tanzania when examined on the basis of physical-chemical features and sensory evaluation.

Silva et al. (2014) studied development and chemical and sensory characterization of pumpkin seed flour-based cereal bars. Pumpkin seed flours (PSF) with different granulometries were utilized to make cereal bars (CB) with different combinations of brown oats, including PSF 1 (medium granulometry) and PSF 2 (coarse granulometry). However, there were five different formulations made: CB-1 (control), which had 25 per cent brown oats and 0 per cent PSF; CB-2 (12.5 PSF 1 and 12.5 brown oats); CB-3 (25 PSF 1 and 0% brown oats); CB-4 (12.5 PSF 2 and 12.5 brown oats); and CB-5 (25% brown oats and 0% PSF) (25 per cent PSF 2 and 0

percent brown oats). It was showed that the bars CB-2 and CB-5 received the majority of the greatest hedonistic scores, according to the analysis of the acceptance test results using a conventional preference mapping. Result indicated that in the cereal bars CB-2 and CB-5, respectively, crude protein increased by 87.5 and 62.5 percent, while dietary fibre increased by 77 and 44 per cent. Result identified CB-2 and CB-5 as fibre sources.

Kanwal et al. (2015) studied the development, physico-chemical and sensory properties of biscuits supplemented with pumpkin seeds to combat childhood malnutrition in Nutritive pumpkin seed flour. The results were compared to the control group after four different percentages of pumpkin seed flour were substituted for wheat flour for making fortified biscuits (T2 = 5%, T3 = 10%, T4 = 15%, and T5= 20%). (T1). It was showed that T5 had the highest percentage of pumpkin flour (20%), as well as the highest percentages of protein (12.30%), fat (28.29%), ash (4.13%), iron (2.28%), and zinc (2.28%). (3.11 per cent). All sensory metrics in the sensory experiment's results indicated an increased trend. It was found that the results were satisfactory on all counts, but treatment T4 with (15%) pumpkin seed flour received the highest overall score of 8.0. It was revealed that adding pumpkin seed flour to complement wheat flour can be done successfully.

Mbogne et al. (2015) determine the germination potential of pumpkin (*Cucurbita spp.*) seeds stored in different materials and at different temperatures. However, two types of *Cucurbita moschata* and one variety of *Cucurbita maxima* pumpkin were used to harvest the seeds. These seeds were stored in the lab at two distinct temperatures, -20°C and 5°C. Every 30 days, germination tests were conducted on these seeds that had been preserved for five months. The seeds were then placed in Petri dishes with distilled water added and kept there on paper towels. The number of germinations was recorded ten days later, and each radicle's length was measured. The results revealed that while long-term storage decreases viability, room temperature is the optimal environment for maintaining pumpkin seeds.

Carolina et al. (2017) evaluated the physiological and sanitary quality of pumpkin seeds frozen at -18°C and cooled at 15°C, for 36 h and 7 days in polyethylene terephthalate (PET) bottles and in plastic bags with vacuum. Results revealed that freezing seeds at -18°C for 36 h in PET bottle provided an increase in the first count of germination and seedling length reduction. The physiological and

sanitary qualities of pumpkin seeds frozen at -18°C for 36 h in PET bottle and stored for up to six months under ambient conditions and in a cold chamber were also examined. Refrigerated storage provided increased seed viability as compared to ambient storage. In the sixth month of storage, a reduction of the genera *Aspergillums* and *Penicillium* occurred in both environments.

Kaur et al. (2017) studied on formulation and evaluation of cookies supplemented with pumpkin seed (*Cocurbita moschata*) flour. In order to create cookies, raw (T1 15%, T2 30%, T3 45%) and roasted (T4 15%, T5 30%, T6 45%) pumpkin seed flour was added. Six experimental samples and one control sample were produced. An organoleptic analysis was performed. The findings showed that cookies that included 30% pumpkin seed flour, whether they were baked or roasted, were well accepted. Control cookies had a higher moisture content than those supplemented with roasted pumpkin seed flour (8.27%), roasted pumpkin seed flour had the highest protein and fat contents (8.29 and 28.97%), and raw pumpkin seed flour had the highest fibre and ash contents (2.50 and 2.52%), respectively. Iron, zinc, and total carotenoid levels were shown to be greater in 2.36, 1.28, and 0.231 mg/100gm of raw pumpkin seed flour were added to cookies, respectively. However, the highest antioxidant activity was also found in cookies that also contained raw pumpkin seed flour (58.10%) cookies. On the basis of sensory evaluation, supplementation up to levels of 90:10 and 80:20 was found to be the best for weaning mixes in which wheat flour was replaced by pumpkin flour and pumpkin seed flour.

Anju et al. (2018) studied the preparation of pumpkin powder and seed kernel powder was utilized for the development of weaning mix and respectively. The best ratio for cookies was found to be 80:20. Six different treatments of weaning mix in which wheat flour was supplemented with pumpkin powder were T1 (100%), T2 (90:10), T3 (80:20), T4 (70:30), T5 (60:40), in all instances, adding pumpkin powder or seed kernel powder to wheat flour had a good impact on the nutritious characteristics. Overall, it can be claimed that this nutritious crop can be successfully used to produce high-quality and nutritionally sound foods. Weaning mixes and cookies are examples of enriched processed foods. On the basis of sensory evaluation, supplementation up to levels of 90:10 and 80:20 was found to be the best for weaning mixes in which wheat flour was replaced by pumpkin flour and pumpkin seed flour, respectively. The best ratio for cookies was discovered to be 80:20. Six

different treatments of weaning mix in which wheat flour was supplemented with pumpkin powder were T1 (100%), T2 (90:10), T3 (80:20), T4 (70:30), T5 (60:40), in all instances, adding pumpkin powder or seed kernel powder to wheat flour had a good impact on the nutritious characteristics. Overall, it can be concluded that this nutrient- rich crop is exploitable. Enabling the creation of processed foods that are high-quality and nutritionally enhanced, including cookies and weaning mixes.

Alla et al. (2018) studied development and analysis of nutria-bar enriched with zinc for sports athletes. However a ready-to-eat nutribar was made using pumpkin seeds, a zinc-rich local food, in various quantities, along with other cereals like oats and wheat flakes, sweeteners like honey and sugar, almonds, and raisins. Moreover the developed bar's sensory qualities and keeping quality were assessed using standardized procedures. Organoleptic evaluation revealed a considerable difference between the variations therefore highly regarded product was chosen. Study was found that the designed bar's strong nutritional value and large amount of zinc were confirmed by the nutritional analysis, which found 425.1 Kcals and 1.663 mg of zinc in 100 g of the bar.

Kaur et al. (2018) studied development and nutritional evaluation of cake supplemented with pumpkin seed flour. Both raw and roasted pumpkin seed flour were added to make cake. An organoleptic analysis was done. The results indicates that (20%) of respondents found the cake to be very wellreceived. Moisture content was higher in the control cake (20.26%), protein content was highest in the cake with the addition of roasted pumpkin seed flour (8.45%), fat content was higher in the cake with the addition of roasted pumpkin seed flour (21.08%), and fibre and ash content were higher in the cake with the addition of raw pumpkin seed flour (1.80 and 1.59%, respectively). However, the raw pumpkin seed flour-supplemented cake had higher iron and zinc contents, measuring 2.04 and 0.64 mg/100g, respectively. It was discovered that the cake enriched with raw pumpkin seed flour had the highest total carotenoid concentration (0.190 mg/100g).

Zhivika et al. (2019) studied application of pumpkin seed powder in sponge cake. The physical, aesthetic, and sensory qualities of sponge cake that had two different amounts of pumpkin seed powder (0, 5 and 10%) added to it were examined. Defatted pumpkin seed powder, wheat flour, eggs, and pumpkin seed powder were combined to make sponge cake. The volume of the cakes containing

pumpkin seed powder was found to be less than that of the cake control (255.00 5.07cm³), with the volume of the cake containing (5%) pumpkin seed powder having the smallest volume (229.00 5.17 cm³), according to the results. The cakes with the most porosity were the control cake (65.62 1.41%) and the cake with (5%) pumpkin seed powder (64.20 1.00%). The cake control's (312.60 3.15%) ability to absorb water was the least effective compared to the cakes with 5 and (10%) powdered pumpkin seed. The cake's crust, which contained (10%) pumpkin seed powder as a fibre source, showed the lowest Chroma readings. The control's crust and crumbs matched the cake's with 5 per cent pumpkin seed powder in terms of hue.

Mishra et al. (2019) studied development and quality evaluation of value added pumpkin seed products. The pumpkin seeds are one of the underutilized crops. The macro- and micronutrients protein, fat, iron, zinc, magnesium, and calcium are all abundant in pumpkin seeds. In this study, *mathri* and *halwa*, two foods with additional value, are made with pumpkin seeds. These products underwent a sensory test, and the results were positive in terms of their acceptance. It was determined what the pumpkin seed *Mathri's* immediate makeup was. The findings indicated that roasted pumpkin seeds *Mathri* are fairly high in protein (20.15%), crude fat (31.1%), crude fibre (2.50%), and carbohydrate (33.1%) content. Ash content in the pumpkin seeds from *Mathri* was discovered to be (8.78%). Foods could contain pumpkin seed to boost their nutritional value, particularly in diets lacking in macro- and micronutrients.

Kumari et al. (2019) carried out studies on nutrient and mineral composition of developed value added cookies incorporating germinated pumpkin seed powder. Products made by substituting refined wheat flour in various amounts (10, 20, or 30) with germinated pumpkin seeds are categorized as Type I, Type II, and Type III. Pumpkin seed powder was found to enhance the nutritional content of cookies in terms of ash, fat, protein, fibre, and total and accessible minerals. Crude protein content increased from 10.75 to 20.49g/100g, crude fibre content increased from 0.78 g/100g in control to 2.85 g/100g in Type II cookies, and crude fat content increased from 19.26 to 28.70g/100g. The product's mineral profile was also improved as a result of value addition. The highest levels of incorporation were for calcium, magnesium, zinc, and iron, HCl extractability also showed a significant (P<0.05) improvement. It was determined that created goods can be very helpful in addressing

the issue of micronutrient deficit in the population of all age groups. The content of raw pumpkin seed flour was higher in cookies enriched with it, at 2.36, 1.28, and 0.231 mg/100gm, respectively. While the highest level of antioxidant activity was also seen in cookies that used raw pumpkin seed flour (58.10%) as an addition.

Abdelgadir et al. (2019) studied formulation and quality evaluation of biscuits supplemented with defatted pumpkin seed flour. Wheat flour and dried pumpkin seed flour were combined in amounts of 0, 5, 10, and (15%) (w/w) to prepare supplemental biscuits. The use of pumpkin seed flours improved the that were prepared. The quantity of protein, ash, crude fibre, and total carbohydrates increased when the supplementation ratio of pumpkin seed flour increased from 0 to (15%) (w/w). It was discovered that the biscuits using (15%) (w/w) pumpkin seed flour had the highest levels of total carbs (97.84%), ash (1.12%), fibre (4.25%), and protein (8.8%). According to the results of the sensory evaluation, the biscuit that had been supplemented with 15 per cent (w/w) had a better degree of general acceptability, taste, texture, colour, and flavour, and it was determined to be more acceptable than other enhanced cookies. For all of the sensory qualities, there was a downward trend in acceptability as pumpkin seed flour content increased. Results showed that total carbohydrates reduced, whereas there was a considerable rise in ash, crude fat, crude protein, and crude fibre.

Parameshwari et al. (2019) studied development and nutritional evaluation of pumpkin seed flour incorporated cookies. Different mixtures of refined wheat flour and pumpkin seed powder in the proportions of 90:10, 80:20, and 70:30 were used to make the cookies. The cookies' physical characteristics, proximate analysis, antioxidant activity, and sensory characteristics were all examined. The findings show that cookies made with 30 per cent (70:30 Variation-3) pumpkin seed flour had superior physical and sensory qualities.

Kumari et al. (2019) carried out study on nutrient and mineral composition of developed value added cookies incorporating germinated pumpkin seed powder. However Products where, made by substituting refined wheat flour in varying amounts (10, 20, and 30) with germinated pumpkin seeds are categorized as Type I, Type II, and Type III. Pumpkin seed powder was found to enhance the nutritional content of cookies in terms of ash, fat, protein, fibre, and total and accessible minerals. It was estimated that crude protein level increased from 10.75 to

20.49g/100g, crude fibre content climbed from 0.78 g/100g in control to 2.85 g/100g in Type II cookies, and crude fat content increased from 19.26 to 28.70g/100g. It was also revealed that the product's mineral profile was also improved as a result of value addition. The highest levels of incorporation were for calcium, magnesium, zinc, and iron, HCl extractability also showed a significant (P0.05) improvement. It was determined that the amount was higher in cookies added with raw pumpkin seed flour, measuring 2.36, 1.28, and 0.231 mg/100gm, respectively. It was conclude that such produced goods can be very helpful in addressing the micronutrients deficiency problem in the population of all age groups. While the highest level of antioxidant activity was also seen in cookies that used raw pumpkin seed flour (58.10%) as an addition.

Khvostenko et al. (2020) examined the physicochemical properties and sensory qualities of sponge cake boosted with two different quantities of pumpkin seed powder 5 per cent 10 per cent Sensationally, the popularity of sponge cakes with pumpkin seed powder has been carefully evaluated. It was discovered that the control cake had a larger volume than the semi-finished cake with 5 per cent more pumpkin seed powder. It was found that the control sample and the sample containing 5 per cent pumpkin seed powder displayed greater porosity when compared to the other. Whereas, comparing samples that included 5, and (10%) of pumpkin by-products, the control sample's capacity to absorb water was the lowest and the cake samples with (10%) pumpkin content had the lowest crust chroma levels. It was conclude that when the percentage of pumpkin seed powder was increased from 0 to (10%), the control's crust and crumbs were the same colour. The amount of protein, fibre, and total carbs rose when the percentage of pumpkin seed powder was raised from 0 to 10 per cent.

Roshini et al. (2020) conducted a study to formulate formulating brownies with incorporation of roasted pumpkin seed flour. However in place of wheat flour, pumpkin seed flour was processed into a powder and used to make brownies. Moreover different ratios of pumpkin seed flour to wheat flour, such as 100:0, 90:10, 80:20, 70:30, and 60:40, were used to make brownies. Study was evaluated the brownies' nutritional and organoleptic properties. According to the organoleptic research found that brownies made with flour containing (40%) pumpkin seeds were both tastier and healthier than brownies made with regular flour. Study was

assumed that consuming items enhanced with pumpkin seed flour should be recommended in order to improve individual's nutritional condition. The research revealed that the inclusion of it is extremely acceptable and suggested to use pumpkin seed flour in various recipes at a level of up to (30%) to increase the nutritional value of diets in terms of protein, fat, fibre, energy, iron, and zinc. To address malnutrition, value-added products made with pumpkinseed flour can be given to the kids.

Alshehry et al. (2020) studied to evaluate the pumpkin seeds powder as functional properties, phytochemicals, and vitamins to prepare cookies using partial replacement of 72 per cent wheat flour extraction. In raw materials and their mixes, dietary fibers, mineral content and chemical content were all determined. In contrast, cookies sensory assessment, physical characteristics, colour, and texture profile analysis were established. Results indicated that a pumpkin seed powder had excellent functional and emulsification qualities. The total phenolic content, total flavonoid compounds, antioxidant activity, and vitamin content of pumpkin seeds were also quite high. The combination of (15%) fortified pumpkin seeds powder had the highest levels of protein, fat, ash, and crude fibre, according to the data. This may be because pumpkin seeds have a more complex chemical makeup than wheat flour, which is extracted from (72%) of the seeds. Additionally, as the pumpkin seeds powder rose, the fibre fractions in the various blends increased, causing pumpkin seeds the rinds are known to be rich in fibre. However, the minerals in the various mixes steadily increased when the powder from pumpkin seeds was added because the pumpkin had the highest mineral concentration. The sensory assessment, colour profile analysis, and texture profile analysis were all improved by the addition of pumpkin seed powder to wheat flour up to (15%). Based on findings, it can be determined that adding up to (15%) pumpkin seeds to cookies improves their flavour and texture by providing an excellent dose of chemicals, phytochemicals, and vitamins. Therefore, it might be suggested that for cookies to be of acceptable quality and nutritional content, pumpkin seeds should be incorporated up to (15%).

2.5 Health benefits of pumpkin seeds

Sharma et al. (2013) studied anti-diabetic and anti-hyperlipidemic activity of pumpkin seeds (*cucurbita maxima*) on streptozotocin induced diabetic rats. The effectiveness of the pumpkin seeds against streptozotocin (50 mg/kg i. p.) at a dose of 200 mg/kg for 21 days was tested in wistar albino rats. As a reference medication, glibenclamide (500 g/kg) was employed. On days 0, 7, 14, and 21, fasting blood glucose (FBG) parameters were evaluated. When compared to the control, it was discovered that the blood glucose concentration was considerably (P 0.05) lower. Additionally, *Cucurbita maxima* oral administration considerably (P 0.05) lowered serum total cholesterol, LDL, VLDL, and triglyceride levels while notably raising insulin and HDL cholesterol levels. In streptozotocin-induced diabetic rats, administration of the reference medication glibenclamide likewise resulted in a substantial (P0.05) decrease in blood glucose concentration. According to the findings, pumpkin seeds have an anti-diabetic and anti-hyperlipidemic impact, which can help to reduce the is a source of powerful anti-diabetic agents and is in a diabetic state.

Ofoego et al. (2017) investigated the effect of methanolic seed extract of *Cucurbita pepo* (pumpkin) on *Azadirachta Indica* (neem) leaf induced testicular damage in adult male Albino Wistar rats. However, 20 adult male albino wistar rats were selected and were split up into 5 groups (I through V), with 4 animals in each group. Was I in Group. Groups II got 500mg/kg of the ethanolic seed extract of *Cucurbita pepo* for 5 weeks (ESECP). Methanolic *Azadirachta indica* leaf extract (500 mg/kg; Group III) was administered for two weeks, followed by three weeks of ESECP at 500 mg/kg. Group IV received a co-administration of 500mg/kg of MLEAI and ESECP whereas Group V received 500mg/kg for 5 weeks. Each extract was administered orally one daily. 24 hours after the last treatment, the rats were given general anesthesia, and blood and testicles were removed for further examination. The results showed that the serum both testosterone levels and Rats treated with ESECP showed improvement in sperm parameters (count, motility, and morphology) and superior testicular microarchitecture when compared to rats just receiving MLEAI therapy. This reveals that *Cucurbita pepo* ethanolic seed extract has effects on testicular damage.

Malkanthi et al. (2018) investigated the glycemic response and antioxidant activity of blended biscuits using pumpkin seed powder (*Cucurbita maxima*). However in place of refined wheat flour, pumpkin seed powder at 5, 7.5, and 10(%) was used to produce biscuits. We looked at the biscuits with the most delectable pumpkin seed powder's nutritional composition and antioxidant activity. Normal healthy individuals were given 25g of easily digestible carbs and white bread as the reference food, with a 4-day washout interval in between, in order to evaluate the glycemic reaction of the most popular pumpkin powder-infused biscuits. The estimated serum blood glucose levels were revealed to be 0, 30, 60, 90, and 120 minutes, respectively. Out of those with varying levels of integration, panelists chose biscuits with a (5%) inclusion of pumpkin seed powder best. 5 per cent antioxidant capacity pumpkin It was determined that adding pumpkin seed powder up to (5%) was appropriate, and that biscuits manufactured with (5%) pumpkin seed powder had higher antioxidant activity than the control. It was observed that in comparison to white bread, the blended biscuits with (5%) pumpkin seed powder had a lower peak glucose response.

Leibbrand et al. (2019) examined the effects of a proprietary oil-free hydroethanolic pumpkin seed extract on the symptoms of BPH by Simone 60 males (62.3 years old; 95% CI: 60.3-64.3 years) with average International Prostate Symptom Score (IPSS) of 14.8 (95% CI: 13.5-16.1) participated in the trial by taking the oil-free hydroethanolic pumpkin seed extract once daily before bed for three months. The volume of postvoid residual pee was calculated using ultrasound, and the frequency of nocturia was recorded in the bladder diary. It was found that the IPSS change over the therapy period demonstrated that during the 12-week intervention, both the overall IPSS and each individual question, QoL, experienced significant impacts. Injury brought on by *Azadirachta indica* in mature male albino wistar rats that are both protective and ameliorative.

Syed et al. (2019) studied nutritional and therapeutic importance of the pumpkin seeds. Pumpkin seeds have positive health effects on blood sugar, cholesterol, immunity, liver, gallbladder, leaning difficulties, prostate gland, depression, inflammation, cancer treatment, and parasite inhibition. The nutritional profile of pumpkin seeds proved just how nutrient-dense and health- promoting they are. However, pumpkin seeds have been used medicinally and have therapeutic and

nutritional value. They are important in the provision of micronutrients and are also used in the treatment and management of diabetes, inflammation, hyperlipidemia, hypertension, cancer, and to protect the heart, among other conditions.

Alzubaidi et al.(2019) investigated some histopathological and immunological effects of Pumpkin Seed Oil against *Salmonella Typhi* in NZW rabbits. However In the experiment, twenty male rabbits Were utilized, and each was randomly assigned to one of the four groups below: The control group, the first group (unimmunized), received an oral injection of 1 ml/kg saline. The third group received the same quantity of oil extract (10 l) from pumpkin seeds twice within two weeks before being challenged intraperitoneally with 1 ml of *S. Typhi*. A bacterial suspension was administered intraperitoneally (i.p.) to the second group and inoculation with the (10 l) pumpkin seed vaccine was given to the fourth group. However at day 30, all of the animals were scarified, and blood samples were taken in order to carry out an immunological phagocytic assay. The livers and spleens were sampled for histopathological examination. It was found that The pumpkin seed oil extract significantly improved tissue morphology and cellular immunity in the third and fourth groups (P 0.05). (10 l). According to the findings, 10 l of pumpkin seed oil can serve as an immunization against *S. thphi* infection.

Majid et al. (2020) Assessed effect of pumpkin seed oil on cholesterol fractions and systolic/diastolic blood pressure investigating effects of consumption of 1000 mg of PSO on total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL), systolic (SBP) and diastolic (DBP) blood pressure ((BP). PSO has a high level of oxidative stability and a healthy composition of vital fatty acids, as well as sterols and tocopherols. Wherever, one hundred twenty-seven volunteers, aged 39 to 63, were randomly assigned to the case and control groups. These participants had varied degrees of dyslipidemia, hypertension, diabetes, and obesity. Both groups underwent pre and post-intervention biochemical, anthropometric, and clinical evaluations. Group 1 (patients) (n=63) received 1000 mg of PSO along with advice on adopting a healthy diet and way of life, while Group 2 (controls) (n=64) received simply dietary and lifestyle suggestions. However, the beneficial effects of the intervention were found by analysing the cases' baseline and endpoint data. Data revealed that both a significantly increased and a significantly decreased endpoint LDL and DBP value. In the HDL cholesterol. The results of the

study showed that PSO had hypolipidemic and anti-hypertensive activity since it decreased DBP and LDL while raising HDL levels.

Above research articles concluded that the pumpkin seeds have nutritional and health benefits as well as also provide as the delicious food in many regions of the world

CHAPTER -III
MATERIAL AND METHODS

CHAPTER - III

MATERIALS AND METHODS

This study was designed to evaluate effect of incorporation of pumpkin seeds flour in the commonly consumed selected bakery products on the acceptability total 50 households were surveyed to find out the consumption pattern of different bakery products in the daily diet and to know awareness regarding use of pumpkin seeds flour in the bakery products.

The four bakery products selected respectively sweet biscuits, salt biscuits, *nankhatai* and cupcake. Were incorporated with different level of pumpkin seeds flour and evaluated for acceptability. Nutrient and acceptability bakery products were determined

3.1 Selection of sample

From the Parbhani region, specifically from the areas of Ramkrushna Nagar, Bhagayalaxmi Nagar, Shivram Nagar, Jagruti Colony, Ekata Nagar, and Vidyapeeth Parisar, a total of 50 houses with various socio economic status were chosen at random. The homemaker from each household were interviewed using a pre-structured interview schedule in order to get the information.

An interview schedule was prepared covering several aspects, including basic information of homemakers, frequency of consumption of bakery goods, and information on preferences for bakery product by particular age group. Information regarding how often pumpkin seeds are consumed is also included.

3.2 Collection of materials

The four bakery products selected were prepared utilize the pumpkin seeds flour.

Pumpkin seeds (*cucurbita*) were procured from local market of parbhani city. The collected pumpkin seeds were cleaned by removing foreign material. Then the pumpkin seeds were grinded to fine powder. The various steps followed in preparation of pumpkin seeds flour are given in flow chart (Fig.3.2) pumpkin seed flour was store in an air tight container and kept in refrigerator till the end of experiment.

3.3 Incorporation of pumpkin seeds flour in the selected bakery products

Four bakery products namely sweet biscuit, salt biscuit, *nankhatai* and cupcake were selected for incorporation of pumpkin seeds flour at different levels. The levels selected for incorporation of pumpkin seeds flour were 5, 10 and 15. The major ingredients replaced by the pumpkin seeds flour were maida (refined wheat flour) in the preparation sweet biscuits, salt biscuits, *nankhatai* and cupcake.

3.4 Sensory evaluation of prepared bakery products

All the four products were prepared without and with different level of incorporation of pumpkin seeds flour. The sample of all variation were served freshly to selected panel member for the evaluation sensory parameter such as colour, texture, taste, flavour and overall acceptability. The sensory evaluation of prepared bakery products was carried out by using 5 point hedonic rating taste. (Meilgaard, et al. 1999).

3.5 Nutrient analysis of selected bakery products

The highly accepted variations of prepared bakery products were analyzed for proximate composition (Mshandete et al (2007)) and mineral content. Calcium and magnesium contents were estimated by EDTA method. Trace minerals such as copper, zinc, iron and manganese were estimated by atomic absorption spectrophotometer (Qureshi et al. 2006) and carbohydrate content was estimated by difference method. (Appendix IV)

3.6 Shelf life study

The prepared bakery products sweet biscuit, salt biscuit, *nankhatai* and cupcake were store in zip lock polyethylene pouches for 60 days under normal room temperature except cupcake which was stored for 7 days. The acceptability of bakery products was tested periodically with the interval of 15 day.

3.7 Statistical analysis of the collected data

The information obtained was combined, tabulated, and examined. By computing the "F" value, the analysis of variance was statistically used to assess the distinction between variations for each sensory feature. Using the "t" test, it was determined whether there was a statistically significant difference in the nutritional content of produced bakery products made with and without the addition of pumpkin seeds flour.

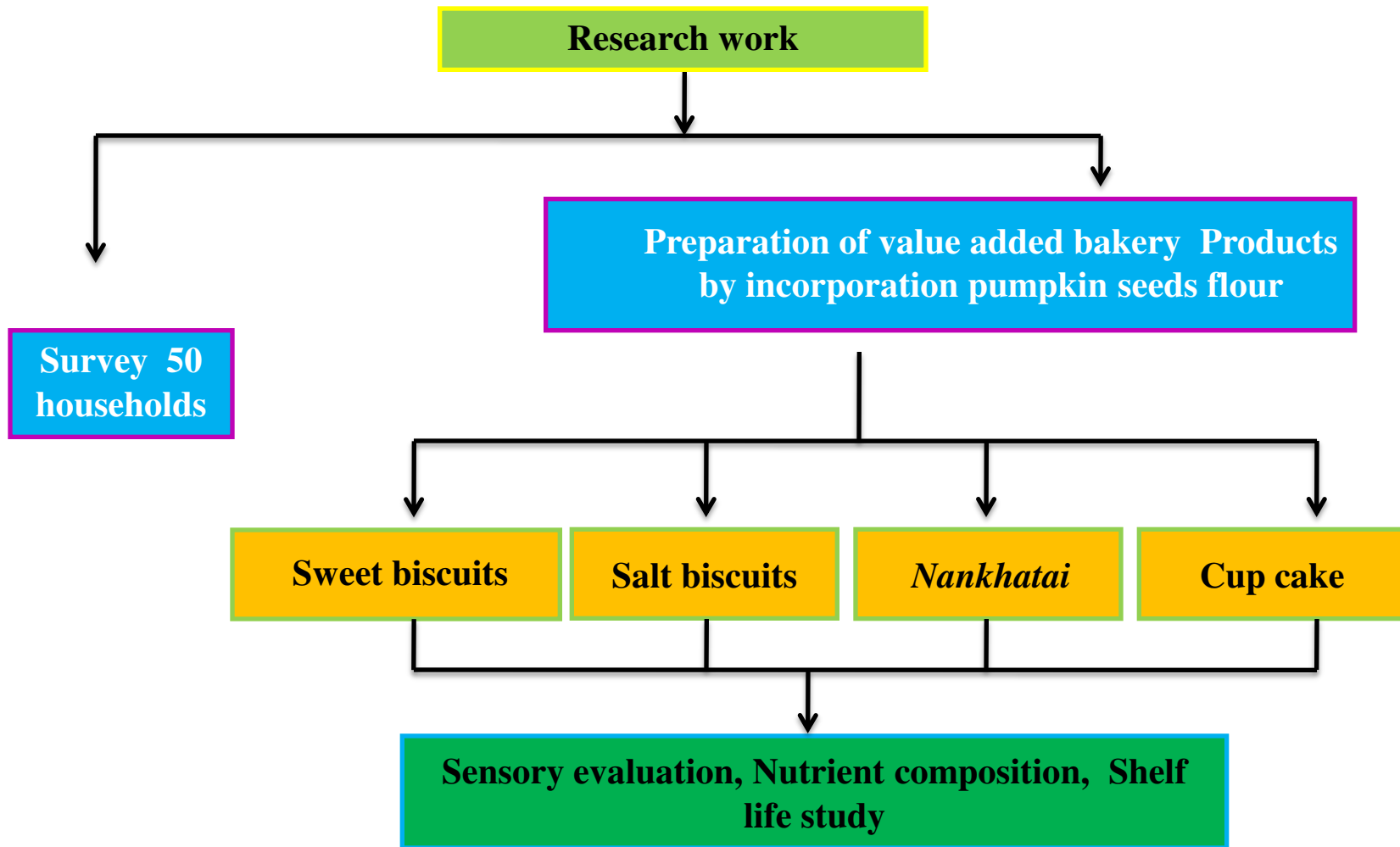


Fig. 3.1 Schematic Representation of Research work

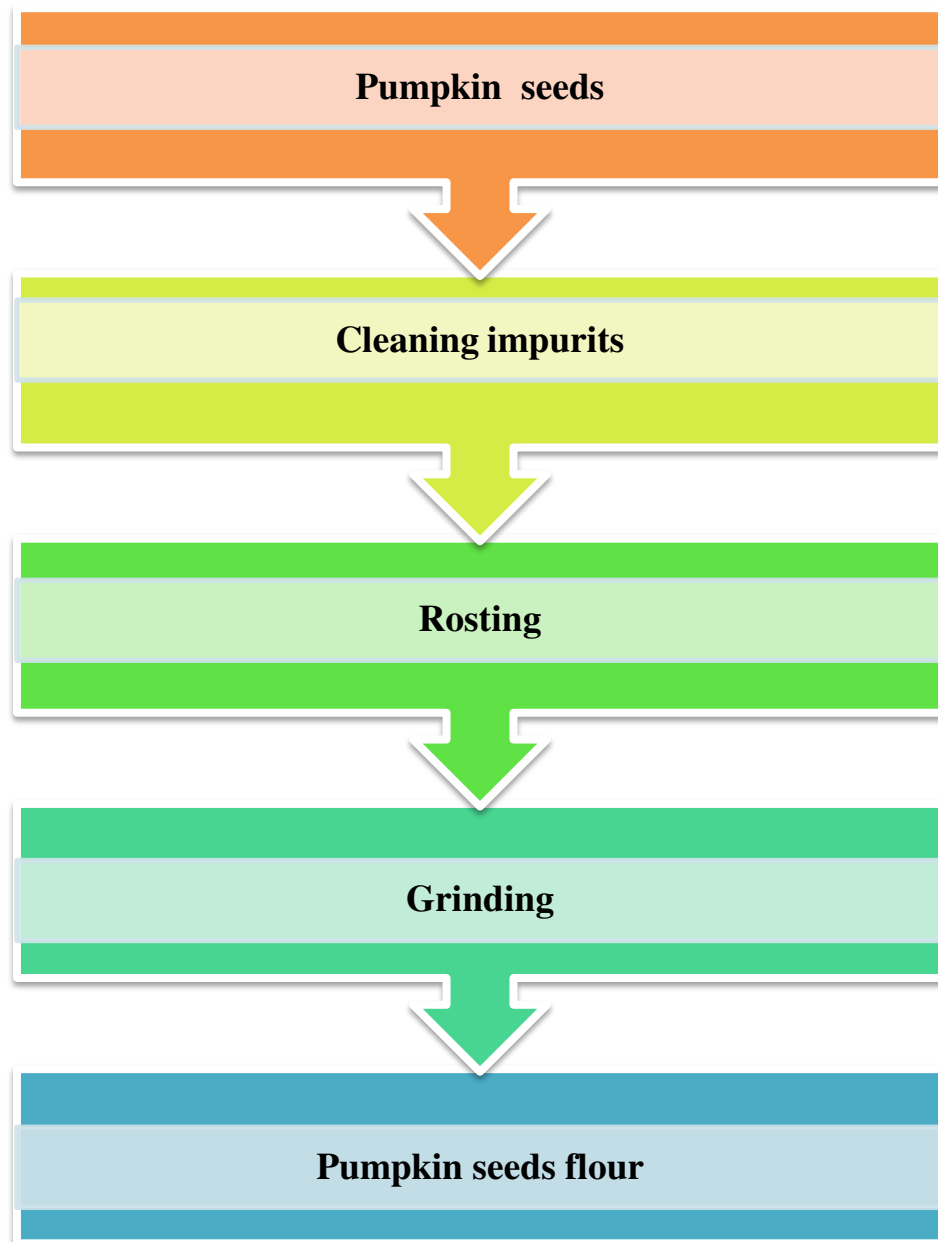


Fig. 3.2: Flowchart of preparation of pumpkin seeds flour



Plate 3.1 Conducting survey

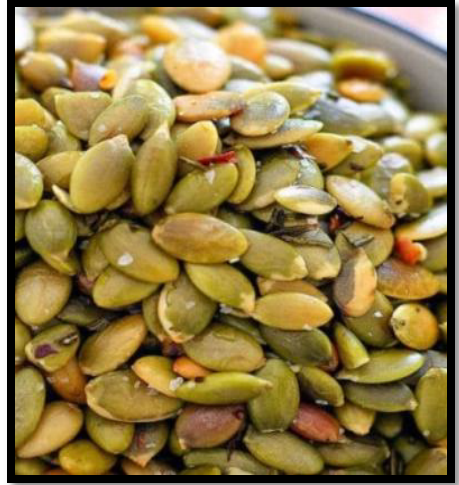


Plate 3 .2 : Preparation of pumpkin seeds flour.



Plate 3 .3: Preparation of bakery products

CHAPTER -IV
RESULTS AND DISCUSSION

CHAPTER -IV

RESULTS AND DISCUSSION

Pumpkin seeds are nutritionally dense food but commonly discarded as waste. (Parameshwari et al. 2019) Pumpkin seeds are valued for their high protein content (Mansour et al.1999) and useful amounts of the essential fatty acids such as linoleic acid. Pumpkin seeds contain remarkably high proportions of essential amino acids (Mukesh et al. 2010). Thus nutrition research on low cost, food unfamiliar nutrient rich food and their health benefits to human Population is the need of the hour. (Parameshwari et al. (2019) Thus, taking into consideration the economic, nutritional and health benefits of pumpkin seeds bakery products are prepared by incorporation with pumpkin seeds flour. Acceptability of prepared bakery products such as sweet biscuit, salt biscuit, *nankhatai* and cupcakes was evaluated by incorporating 5, 10 and 15 per cent levels of pumpkin seeds flour. Among the prepared variations highly acceptable bakery products was evaluated for nutritional composition and storage study. The data obtained from the study was statistically analyzed and discussed under numerous headings.

4.1 Socio economic status of selected households

4.2 Consumption pattern of pumpkin seeds

4.3 Sensory evaluation of bakery products prepared without and with different levels of incorporation of pumpkin seeds flour

4.4 Nutritional composition of bakery products prepared without and with incorporation of pumpkin seeds flour

4.5 Storage study of bakery products prepared with incorporation of pumpkin seeds flour

A survey of randomly selected 50 households was conducted in parbhani city. The information regarding general aspects of household and consumption pattern of uncommon edible seeds and pumpkin seeds was collected with the help of pre tested questionnaire by personal interview of homemakers.

4.1 Socio economic status of selected households

Table 1 Represent the general information of homemakers from selected households. The data indicated that age group of selected homemakers was ranging from 21 to 60 years. Most of the respondents (46%) were belonging to 31 to 40 years while 28 per cent were belonging to 41 to 50 years and 22 per cent were from 21 to 30 years of age group. Most of the homemakers (82 %) were from nuclear family and less (18%) were from joint family. The data with regard to occupation revealed that maximum homemakers were non-working (95%) whereas, minimum (5%) homemakers were engaged in different services. Most of the homemakers were having the monthly income above 40000 (74%) followed by 20000 to 30000 (24%) and 10000 to 20000 (2%). From the results of the survey it was noted that most of the homemakers (68%) were vegetarian and remaining (32%) were non vegetarian. When literacy level is taken into consideration it was showed that most of the homemakers (96%) were literate among which majority of homemakers were graduated (30%) followed by secondary school educated (28%), post graduated (16%), higher secondary educated (14%), middle school educated (6%) and primary school educated (2%).

Table 4.1 Socio economic status of selected households

Sr. No.	Particulars	Number	Percentages
1	Type of family		
	a) Nuclear	41	82
	b) Joint	9	18
	c) Extended	0	0
2	Age group (years)		
	a) 21-30	11	22
	b) 31-40	23	46
	c) 41-50	14	28
	d) 51- above	2	4
3	Family size		
	a) Small family	25	50
	b) Medium family	25	50
	c) Large family	0	0
4	Monthly income		
	a) Group I (< Rs 10,000)	0	0
	b) Group II (Rs.10,000-20,000)	1	2
	c) Group III (Rs.20,000-30,000)	12	24
	d) Group IV (>Rs. 40,000)	37	74
5	Food habit		
	a) Vegetarian	34	68
	b) Non- Vegetarian	16	32
6	Literacy level of home maker		
	a) Illiterate	2	4
	b) Primary school(1-5)	1	2
	c) Middle school (6-8)	3	6
	d) Secondary school(9-10)	14	28
	e) High secondary (11-12)	7	14
	f) Graduation diploma	15	30
	g) Post-graduation	8	16

4.2 Consumption pattern of pumpkin seeds

Information regarding consumption of uncommon edible seeds by surveyed households is presented in table 4.2.

Table 4.2: Consumption of uncommon edible seeds

Sr. No	Name of the selected uncommon edible seeds	Edible seeds consumption	Percentage (%) of seeds
1	Water melon seeds	38	76
2	Muskmelon seeds	35	70
3	Rajkeera seeds	4	8
4	Pumpkin seeds	12	24
6	Garden cress seeds	4	8
7	Sunflower seeds	31	62
9	Tamarind seeds	3	6

Result of study showed that most of the households know about uncommon edible seeds. It was noted that consumption of watermelon (76%) muskmelon (70%) and sunflower seeds (62%) was higher as compared rajkeera seeds (8%) pumpkin seeds (24%), garden cress seeds (8%) and tamarind seeds (6%) which were consumed rarely by the selected households. It can be concluded that the consumption of pumpkin seeds was less as compared to watermelon, muskmelon, and sunflower seeds.

Table 4.3: Information regarding consumption of pumpkin seeds

Sr. No	Particulars	Percentages (%)
1	Do you know about uncommon edible seeds? a) Yes b) No	88 12
2	Do you consume pumpkin seeds? a) Yes b) No	46 54
3	Do you know the nutrient content of pumpkin seeds? a) Yes b) No	22 78
4	Where do you most often purchase pumpkin seeds a) Grocery store b) Own farm c) Farmers market d) Other	16 22 8
5	In which form you consumed pumpkin seeds? a) Raw b) Powder c) Any other	44 2 0
6	Do you know about value addition of products with pumpkin seeds? a) Yes b) No	8 92
7	Do you know the price of pumpkin seeds? a) Yes b) No	6 94

Information regarding consumption of pumpkin seeds by selected households presented in table 4.3

Result of the study showed that 88 per cent households aware about uncommon edible seeds and only 46 per cent households consume pumpkin seeds. Among the households who consume pumpkin seeds only 22 per cent knew about nutrient content of the pumpkin seeds. From the results of the survey it was noted that pumpkin seeds were purchased from local market and own farm and farmer market and consumed in raw (44%) and powder forms (2%).

From the survey it was indicated that 92 per cent households were unaware about value addition of pumpkin seeds in the bakery products and 16 per cent households knew about the price of pumpkin seeds. It was revealed that 16 per cent households were aware about the usefulness of pumpkin seeds for health and only 18 per cent households knew that pumpkin seeds are nutritious.

Information about value addition of pumpkin seeds in different products are given in table 4.4.

Table 4.4 Value additions of pumpkin seeds in different products

Sr. No.	Name of the products	Number of people consume by products	Percentage (%)
1	<i>Laddu</i>	3	6
2	<i>Chikki</i>	1	2
3	<i>Kheer</i>	5	10
4	<i>Halwa</i>	2	4
5	Bakery Products	-	-
6	<i>Mathari</i>	-	-
7	Any Other	2	4

From the survey it was indicated that all the household were unaware about the incorporation of pumpkin seeds flour in the recipes specially for bakery products and *mathri*. It also showed that pumpkin seeds flour was used rarely in the preparation of some sweet products such as *ladu* (6%), *chiki* (2%), *kheer* (10%), and *halwa* (4%). On the whole it was concluded that all the households were unaware about incorporation pumpkin seeds flour in bakery products.

4.3 Sensory evaluation of bakery products prepared without and with different levels of incorporation of pumpkin seeds flour

4.3.1 Sensory evaluation of Sweet biscuits prepared without and with incorporation of pumpkinseeds flour at different levels

The mean of sensory scores for the acceptability of sweet biscuits without (control) and with incorporation of pumpkin seeds flour different levels are given in table 4.5 and illustrated in fig. 4.1.

Table 4.5: Sensory evaluation of Sweet biscuits prepared without and with incorporation of pumpkin seeds flour different levels

Variations	Level of pumpkin seed flour (%)	Mean values of sensory scores of sweet biscuits				
		Colour	Texture	Taste	Flavour	Overall acceptability
Control	0	4.8	4.9	4.9	5	4.9
I	5	4.8	4.9	4.8	4.9	4.8
II	10	4.9	4.9	4.9	4.9	4.9
III	15	4.7	4.6	4.7	4.7	4.7
S.E±		0.08	0.08	0.08	0.06	0.07
CD		0.22	0.22	0.22	0.87	0.08
F-value		1.03^{NS}	3.35**	1.84*	3.78**	2.45*

The mean scores for colour of sweet biscuits prepared without and with 5, 10 and 15 percent level of incorporation of pumpkin seeds flour were found to be 4.8, 4.8, 4.9 and 4.7 respectively. The maximum score of 4.9 was obtained for colour of sweet biscuits at (10%) incorporation of pumpkin seeds flour whereas, minimum

score of 4.7 was recorded for the colour of sweet biscuits with 15 per cent level of incorporation of pumpkin seeds flour.

Statistical analysis revealed that the scores obtained for the colour of sweet biscuits with varying levels of pumpkin seeds flour did not differ significantly from one another.

On the whole it was inferred that 10 per cent level of incorporation of pumpkin seeds flour in sweet biscuits were found to be most liked in terms of colour acceptability as compared to that remaining level of incorporation of pumpkin seeds flour.

The mean scores for the texture of sweet biscuits prepared with different levels of pumpkin seeds flour ranged from 4.6 to 4.9. The maximum score (4.9) was reported by sweet biscuits prepared without and with 5 per cent incorporation of pumpkin seeds flour while lowest score (4.6) was obtained by 15 per cent incorporation of pumpkin seeds flour.

Statistical analysis showed that, the scores obtained for the texture of sweet biscuits prepared with 5 and 10 per cent of incorporation of pumpkin seeds flour did not differ significantly from control. On the other hand scores obtained by 15 per cent incorporation of pumpkin seeds flour differed significantly from control.

The scores registered for the taste of sweet biscuits with control, 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour ranged from 4.7 to 4.9. The lowest score was obtained by 15 per cent incorporation of pumpkin seeds flour. while, highest score 4.9 was obtained by control and 10 per cent incorporation of pumpkin seeds flour.

Statistically the scores obtained for taste of sweet biscuits with 5, 10 and 15 per cent of incorporation of pumpkin seeds flour did not differ significantly from each other and from control.

On the whole it was inferred that 10 per cent level of incorporation of pumpkin seeds flour in sweet biscuits was considered as most acceptable level in terms of taste. The mean scores secured for flavour of sweet biscuits were ranging from 4.7 to 5. The highest score (5) was secured by basic (control) sweet biscuits, followed by (5%) (4.9) and (10%) (4.9), lowest score was obtained by sweet biscuits with 15 per cent incorporation of pumpkin seeds flour. Statistical analysis indicated



Control



5%



10%



15%

Plate 4.1 : Sweet biscuits prepared without and with incorporation pumpkin seeds flour in different level

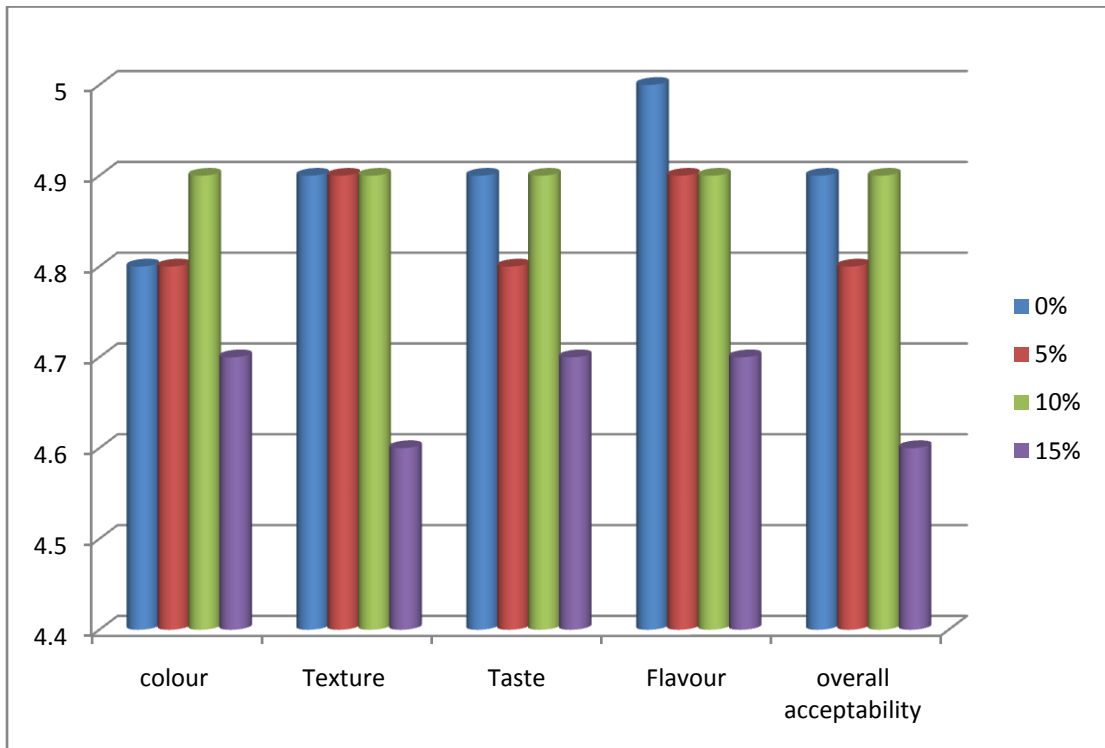


Fig 4.1: Sensory scores of Sweet biscuits prepared without and with incorporation of pumpkin seeds flour at different level

that score obtained by sweet biscuits control, 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour did not differ significantly from each other.

In case of overall acceptability scores obtained by sweet biscuits control, 5, 10 and 15 per cent level of pumpkin seeds flour incorporation were found to be 4.9, 4.8, 4.9 and 4.7 respectively.

From the statistical analysis it was observed that control and all the variations of sweet biscuits prepared at different level of incorporation differed significantly among each.

From result it can be concluded that among variations the sweet biscuits prepared with 10 percent level of incorporation of pumpkin seeds flour was found to be most acceptable in terms of colour, texture, taste and overall acceptability.

4.3.2 Sensory evaluation of salt biscuits prepared without and with incorporation of pumpkin seeds flour at different level

The mean scores of sensory characteristics for the acceptability of salt biscuits prepared without and with incorporation of pumpkin seeds flour are tabulated in Table 4.6 and depicted in the fig. 4.2

Table 4.6: Mean sensory evaluation scores of salt biscuits prepared without and with incorporation of pumpkin seeds flour at different level

Variations	Level of pumpkin seed Flour (%)	Mean values of sensory scores of salt biscuits				
		Colour	Texture	Taste	Flavour	Over all acceptability
Control	0	4.7	4.9	4.8	5	5
I	5	4.8	4.8	4.8	4.8	4.8
II	10	4.9	4.9	4.9	4.9	4.9
III	15	4.8	4.6	4.6	4.7	4.7
S.E±		0.08	0.08	0.08	0.07	0.06
CD		0.23	0.23	0.24	0.19	0.19
F-value		0.56^{NS}	2.53*	1.63^{NS}	3.45**	5.03**

The scores for the colour of salt biscuits prepared without and with 5, 10 and 15 per cent incorporation of pumpkin seeds flour were 4.7, 4.8, 4.9 and 4.8 respectively. The highest score of 4.9 per cent was obtained by salt biscuits prepared with 10 per cent level of incorporation of pumpkin seeds flour, followed by 4.8 which was obtained by salt biscuits prepared with 5 and 15 per cent incorporation of pumpkin seeds flour. On the other hand the lowest score of 4.7 for colour was noticed by the salt biscuits prepared without incorporation of pumpkin seeds flour.

Statistical analysis showed that the scores for colour of salt biscuits without and with 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour were found to differ non significantly from each other.

The mean scores of texture of salt biscuits prepared with different levels of incorporation of pumpkin seeds flour were ranging from 4.9 to 4.6. The score obtained for texture of salt biscuits prepared without and with 10 per cent level of incorporation of pumpkin seeds flour was higher and the lowest score was noticed at (15%) incorporation of pumpkin seeds flour.

Statistical analysis showed that, the scores obtained for texture of salt biscuits prepared with 15 per cent level of incorporation of pumpkin seeds flour differed significantly from control and remaining variations does not differed significantly with control.

It can be concluded that 10 per cent level of incorporation of pumpkin seeds flour in salt biscuits was most accepted and suitable level of incorporation in terms of texture.

The mean sensory scores for taste of salt biscuits were 4.8, 4.8, 4.9 and 4.6 for 0, 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour. The highest score 4.9 was recorded for 10 per cent level of incorporation of pumpkin seeds flour and lowest score was recorded 15 per cent incorporation of pumpkin seeds flour.

Statistical analysis showed that significant difference was noticed in the mean score for taste of salt biscuits prepared with incorporation of 10 and 15 per cent level of incorporation of pumpkin seeds flour.

On the whole it was inferred that 10 per cent level of pumpkin seeds flour



Control



5%



10 %



15 %

Plate 4.2 : Salt biscuits prepared without and with incorporation of pumpkin seeds flour at different level

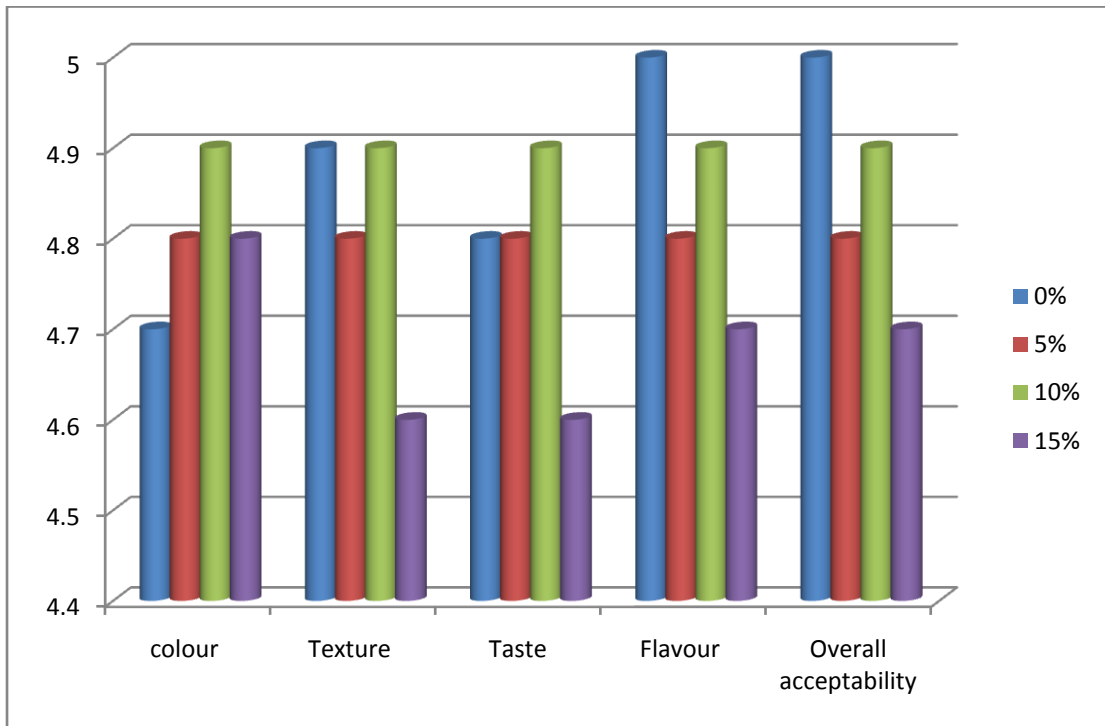


Fig 4.2: Sensory scores of Salt biscuits prepared without and with incorporation of pumpkin seeds flour at different level

incorporation was found to be most acceptable for taste of salt biscuits.

The scores for the flavour of salt biscuits prepared with different levels of incorporation of pumpkin seeds flour were ranging from 5 to 4.7. The highest score 5 was secured for the flavour of salt biscuits prepared without incorporation pumpkin seeds flour whereas, lowest score of 4.7 was secured by 15 per cent level of incorporation of pumpkin seeds flour.

Statistical result showed that the mean scores for flavour of salt biscuits prepared with 5 and 15 per cent level of incorporation of pumpkin seeds flour differed significantly from control but at (10%) level of incorporation of pumpkin seeds flour did not differed significantly from control.

In conclusion the result indicated that the highest score of 5 was obtained for flavour of control salt biscuits, followed by (10%) (4.9) level of incorporation of pumpkin seeds flour. The mean scores for overall acceptability of salt biscuits prepared without (control) and with incorporation of 5,10 and 15 per cent level of incorporation of pumpkin seeds flour were 5,4.8,4.9 and 4.7 respectively. The maximum score was obtained by the salt biscuits prepared without incorporation pumpkin seeds flour followed by 4.9 which was secured by 10 per cent level of incorporation of pumpkinseeds flour while the minimum score of 4.7 was obtained by the salt biscuits prepared by 15 per cent level of incorporation of pumpkin seeds flour.

Statistical analysis showed that score obtained for overall acceptability of salt biscuits prepared without incorporation of pumpkin seeds flour differed significantly from salt biscuits prepared with 5 and 15 per cent level of incorporation of pumpkin seeds flour

4.3.3 Sensory evaluation of *Nankhatai* prepared without and with of incorporation of pumpkin seeds flour at different levels

The mean values of sensory scores for the acceptability of *nankhatai* prepared without and with varying levels of incorporation of pumpkin seeds flour are given in Table.4.7 and illustrated in Fig. 4.3.

Table 4.7: Mean sensory evaluation scores of *Nankhatai* prepared without and with incorporation of pumpkin seeds flour at different level

Variation	Level of pumpkin seeds flour (%)	Mean values of sensory scores of <i>Nankhatai</i>				
		Colour	Texture	Taste	Flavour	Overall acceptability
Control	0	4.9	4.9	4.9	5	4.9
I	5	4.8	4.7	4.6	4.8	4.6
II	10	4.9	4.9	4.9	4.9	4.9
III	15	4.7	4.8	4.7	4.8	4.75
S.E±		0.07	0.07	0.06	0.06	0.08
CD		0.22	0.20	0.23	0.18	0.02
F-value		1.30 ^{NS}	2.45*	3.36**	1.89 ^{NS}	3.36**

The mean scores obtained for colour of *nankhatai* prepared with 0, 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour were ranged from 4.9 to 4.7. *Nankhatai* prepared with 10 per cent incorporation of pumpkin seeds flour secured maximum score (4.9) which was same as control whereas, the lowest score of 4.7 was secured by *nankhatai* prepared with 15 per cent of incorporation of pumpkin seeds flour.

Statistical analysis showed that the scores for colour of *nankatai* prepared without and with incorporation of pumpkin seeds were non-significant.

The mean values for the texture of *nankhatai* prepared at 0,5,10 and 15 per cent level of incorporation of pumpkin seeds flour were 4.9,4.7,4.9 and 4.8 respectively. It was noticed that highest score(4.9) was observed for *nankhati* prepared with 10 per cent and 0 per cent incorporation of pumpkin seeds, whereas the lowest



Control



5%



10 %



15 %

Plate 4.3 : *Nankhatai* prepared without and with incorporation of pumpkin seeds flour at different level

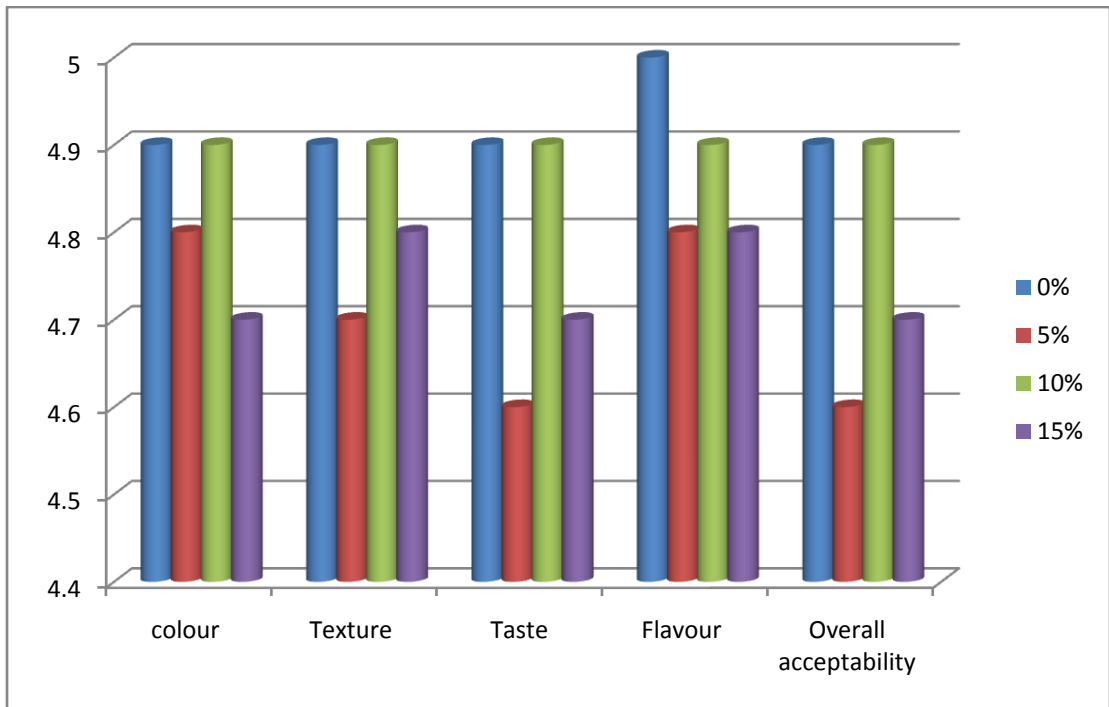


Fig 4.3: Sensory scores of *Nankhatai* prepared without and with incorporation of pumpkin seeds flour at different level

score of 4.7 was recorded by 5 percent level of incorporation of pumpkin seeds flour. Statistically it was showed that score obtained for the texture of *nankhatai* prepared with 5 percent of incorporation of pumpkin seeds was at par with the control and with 10 per cent whereas, score obtained by 15 and 10 per cent incorporation differed non significantly from control.

On the whole texture of *nankhatai* prepared without incorporation of pumpkin seeds flour and with 10 per cent incorporation of pumpkin seeds secured maximum score.

In case of taste maximum score of 4.9 was recorded by the *nankhatai* prepared with 10 per cent which was found to be similar to score obtained by without incorporation of pumpkin seeds flour, followed by 15%(4.7). Whereas the lowest score (4.6) was secured by *nankhatai* prepared with 15 percent of incorporation.

Statistical data indicated that the non significant difference was noticed in the taste of *nankhatai* prepared with control, 10 and 15 per cent level of incorporation of pumpkin seeds. On the other hand *nankhatai* prepared with 5 per cent level of incorporation of pumpkin seeds flour differed significantly from *nankhatai* prepared with control and 10 per cent level of incorporation of pumpkin seeds flour.

The mean score obtained for flavour of *nankhatai* prepared without (control) and with 5,10 and 15 per cent levels of incorporation pumpkin seeds flour ware 5, 4.8, 4.9 and 4.8 respectively. Maximum score of 5 for flavour was obtained by control followed by 10% (4.9). While minimum score 4.8 was obtained by 5 and 15 per cent level of incorporation of pumpkin seeds flour.

Statistical result revealed that non significant difference was noticed among the scores for flavour of *nankhatai* prepared with 5, 10 and 15 per cent incorporation of pumpkin seeds flour. Whereas, *nankhatai* prepared without incorporation of pumpkin seeds flour differed significantly with *nankhtai* prepared with 5 and 15 per cent incorporation of pumpkin seeds flour.

The mean score of overall acceptability of *Nankhatai* prepared with different levels incorporating pumpkin seeds flour were ranging from 4.6 to 4.9. The highest score for overall acceptability of *nankhatai* prepared without and 10 per cent level of incorporation of pumpkin seeds flour was found to be same. While the minimum score 4.6 recorded by *nankhatai* prepared with 5 percent level the incorporation of pumpkin

seeds flour. Statistical analysis indicating that mean score of overall acceptability of *nankhatai* prepared without and with different level of incorporation of pumpkin seeds flour differed significantly with each other

4.3.4 Sensory evaluation of cupcake prepared without and with of incorporation of pumpkin seeds flour different levels

The mean value of sensory scores for the acceptability of cupcake prepared without and with varying level of incorporation of pumpkin seeds flour is given in Table 4.8 and Fig 4.4.

Table 4.8: Mean sensory evaluation score of cupcake without and with incorporation of pumpkin seeds flour at different level.

Variations	Level of pumpkin seed Flour (%)	Mean values of sensory scores of cupcake				
		Colour	Texture	Taste	Flavour	Overall acceptability
Control	0	4.9	4.9	4.9	5	5
I	5	4.7	4.7	4.6	4.8	4.7
II	10	4.7	4.8	4.8	4.8	4.7
III	15	4.8	4.9	4.9	4.9	4.9
S.E±		0.08	0.08	0.06	0.08	0.08
CD		0.24	0.23	0.18	0.22	0.23
F-value		1.02^{NS}	3.38**	1.89^{NS}	2.95*	3.38**

The mean score for colour of cupcake of at 0, 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour were 4.9, 4.7, 4.7 and 4.8 respectively. Maximum score (4.9) for colour was recorded by control cupcake followed by 4.8 score was recorded for 15 per cent level of incorporation of pumpkin seeds flour. Whereas, minimum score 4.7 was recorded by cupcake prepared with 5 and 10 per cent level of incorporation pumpkin seeds flour. The score obtained for colour of cupcake prepared without (control) and with 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour did not differ significantly with each other.

The mean scores for texture of cupcake prepared with different level of pumpkin seeds flour ranged of 4.7 to 4.9. Minimum score (4.7) was obtained by the



Control



5%



10%



15%

Plate 4.4 : Cup cake prepared without and with incorporation of pumpkin seeds flour at different level

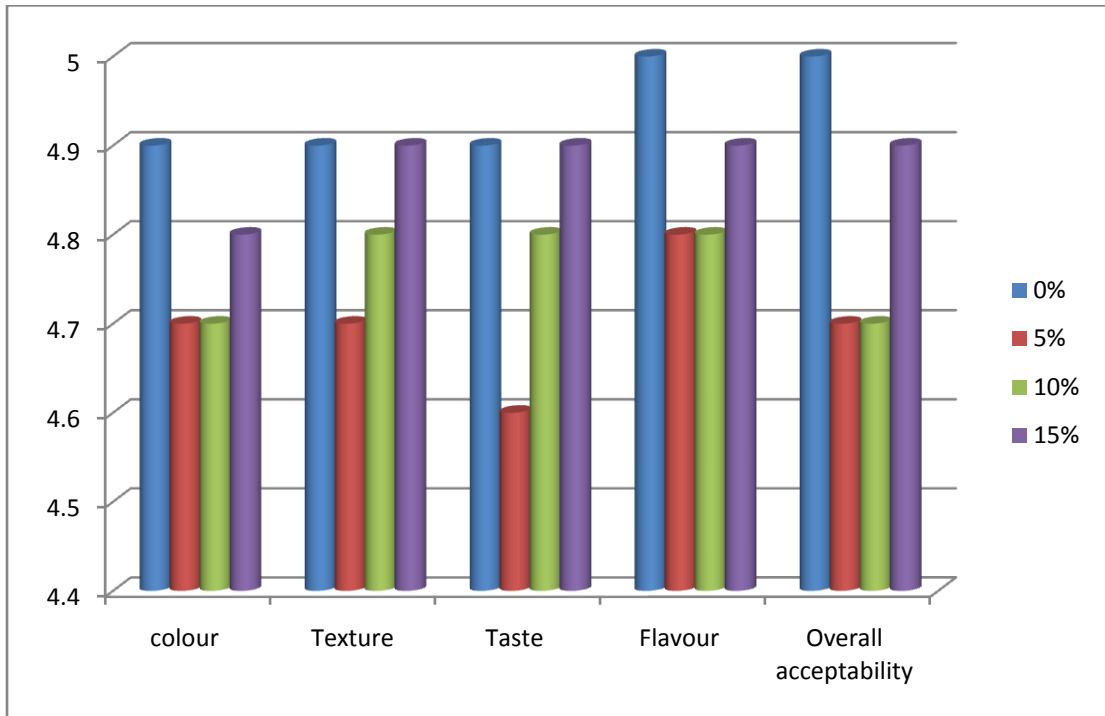


Fig 4.4: Sensory scores of cupcake prepared without and with incorporation of pumpkin seeds flour at different level

cupcake prepared with 5 per cent incorporation of pumpkin seeds flour. Cupcake prepared without (control) and with 15 per cent incorporation of pumpkin seeds flour were secured the highest score (4.9) in terms of texture.

Statistical analysis indicated that scores for the texture of cupcakes prepared without and with 5, 10 and 15 per cent level of incorporation of pumpkin seeds flour not differed significantly with each other.

The score for the taste of cupcake prepared with control to 15 per cent levels of incorporation of pumpkinseeds flour varied from 4.6 to 4.9. The highest score (4.9) was obtained by the cupcakes prepared without and with 15 per cent level of incorporation of pumpkin seeds flour, followed by cupcake prepared by 10% incorporation of pumpkin seeds flour. While lowest score (4.6) was secured by cupcakes prepared with 5 per cent level of incorporation of pumpkin seeds flour.

Statistical data indicated that cupcake prepared with 5 per cent incorporation of pumpkin seeds flour differed significantly with control, 10 and 15 per cent incorporation of pumpkin seeds flour. Whereas 10% incorporation did not differed significantly with control and 15% incorporation is at par with the control.

The score for flavour of cupcake prepared without (control) and with incorporation of pumpkin seeds flour ranged 4.8 to 5. The highest score (5) was secured by control cupcake followed by 4.9 score obtained by cupcake prepared with 15 per cent incorporation, followed by 5 and 10 per cent pumpkin seeds flour incorporated cupcakes .

Statistical analysis indicated that the score for flavour of cupcake prepared without and with different level of pumpkin seeds flour not differed significantly among each other.

The mean value for overall acceptability of cupcake prepared with different levels of incorporation of pumpkin seeds flour were ranging from 4.7 to 5. The maximum score (5) was obtained by cupcake prepared without incorporation of pumpkin seeds flour (control) followed by (4.9) score was recorded for 15 per cent level of incorporation of pumpkin seeds flour. Whereas, minimum score (4.7) was secured by cupcake prepared with 5 and 10 per cent incorporation of pumpkin seeds flour.

Statistical analysis revealed that the Scores obtained for overall acceptability of cupcake prepared with 5 and 10 per cent incorporation of pumpkin seeds flour differed significantly from control. Whereas, cupcake prepared with 15 per cent incorporation of pumpkin seeds flour not differed significantly from control.

On the whole, it can be concluded that up to 15 percent level of incorporation of pumpkin seeds flour found to most acceptable for all sensory parameters.

4.4 Nutritional composition of bakery products prepared without and with incorporation of pumpkin seeds flour

4.4.1 Nutritional composition of sweet biscuits prepared without and with incorporation of pumpkin seeds flour

The data about nutrient content of sweet biscuits without and with incorporation of pumpkin seeds flour is tabulated in Table 4.9 and illustrated in Fig. 4.5

The moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber content of sweet biscuits prepared with incorporation of pumpkin seeds flour were found to be 0.83, 1.2, 24.89, 10.26, 62.81, 516.3 and 0.14 per cent respectively. Whereas, the sweet biscuits prepared without incorporation of pumpkin seeds flour registered values 1.04, 0.89, 19.42, 6.74, 71.9, 489.4 and 0.02 per cent for moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber respectively.

It was noticed that the total ash, total fat, protein, energy and crude fiber content of sweet biscuits were increased whereas moisture and carbohydrate content decreased.

On the other hand the values of phosphorus, sodium, potassium, calcium, magnesium, iron, manganese, copper and zinc content of sweet biscuits prepared with incorporation of pumpkin seeds flour were 192.4, 335.1, 162, 116.5, 97.9, 7.4, 0.01, 1.6 and 1.0mg/100 gm respectively. While, sweet biscuits prepared without incorporation of pumpkin seeds flour registered values 80.91, 275.4, 108.5, 101, 40.4, 6.3, 0.01, 1.0 and 0.4mg/100gm for phosphorus, sodium, potassium, calcium, magnesium, iron, manganese, copper and zinc respectively. With an incorporation of pumpkin seeds flour in sweet biscuits (10%) there was increase in content of phosphorus, sodium, potassium, calcium, magnesium, iron, copper and zinc. Statistically significant difference was observed in all nutrient content except

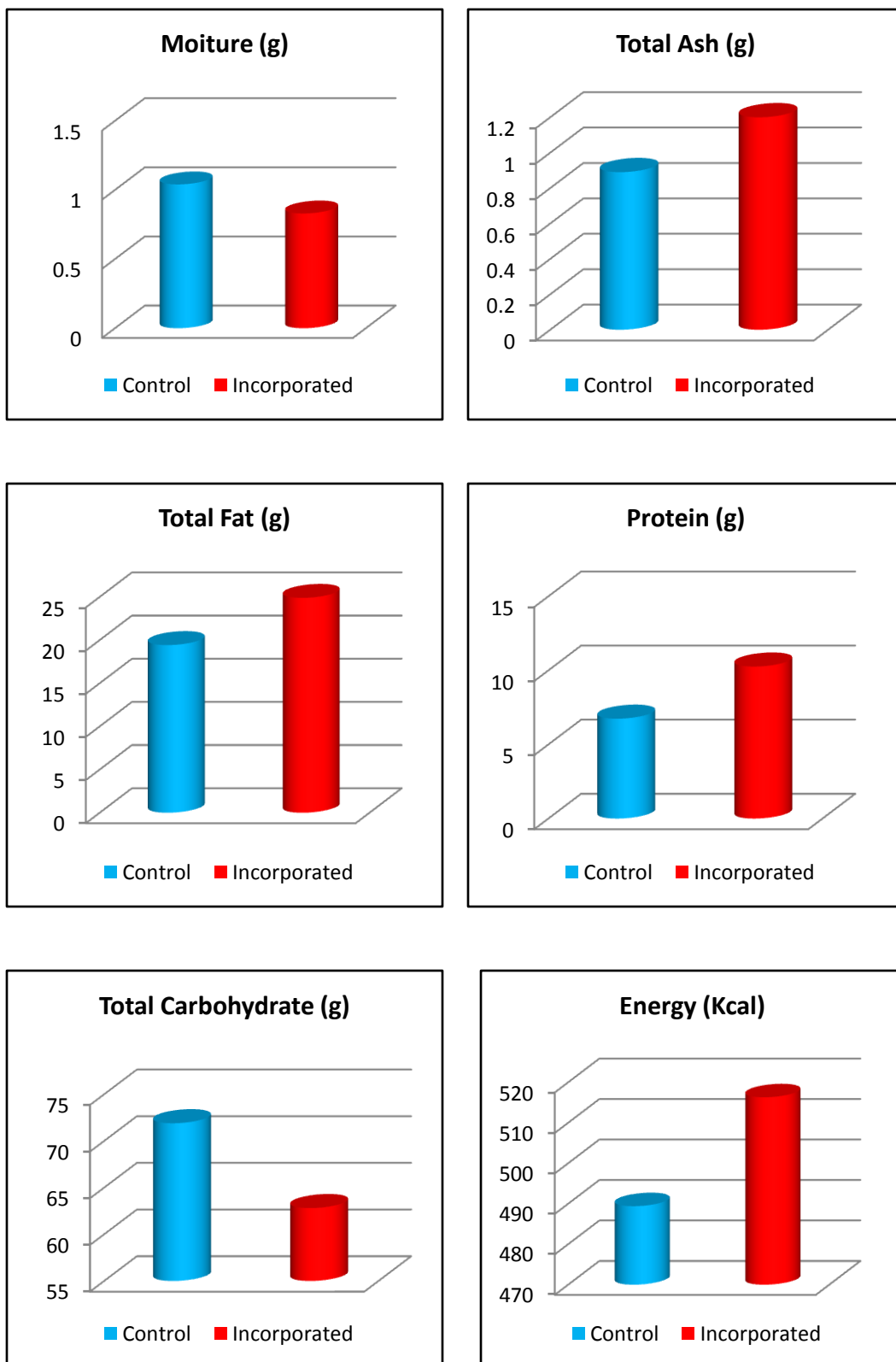


Fig. 4.5 (a): Nutritional composition of Sweet biscuit prepared without and with incorporation of pumpkin seeds flour at different level

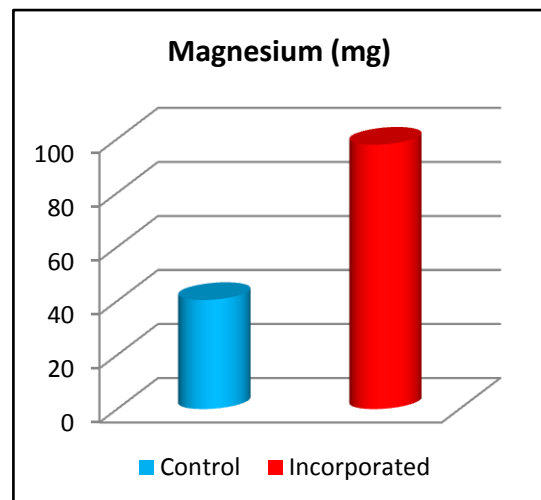
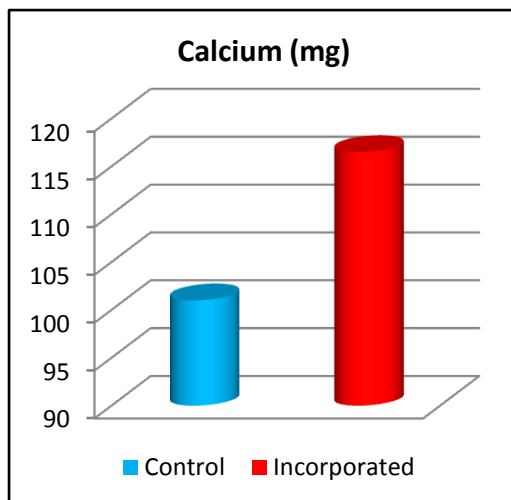
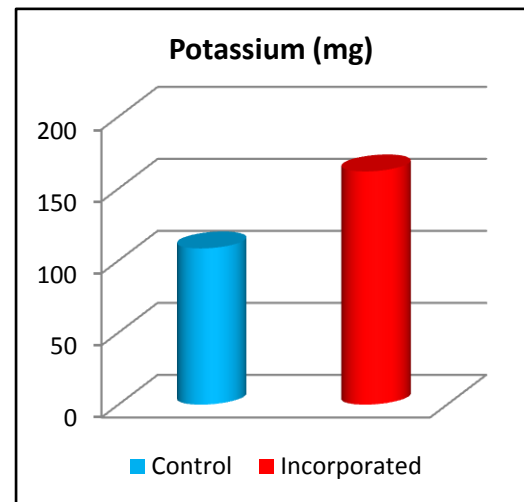
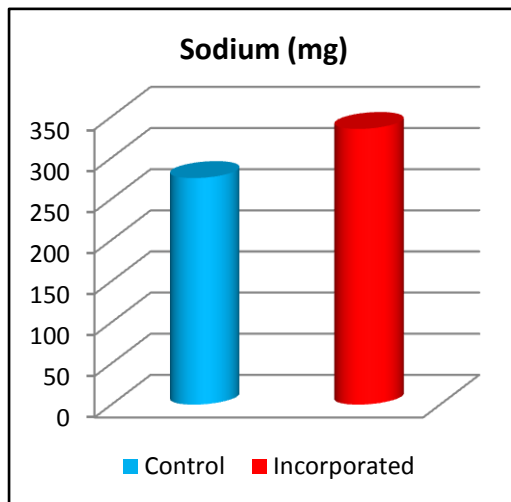
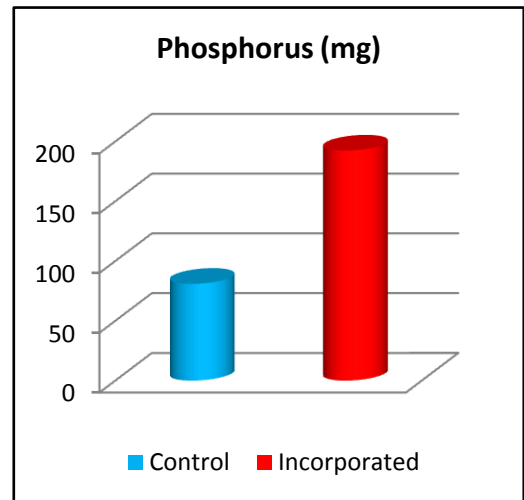
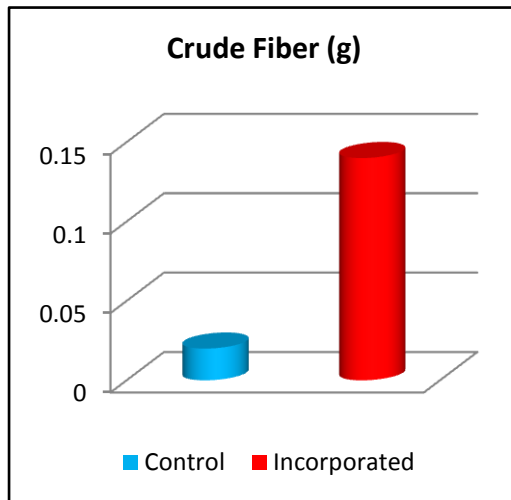


Fig. 4.5 (b): Nutritional composition of Sweet biscuit prepared without and with incorporation of pumpkin seeds flour at different level

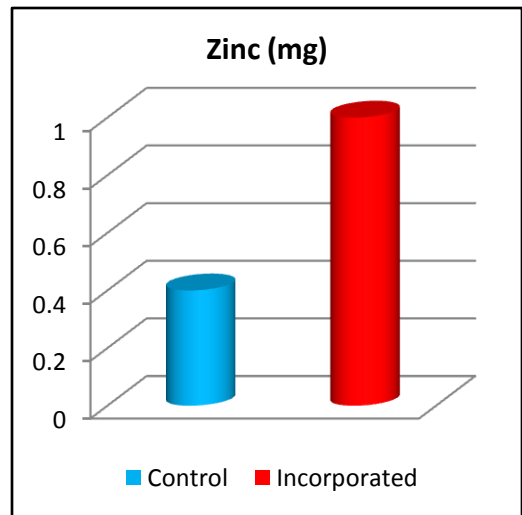
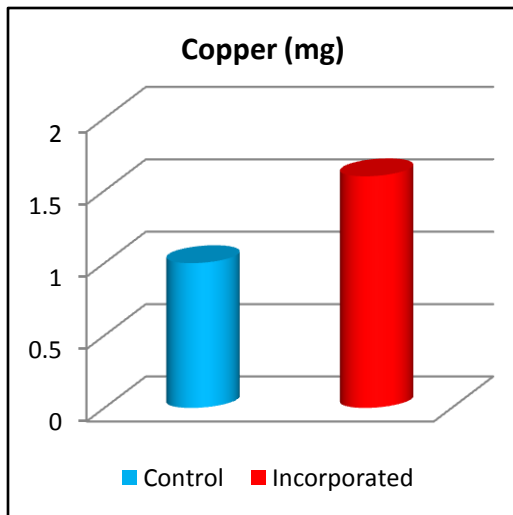
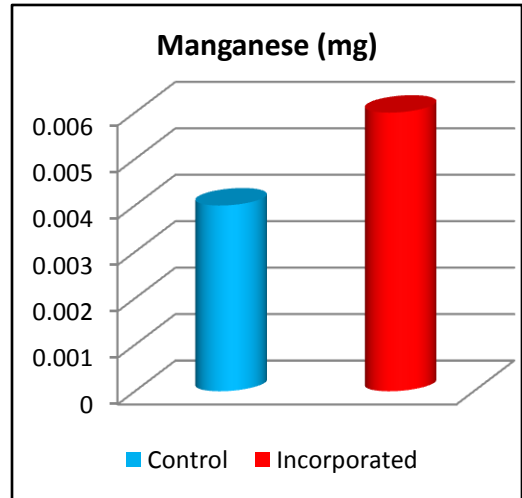
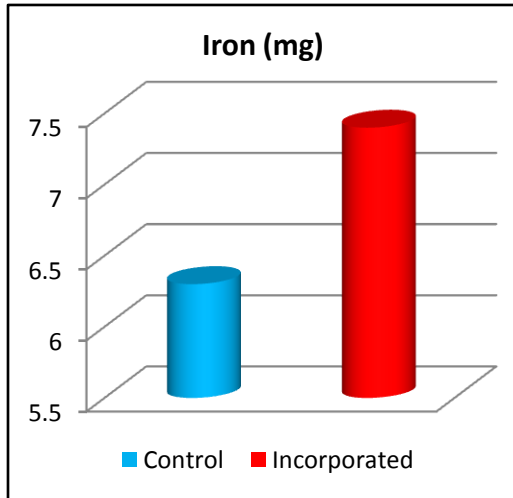


Fig. 4.5 (c): Nutritional composition of sweet biscuit prepared without and with incorporation of pumpkin seeds flour at different level

manganese and copper content.

From the above it was observed that the total ash, total fat, protein, energy, crude fiber, phosphorus, sodium, potassium, calcium, magnesium, iron, manganese, copper and zinc content of sweet biscuits prepared with incorporation of pumpkin seeds flour were more compare to control.

Table 4.9: Nutritional composition of sweet biscuits prepared without and with incorporation of pumpkin seeds flour

Sr. No	Nutrient	Nutrient content		t- value	Increase/ decrease in nutrient content
		Sweet biscuits (control) (mean \pm SD)	Sweet biscuits (incorporated) (mean \pm SD)		
1	Moisture (g)	1.04 \pm 0.010	0.83 \pm 0.010	36.37**	0.21
2	Total ash (g)	0.89 \pm 0.010	1.20 \pm 0.010	5.62*	0.31
3	Total fat (g)	19.42 \pm 0.010	24.89 \pm 1.000	9.42*	5.47
4	Protein (g)	6.74 \pm 0.010	10.26 \pm 1.000	6.12*	3.52
5	carbohydrate (g)	71.90 \pm 1.000	62.81 \pm 1.000	8.73*	9.09
6	Energy value (k cal)	489.4 \pm 1.000	516.3 \pm 1.000	26.9**	26.9
7	Crud fiber (gm)	0.02 \pm 0.010	0.14 \pm 0.010	10.39**	0.12
8	Phosphorus (mg)	80.91 \pm 1.000	192.4 \pm 1.000	111.49* **	111.49
9	Sodium (mg)	275.4 \pm 1.000	335.1 \pm 1.000	51.72* **	59.7
10	potassium (mg)	108.5 \pm 1.000	162 \pm 1.000	92.665 **	53.5
11	Calcium (mg)	101 \pm 2.646	116.5 \pm 1.000	10.147 ** *	15.5
12	Magnesium (mg)	40.4 \pm 3786	97.9 \pm 1.000	33.54 **	57.5
13	Iron (mg)	6.3 \pm 2.100	7.4 \pm 1.000	1.047 ^{NS}	1.1
14	Manganese (mg)	0.02 \pm 0.054	0.01 \pm 1.000	0.896 ^{NS}	0.002
15	Copper (mg)	1.0 \pm 000	1.6 \pm 0.100	10.392 * **	0.6
16	Zinc(mg)	0.4 \pm 0.100	1.0 \pm 0.00	10.39* **	0.6

** Significant at 1 per cent *significant at 5 per cent NS - Non significant

From the result it was found that obtained values for manganese, copper and zinc of sweet biscuits incorporated with pumpkin seeds flour were more when compared with sweet biscuits prepared without incorporation of pumpkin seeds flour. On the whole it can be conclude that incorporation of pumpkin seeds flour had shown

good enhancement in nutrient content of the sweet biscuits.

4.4.2 Nutritional composition of salt biscuit prepared without and with incorporation of pumpkin seeds flour

The values obtained from nutrient content of salt biscuits are tabulated in Table 4.10 and illustrated in Fig.4.6 prepared without incorporation of pumpkin seeds flour obtained values were 0.69, 2.04, 26.09, 8.26, 59.41, 537 and 0.35 per cent for moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber respectively.

Statistically there was no significant difference observed in moisture, total ash, total fat, protein and energy. Whereas the significant difference was noticed in carbohydrate content among control and pumpkin seed incorporated salt biscuits (10%).

The values of moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber content of salt biscuits(10%) prepared with incorporation of pumpkin seeds flour were found to be 1.85, 2.64, 29.59, 12.34, 57.7, 512.5 and 0.46 per cent respectively. Whereas, the salt biscuits

The values of moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber content of salt biscuits(10%) prepared with incorporation of pumpkin seeds flour were found to be 1.85, 2.64, 29.59, 12.34, 57.7, 512.5 and 0.46 per cent respectively. Whereas, the salt biscuits prepared without incorporation of pumpkin seeds flour obtained values were 0.69, 2.04, 26.09, 8.26, 59.41, 537 and 0.35 per cent for moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber respectively.

Statistically there was no significant difference observed in moisture, total ash, total fat, protein and energy. Whereas the significant difference was noticed in carbohydrate content among control and pumpkin seed incorporated salt biscuits (10%).

The phosphorus, sodium, potassium, calcium, magnesium, iron, manganese, copper and zinc content of salt biscuits prepared with incorporation of pumpkin seeds flour were 247.2, 796, 232, 183, 73.2, 15.2, 0.03, 4.4 and 1.2 per cent respectively. While, salt biscuits prepared without incorporation of pumpkin seeds flour registered values 107.2, 794, 147.4, 162.7, 27.4, 4.7, 0.02, 1.8 and 0.5mg/100gm for

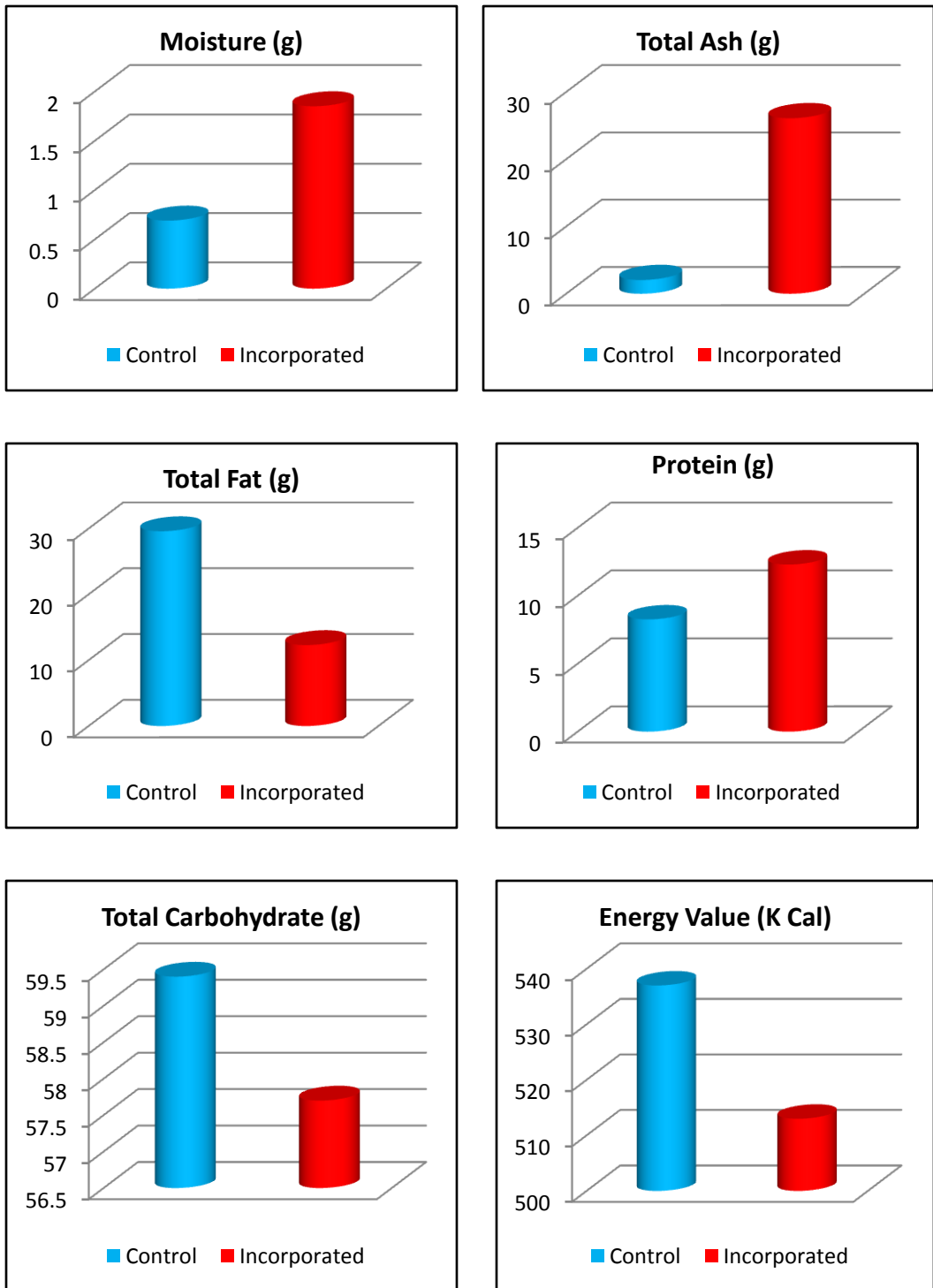


Fig. 4.6 (a): Nutritional composition of Salt biscuit prepared without and with incorporation of pumpkin seeds flour at different level

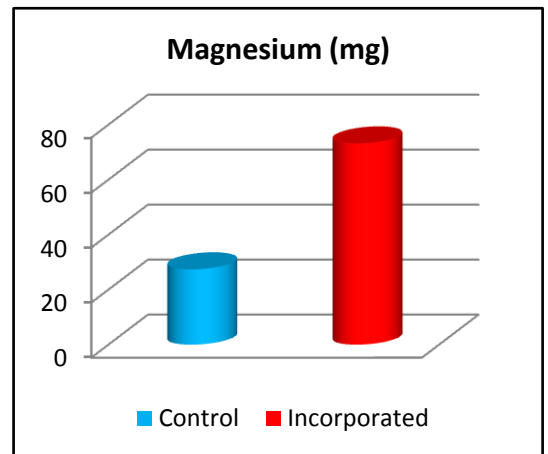
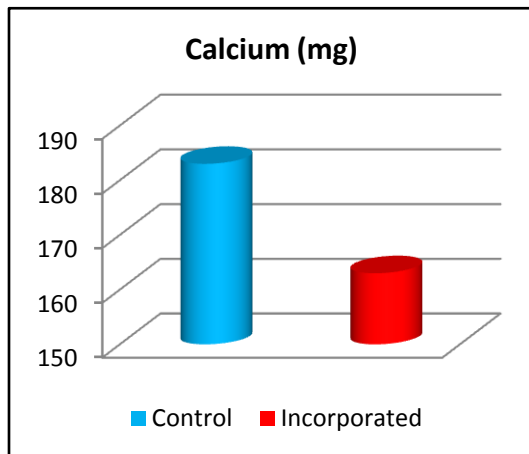
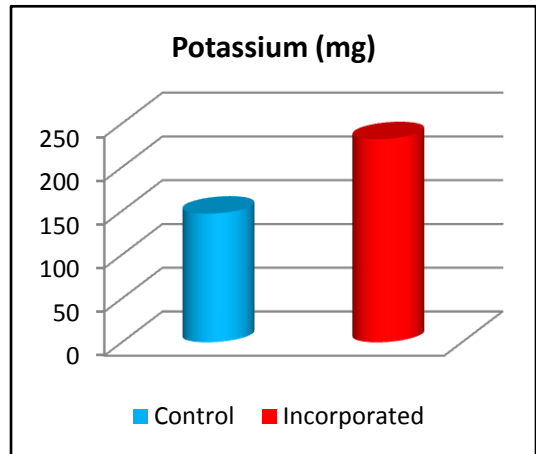
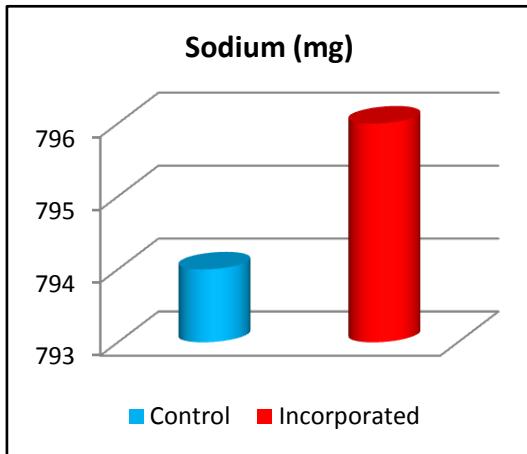
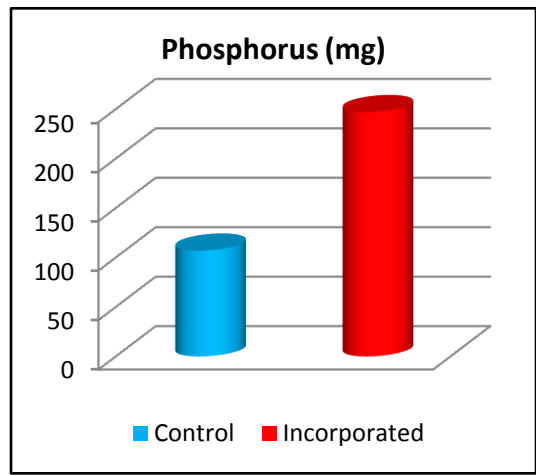
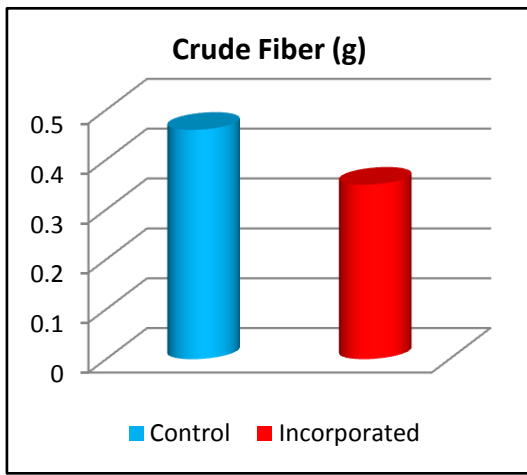


Fig. 4.6 (b): Nutritional composition of Salt biscuit prepared without and with incorporation of pumpkin seeds flour at different level

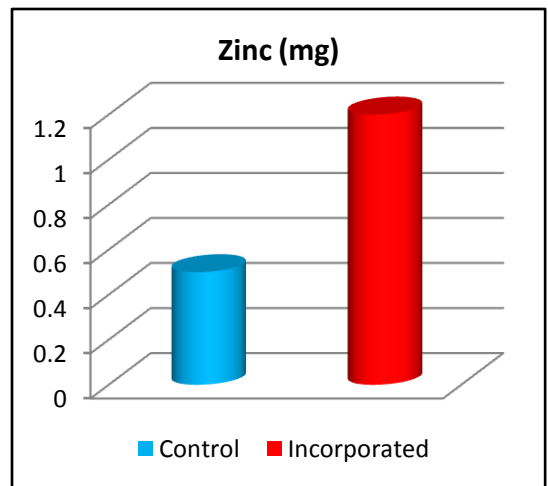
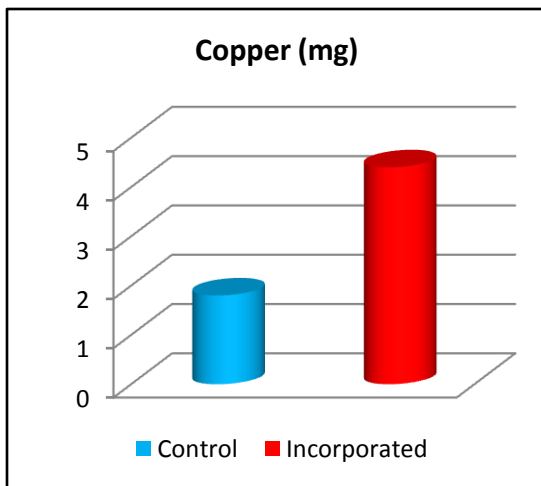
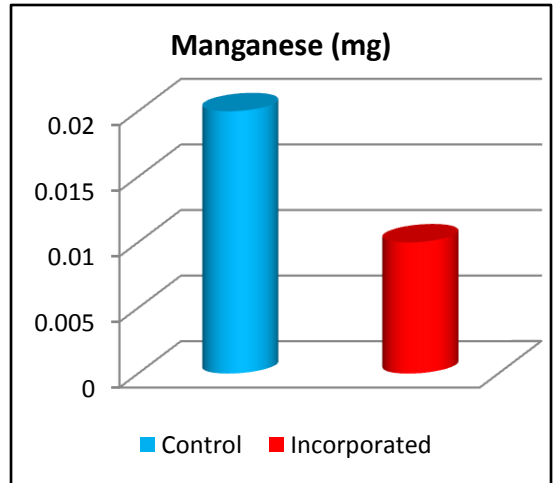
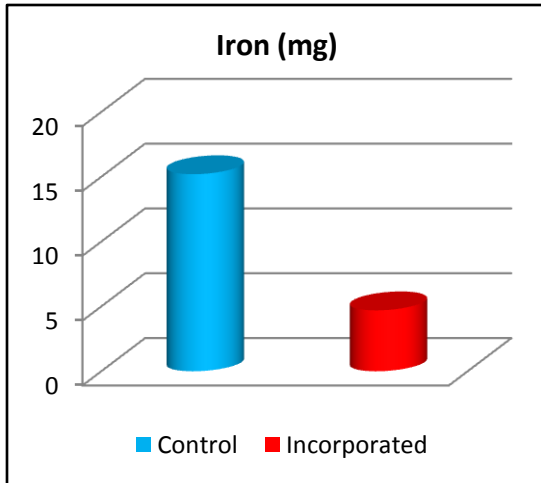


Fig. 4.6 (c): Nutritional composition of salt biscuit prepared without and with incorporation of pumpkin seeds flour at different level

phosphorus, sodium, potassium, calcium, magnesium, iron, manganese, copper and zinc respectively.

Statistical analysis revealed that phosphorus, sodium, calcium, iron and zinc showed the non significant difference, whereas potassium, manganese and copper showed the significant difference among control and pumpkin seeds incorporated salt biscuits.

Table 4.10: Nutritional composition of salt biscuit prepared without and with incorporation of pumpkin seeds flour

Sr. No	Nutrient	Nutrient content		t- value	Increase/ decrease in nutrient content
		Salt biscuits (control) (mean \pm SD)	Salt biscuits (incorporated) (mean \pm SD)		
1	Moisture (g)	0.69 \pm 0.231	1.85 \pm 2.325	0.815 ^{NS}	1.16
2	Total ash (g)	2.04 \pm 0.058	2.64 \pm 2.003	0.509 ^{NS}	0.6
3	Total fat (g)	26.09 \pm 14.42	29.59 \pm 7.09	0.301 ^{NS}	3.5
4	Protein (g)	8.26 \pm 0.643	12.34 \pm 03.101	1.509 ^{NS}	4.80
5	carbohydrate (g)	59.41 \pm 10.066	57.7 \pm 26.577	6.395 ^{**}	1.71
6	Energy value (k cal)	537 \pm 147.585	512.5 \pm 81.739	0.89 ^{NS}	24.5
7	Crud fiber (gm)	0.35 \pm 0.351	0.46 \pm 0.153	0.655 ^{NS}	0.11
8	Phosphorus (mg)	107.2 \pm 39.068	247.2 \pm 118.327	1.649 ^{NS}	140
9	Sodium (mg)	794 \pm 100.539	796 \pm 131.149	1.059 ^{NS}	2
10	potassium (mg)	147.4 \pm 14.189	232 \pm 2.000	10.772 ^{**}	84.4
11	Calcium (mg)	162.7 \pm 39.837	183 \pm 1.000	0.889 ^{NS}	20.3
12	Magnesium (mg)	27.4 \pm 6.429	73.2 \pm 1.000	13.910 ^{**}	45.8
13	Iron (mg)	4.7 \pm 11.533	15.2 \pm 3.039	0.670 ^{NS}	10.5
14	Manganese (mg)	0.02 \pm 0.010	0.03 \pm 0.020	1.000	0.009
15	Copper (mg)	1.8 \pm 2.117	4.4 \pm 0.100	2.107 [*]	2.6
16	Zinc(mg)	0.5 \pm 0.723	1.2 \pm 0.608	10.848 ^{NS}	0.7

** Significant at 1 per cent

*significant at 5 per cent

NS - Non significant

4.4.3 Nutrient content of *Nankhatai* prepared without and with incorporation of pumpkin seeds flour are tabulated in Table 4.11 and illustrated in Fig 4.11

Nutrient content of *nankhatai* prepared with and without incorporation of pumpkin seeds flour are tabulated in Table 4.11 and illustrated in Fig 4.7.

Table 4.11: Nutritional composition of *Nankatai* prepared without and with incorporation of pumpkin seeds flour

Sr. No	Nutrient	Nutrient content		t- value	Increase/ decrease in nutrient Content
		<i>Nankhatai</i> (control) (mean \pm SD)	<i>Nankhatai</i> (incorporated) (mean \pm SD)		
1	Moisture (g)	0.85 \pm 0.050	0.86 \pm 0.029	0.378 ^{NS}	0.01
2	Total ash (g)	0.50 \pm 0.300	0.75 \pm 0.123	1.419 ^{NS}	0.25
3	Total fat (g)	28.82 \pm 14.00	26.92 \pm 14.799	1.517 ^{NS}	1.9
4	Protein (g)	5.63 \pm 0.352	9.24 \pm 2.36	2.510 ^{NS}	3.61
5	carbohydrate (g)	64.20 \pm 56.42	62.24 \pm 19.559	0.047 ^{NS}	1.96
6	Energy value (k cal)	538.7 \pm 139.92	528.2 \pm 149.17	1.00 ^{NS}	10.5
7	Crud fiber (gm)	0.01 \pm 0.002	0.03 \pm 0.020	2.330 ^{NS}	0.028
8	Phosphorus (mg)	56.38 \pm 14.86	169.6 \pm 17.95	9.905*	113.22
9	Sodium (mg)	192 \pm 10.58	172.1 \pm 13.093	1.464 ^{NS}	19.9
10	potassium (mg)	38.53 \pm 0.721	143.3 \pm 18.275	25.344**	104.8
11	Calcium (mg)	310.8 \pm 113.97	321.4 \pm 25.766	0.198 ^{NS}	10.6
12	Magnesium (mg)	46.6 \pm 12.58	34.7 \pm 14.68	0.764 ^{NS}	11.6
13	Iron (mg)	7.8 \pm 0.721	11.8 \pm 3.704	1.567 ^{NS}	4
14	Manganese (mg)	0.01 \pm 0.003	0.01 \pm 0.004	0.225 ^{NS}	0.004
15	Copper (mg)	2.0 \pm 0.500	2.0 \pm 0.200	2.774 ^{NS}	1
16	Zinc(mg)	0.01 \pm 0.002	3.3 \pm 1.082	5.271*	3.3

** Significant at 1 per cent *significant at 5 per cent NS - Non significant

The moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber content of *nankhatai* prepared with incorporation of pumpkin seeds flour were found to be 0.86, 0.75, 26.92, 9.25, 62.24, 528.2, 0.03 per cent respectively. Whereas, the *nankhatai* prepared without incorporation of pumpkin seeds flour obtained values were 0.85, 0.50, 28.82, 5.63, 64.20, 538.7, 0.01 per cent for moisture, total ash, total

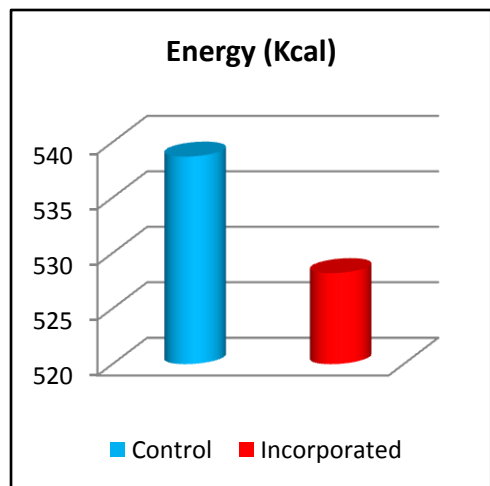
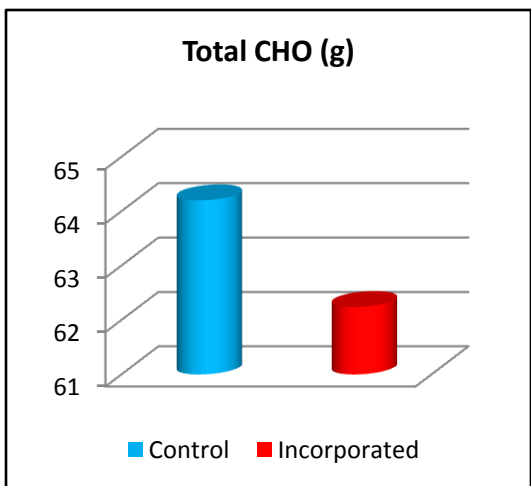
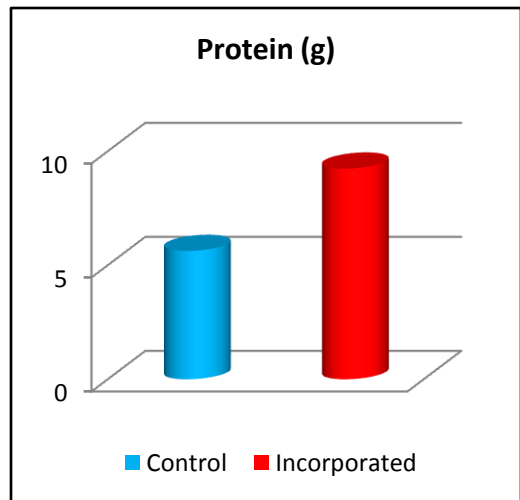
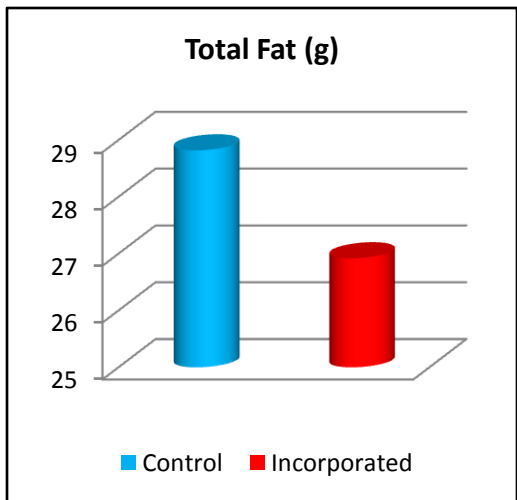
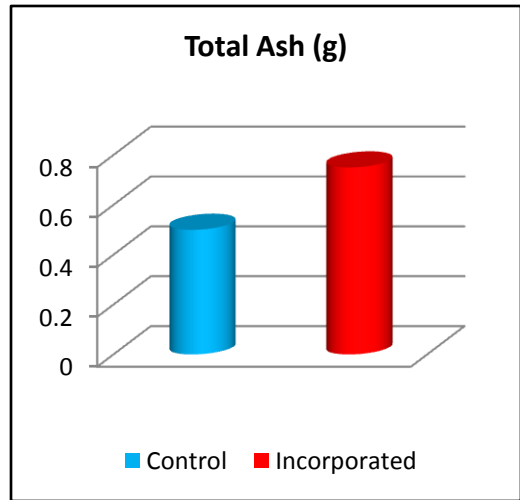
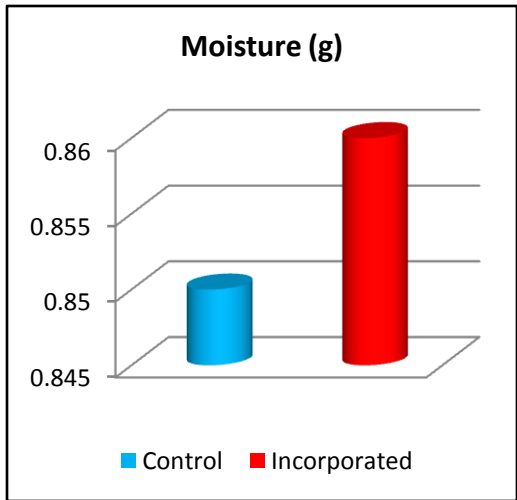


Fig. 4.7 (a): Nutritional composition of *Nankhatai* prepared without and with incorporation of pumpkin seeds flour at different level

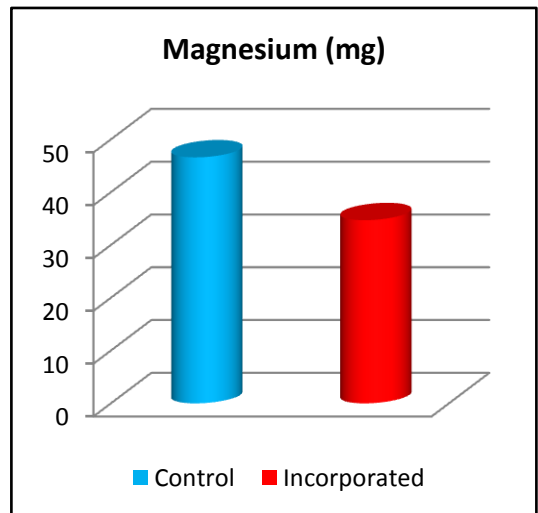
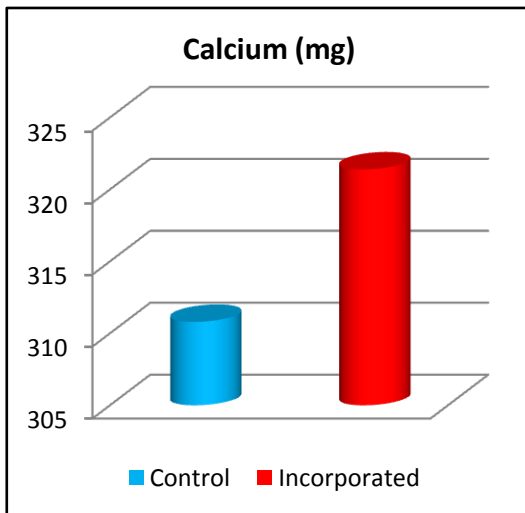
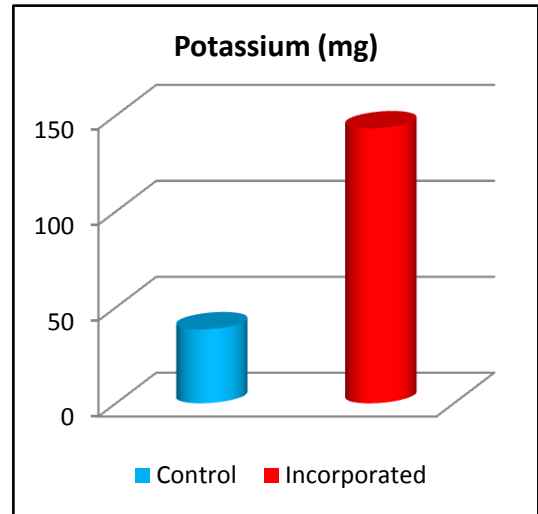
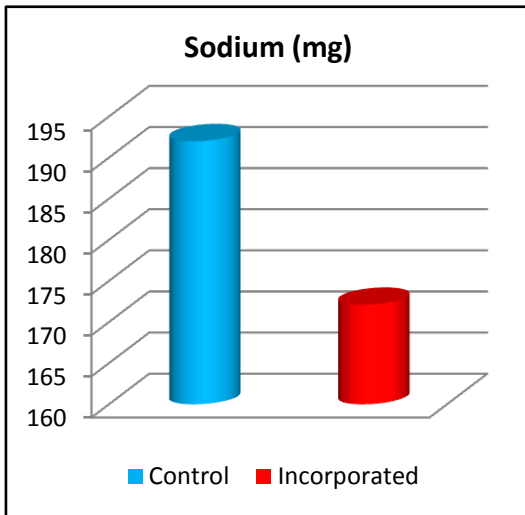
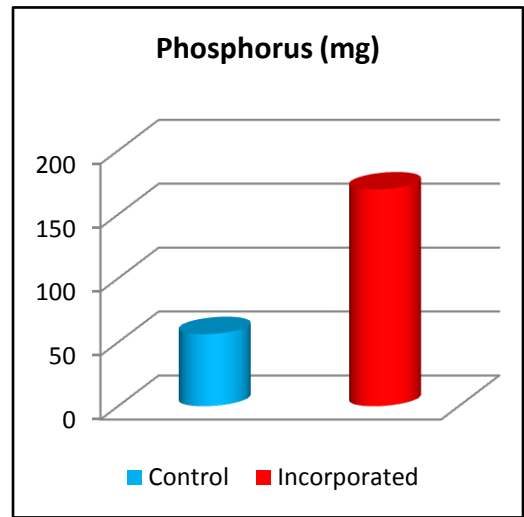
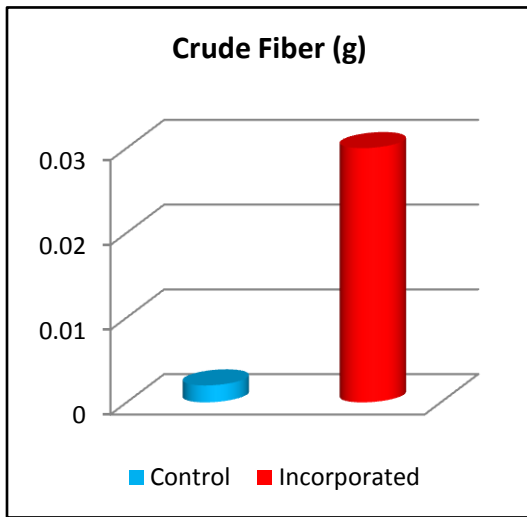


Fig. 4.7 (b): Nutritional composition of *Nankhatai* prepared without and with incorporation of pumpkin seeds flour at different level

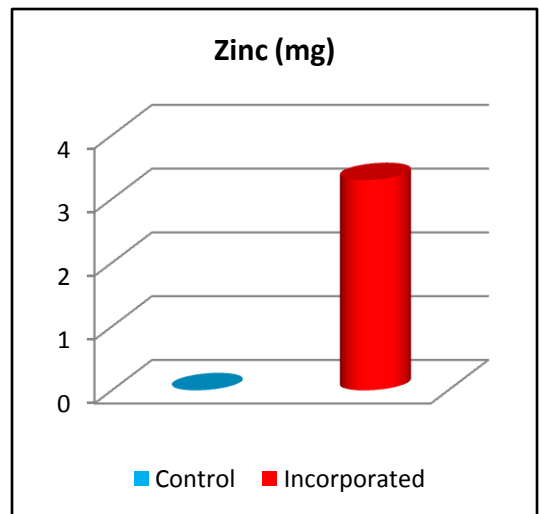
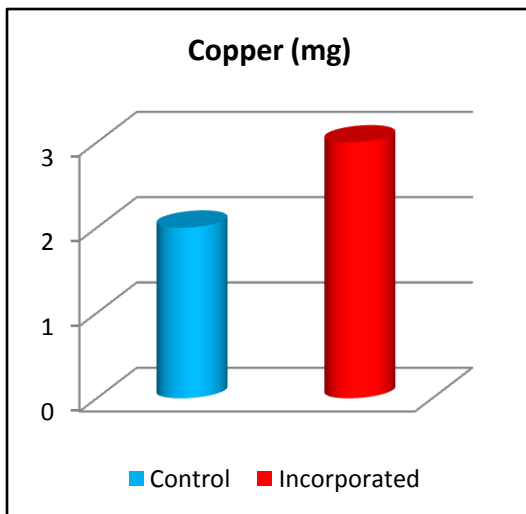
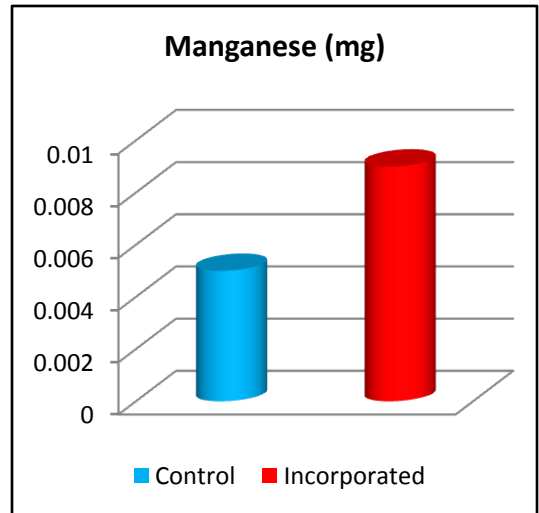
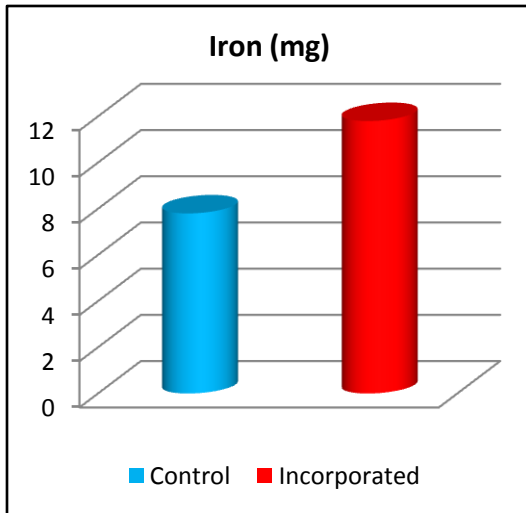


Fig. 4.7 (c): Nutritional composition of *Nankhatai* prepared without and with incorporation of pumpkin seeds flour at different level

fat, protein, carbohydrate, energy and crude fiber respectively.

Statistical analysis revealed that moisture; total ash, total fat, protein, carbohydrates, energy and crude fibers showed the non significant difference among control and pumpkin seeds incorporated *nankatai* (10%).

The improved in phosphorus, potassium, calcium, iron, copper, manganese and zinc content was noticed in pumpkin seeds incorporated *nankatai* (10%) compare to control. The values were mentioned showed in Table 4.11.

Statistically there is no significant difference in sodium, calcium, magnesium, iron, manganese and copper, whereas Phosphorus, potassium and zinc showed the significant difference among control and pumpkin seeds incorporated *nankatai* (10%).

4.4.4 Nutritional composition of cupcake prepared without and with incorporation of pumpkin seeds flour

Nutrient content of *nankhatai* prepared with and without incorporation of pumpkin seeds flour are tabulated in Table 4.12 and illustrated in Fig 4.8.

The moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber content of cup cake prepared with incorporation of pumpkin seeds flour (15%) were found to be 19.92, 2.33, 21.76, 13.69, 42.3, 419 and 0.07 per cent respectively. Whereas, the cup cake prepared without incorporation of pumpkin seeds flour obtained values were 20.8, 1.68, 20.51, 9.04, 48.19, 413.6, 0.01 per cent for moisture, total ash, total fat, protein, carbohydrate, energy and crude fiber respectively. Improvement in total ash, total fat, protein, energy and crude fiber were noticed in pumpkin seeds incorporated cupcake (15%) compare to control.

Statistically there is no significant difference in moisture, total ash, and total fat values, whereas protein, carbohydrates, energy and fibre noticed the significant difference among control and pumpkin seeds incorporated cupcake (15%).

The improvement in phosphorus, potassium, calcium, magnesium, iron and zinc content were from 180.5 to 364, 272.8 to 315.5, 326.1 to 268.3, 24.5 to 184, 7.4 to 10.3 and 0.6 to 1.8mg/100gm respectively. The values of manganese content of control and pumpkin seeds flour incorporated cup cake (15%) was found to be almost same.

Statistical analysis revealed that manganese and copper showed the non significant difference where as Phosphorus, sodium, potassium, calcium, magnesium, iron and zinc showed the significant difference among control and pumpkin seeds flour incorporated cup cake (15%)

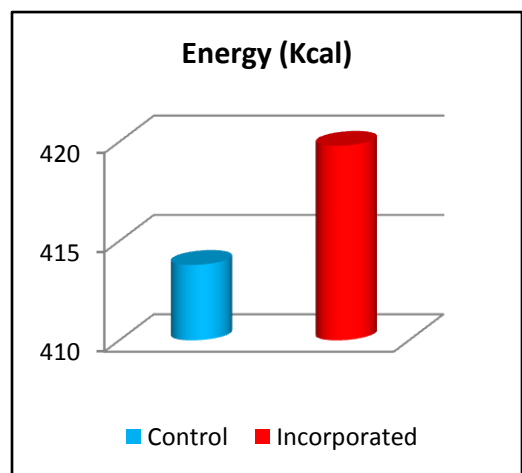
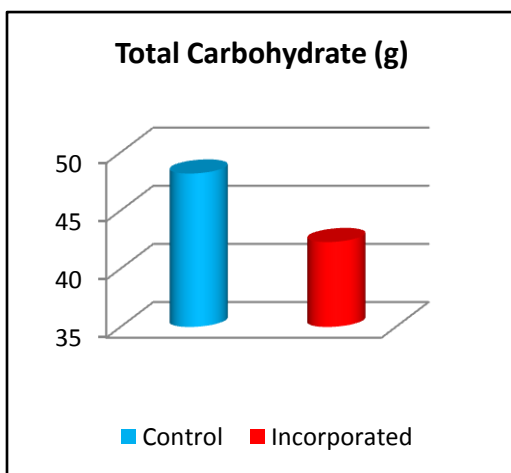
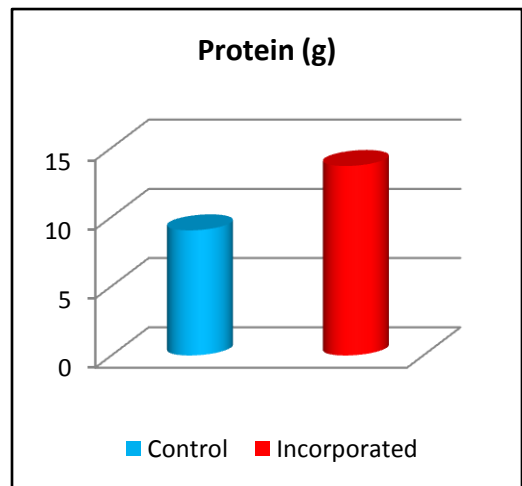
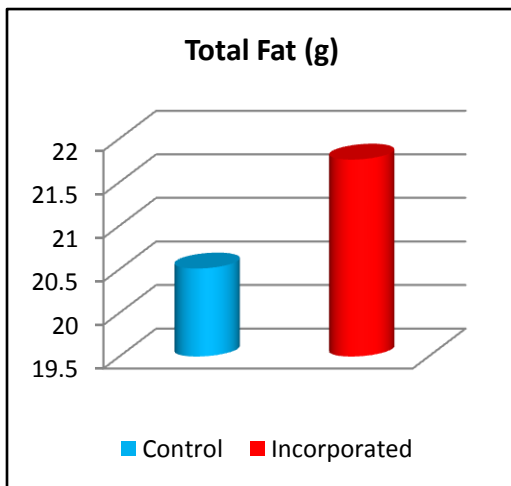
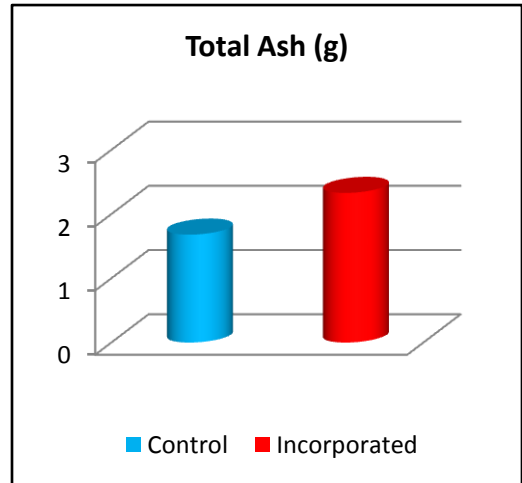
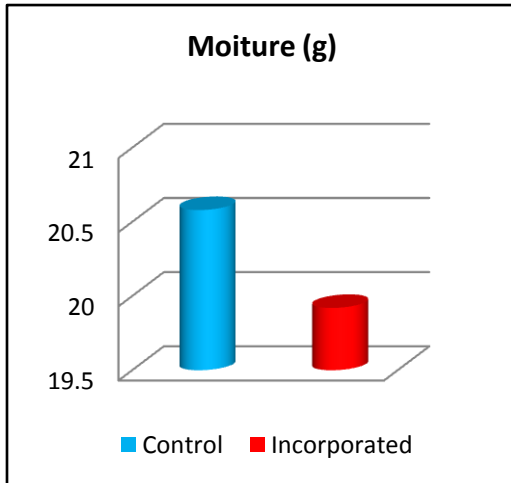


Fig. 4.8 (a): Nutritional composition of Cupcake prepared without and with incorporation of pumpkin seeds flour at different level

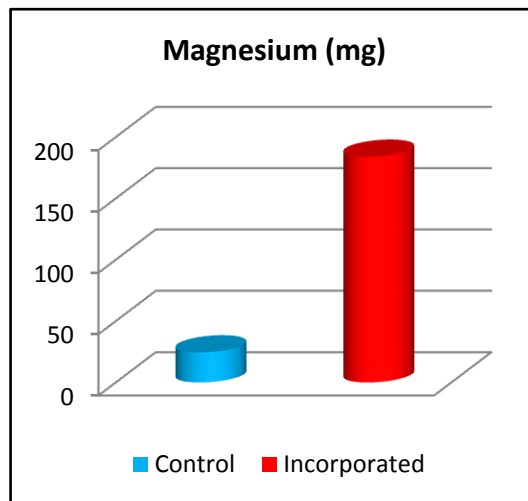
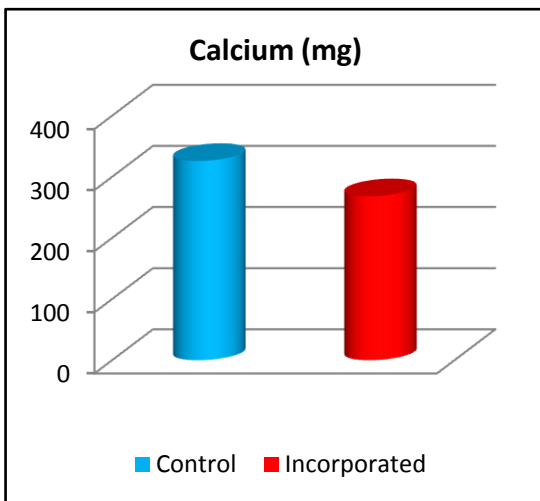
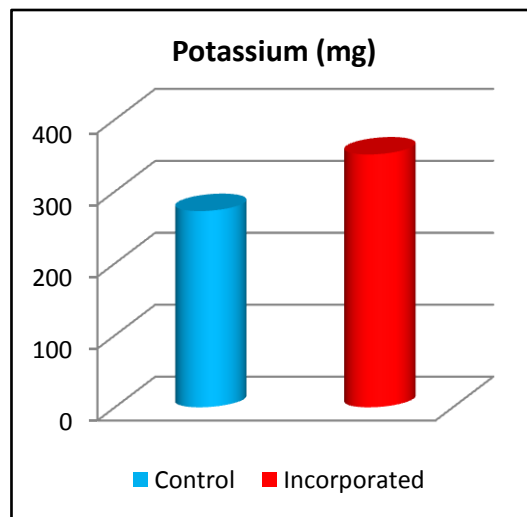
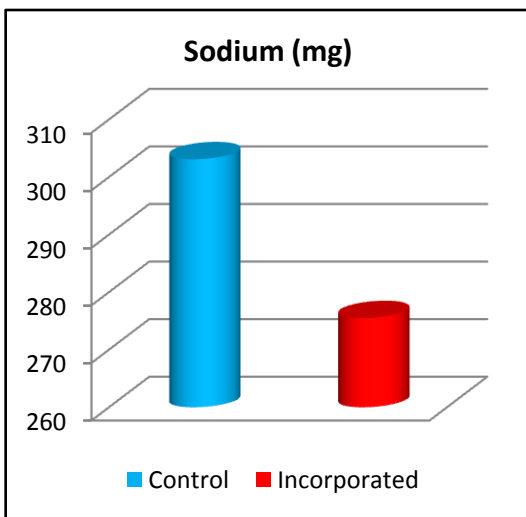
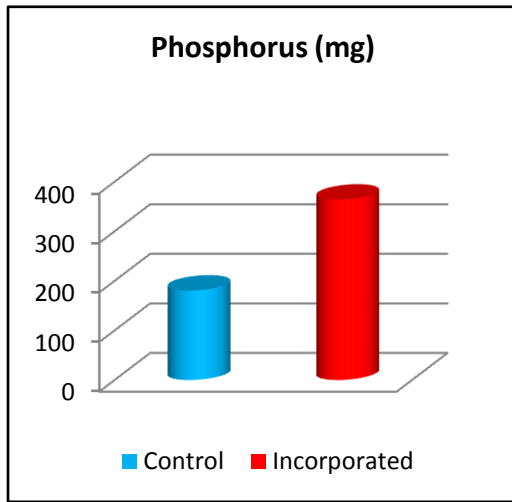
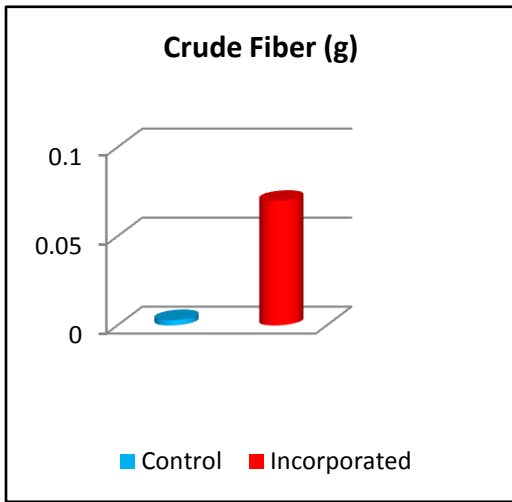


Fig. 4.8 (b): Nutritional composition of Cupcake prepared without and with incorporation of pumpkin seeds flour at different level

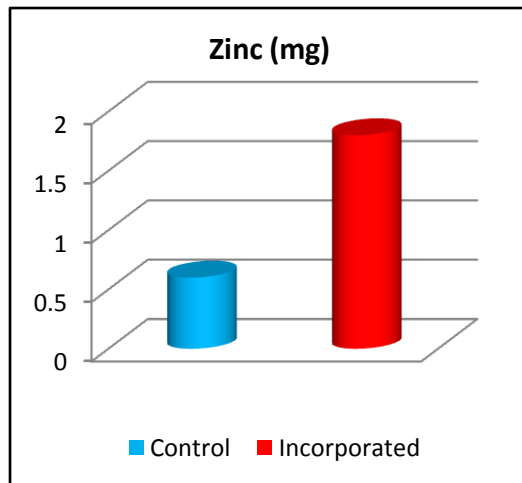
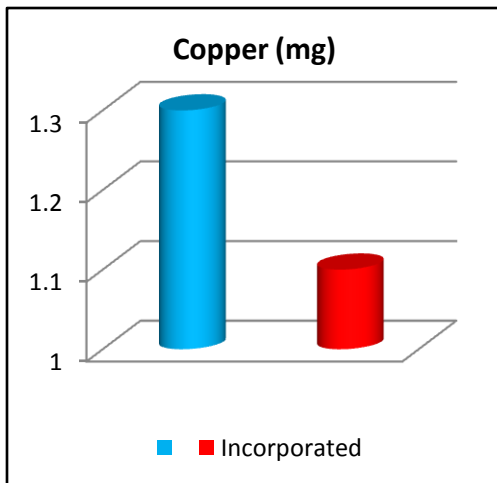
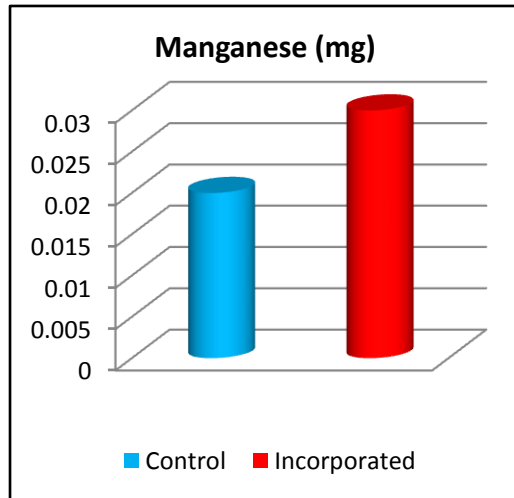
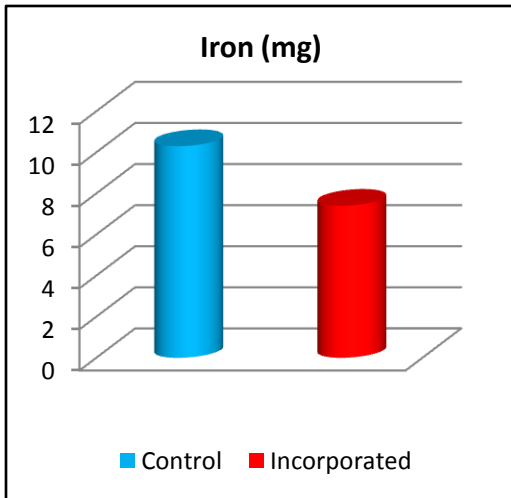


Fig. 4.8 (c): Nutritional composition of Cupcake prepared without and with incorporation of pumpkin seeds flour at different level

Table 4.12: Nutritional composition of cupcake prepared without and with incorporation of pumpkin seeds flour

Sr. No	Nutrient	Nutrient content		t- value	Increase/ decrease in nutrient content
		Cupcake (control) (mean \pm SD)	Cupcake (mean \pm SD)		
1	Moisture (g)	20.8 \pm 1.00	19.92 \pm 1.000	1.431 ^{NS}	0.66
2	Total ash (g)	1.68 \pm 0.010	2.33 \pm 1.000	-1.137 ^{NS}	0.65
3	Total fat (g)	20.51 \pm 1.000	21.76 \pm 1.000	2.165 ^{NS}	1.25
4	Protein (g)	9.04 \pm 1.005	13.69 \pm 1.000	4.650*	4.65
5	carbohydrate (g)	48.19 \pm 2.000	42.30 \pm 1.000	10.202**	5.89
6	Energy value (k cal)	413.6 \pm 1.054	419 \pm 1.000	103.923**	6
7	Crud fiber (g)	<0.01 \pm 0.005	0.07 \pm 0.010	12.497**	0.06
8	Phosphorus (mg)	180.5 \pm 1.000	364 \pm 1.000	184**	183.5
9	Sodium (mg)	303.1 \pm 1.000	275.5 \pm 1.000	47.80**	27.6
10	potassium (mg)	272.8 \pm 20.143	315.5 \pm 1.000	7.826*	78.7
11	Calcium (mg)	326.1 \pm 1.054	268.3 \pm 0.833	247.429**	57.8
12	Magnesium (mg)	24.5 \pm 1.000	184 \pm 1.732	276.08**	159.5
13	Iron (mg)	7.4 \pm 0.1	10.3 \pm 1	5.265*	2.9
14	Manganese (mg)	0.02 \pm 0.010	0.03 \pm 0.020	1.00 ^{NS}	0.02
15	Copper	1.3 \pm 0.100	1.1 \pm 0.100	1.732 ^{NS}	0.2
16	Zinc(mg)	0.6 \pm 0.020	1.8 \pm 0.100	32.88**	1.2

** significant at 1 per cent

*significant at 5 per cent NS - Non significant

4.5 Shelf life study of highly accepted bakery products

4.5.1 Shelf life study of sweet biscuits

Sweet biscuits prepared with 10 per cent incorporation of pumpkin seeds flour was store in sealed polyethylene bags at room temperature for 60 days and acceptability was observed periodically. Table 4.13 and illustrated in fig 4.9 explains the data regarding mean sensory score of sweet biscuits before and during storage periods.

Table 4.13: Mean sensory evaluation scores of sweet biscuits during storage

Storage period (Days)	Storage study of sweet Biscuits				
	Colour	Texture	Taste	Flavour	Overall acceptability
Day 1	5	5	5	5	5
Day 15	4.9	4.9	5	5	5
Day 30	4.9	4.9	4.9	5	4.8
Day 45	4.9	4.9	4.9	4.8	4.9
Day 60	4.7	4.7	4.8	4.7	4.7
S.E ±	0.10	0.10	0.08	0.09	0.11
CD	0.12	0.28	0.24	0.25	0.13
F value	1.12	1.12	0.92	2.43	0.19

** significant at 1 per cent *significant at 5 per cent NS - Non significant

From table it can be noticed that as the days of storage increased, the score decreased. The score for colour, texture, flavor and overall acceptability of sweet biscuits decreased significantly from 5 to 4.7, 5 to 4.7, 5 to 4.7 and 5 to 4.7 respectively. Non significantly decrease in score of taste was from 5 to 4.8 during storage. It was found that sweet biscuits was well acceptable even on 60th day also.

Hence it can be concluded that sweet biscuits prepared with 10 per cent of incorporation of pumpkin seeds flour can be stored up to 60th days at room temperature

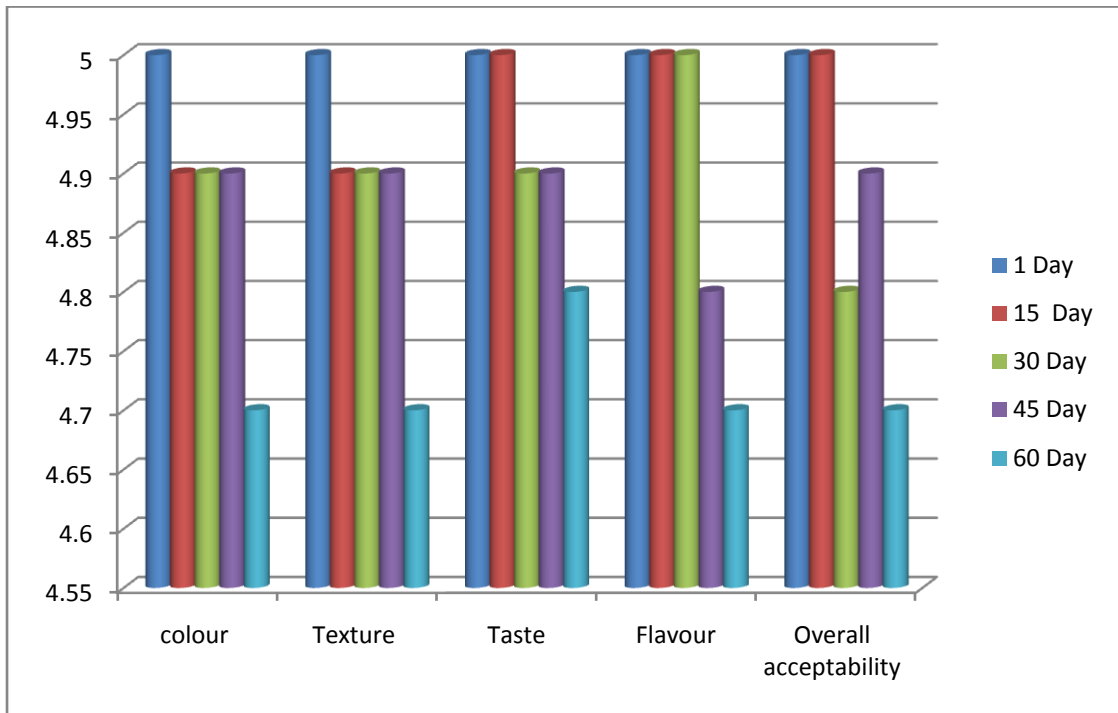


Fig 4.9: Shelf life study of sweet biscuits prepared with incorporation of pumpkin seeds flour

4.5.2 Shelf life study of Salt biscuits biscuits

Salt biscuits prepared with 10 per cent incorporation of pumpkin seeds flour were stored in polyethylene bags at room temperature for 60 days. The results of the mean sensory score evaluation of sweet biscuits from 1 day to 60 days of storage period are presented in the Table 4.14 and illustrated in Fig 4.10

Table 4.14: Mean sensory evaluation scores of salt biscuits during storage

Storage period (Days)	Storage study of salt biscuits				
	Colour	Texture	Taste	Flavour	Overall acceptability
1	5	5	5	5	5
15	4.9	5	5	5	5
30	4.9	5	4.9	4.9	4.9
45	4.9	5	4.9	4.9	4.8
60	4.9	4.9	4.9	4.8	4.8
S.E ±	0.04	0.08	0.07	0.08	0.09
CD	0.12	0.24	0.21	0.24	0.26
F- value	1.00	0.25	0.50	0.92	1.09

** significant at 1 per cent *significant at 5 per cent NS - Non significant

The score for the colour of salt biscuits ranged from 5 to 4.9 during storage on 1st day to 60th days. The score for texture of salt biscuit ranged from 5 to 4.9. There was not much difference observed in score of texture up to 60 days of storage.

Result indicated that scores for taste, flavour and overall acceptability of salt biscuit were ranged from 5 to 4.9, 5 to 4.8 and 5 to 4.8 respectively.

Statistical result showed that there was a non significant difference among the all scores for colour, texture, taste, flavour and overall acceptability during storage.

Hence, from the findings it observed that salt biscuits 10 per cent incorporation of pumpkin seeds flour can be stored up to 60 days

4.5.3 Shelf life study of Nankhatai

Nankhatai prepared with 10 per cent incorporation of pumpkin seeds flour was store in zip lock polyethylene bags at room temperature for 60 days and acceptability was accessed periodically. The results of the mean sensory score evaluation of *nankhatai* from 1 day to 60 days of storage period are presented in the Table 4.14 and illustrated in Fig 4.11

Table 4.15: Mean sensory evaluation scores of *Nankhatai* during storage

Storage period (Days)	Storage study of <i>Nankhatai</i>				
	Colour	Texture	Taste	Flavour	Overall acceptability
1	5	5	5	5	5
15	4.9	5	5	5	5
30	4.9	5	4.9	5	4.9
45	4.9	4.9	4.9	4.9	4.9
60	4.9	4.8	4.9	4.6	4.8
S.E ±	0.08	0.08	0.07	0.08	0.08
CD	0.24	0.24	0.21	0.23	0.24
F- value	0.25	0.92	0.50	4.09	0.92

** Significant at 1 per cent *Significant at 5 per cent NS - Non significant

Result indicated that scores for colour, texture and taste of *nankhatai* were ranged from 5 to 4.9, 5 to 4.8 and 5 to 4.9 respectively.

The score for flavour of *nankhatai* was 5, 5, 5, 4.9 and 4.6 on 1st, 15th, 30th, 45th and 60th day of storage respectively. On the other hand the score for overall acceptability of *nankhatai* was 5, 5, 4.9, 4.9 and 4.8 on 1st, 15th, 30th, 45th and 60th day of storage respectively.

Statistical result showed that there was a non significant difference among the all scores for colour, texture, taste and overall acceptability during storage. The score reduced significantly on 60th day for flavour. It was found that nankatai was well acceptable even on 60th day also.

It was concluded that *nankhatai* prepared with 10 per cent incorporation of pumpkin seeds flour can be stored up to 60 days.

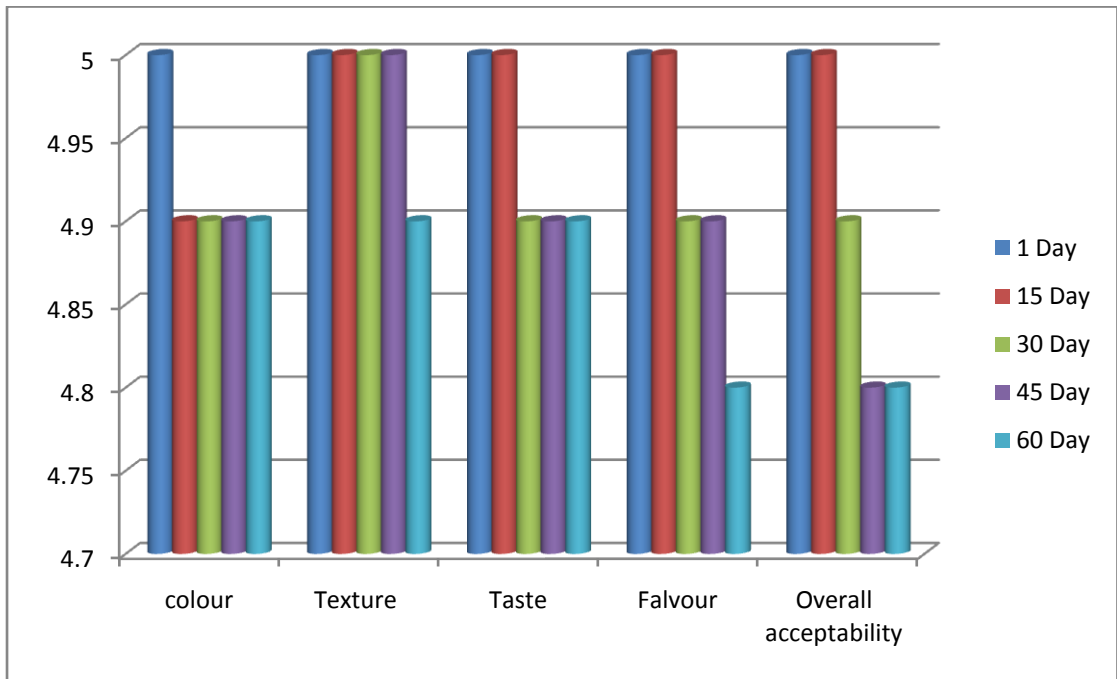


Fig 4.10: Shelf life study of salt biscuits prepared with incorporation of pumpkin seeds flour

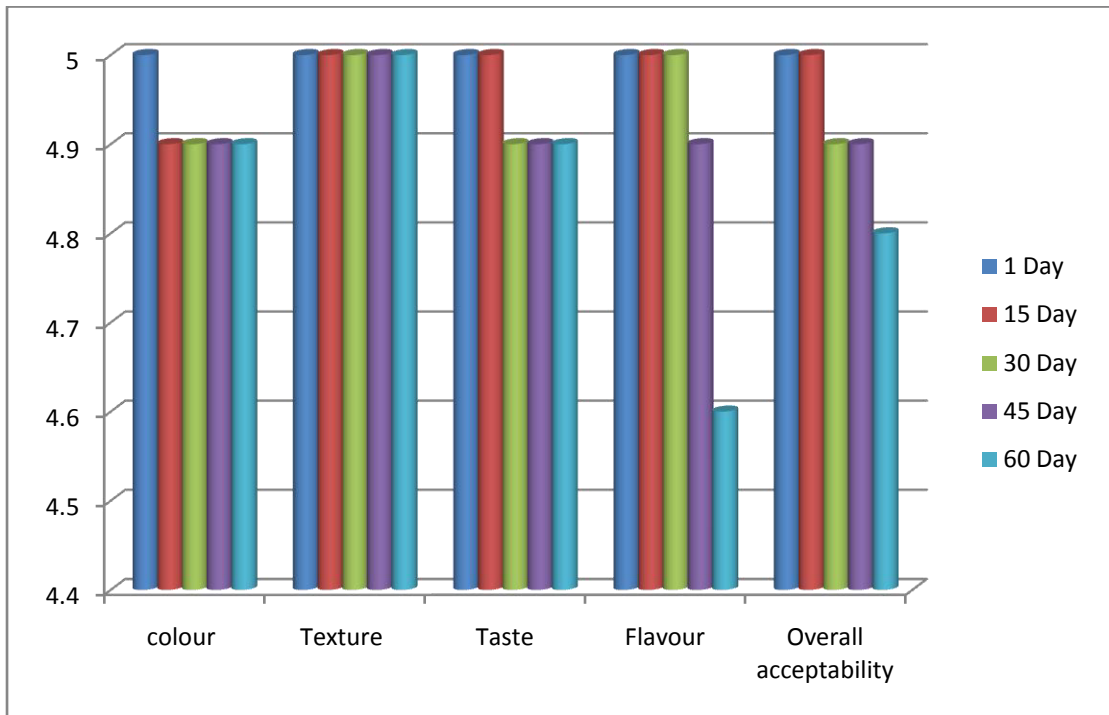


Fig 4.11: Shelf life study of *Nankhatai* prepared with incorporation of pumpkin seeds flour

4.5.4 Shelf life study of Cup cake

Cupcake prepared with 15 per cent incorporation of pumpkin seeds flour was store in air tight polyethylene bags at room temperature for 8 days and acceptability was accessed every day. Table 4.16 and Fig. 4.12 explain the data about mean sensory score of cupcake before and during the storage period.

Table 4.16: mean sensory evaluation scores of cupcake during storage

Storage period (Days)	Storage study of cup cake				
	Colour	Texture	Taste	Flavour	Overall acceptability
1	5	5	5	5	5
2	5	5	5	5	5
3	5	5	5	5	5
4	5	5	5	5	4.9
5	5	4.9	5	4.9	4.9
6	5	4.9	4.9	4.9	4.8
7	4.9	4.9	4.9	4.8	4.8
8	4.7	4.8	4.9	4.8	4.8
S.E ±	0.064	0.07	0.06	0.08	0.09
CD	0.17	0.21	0.16	0.23	2.60
F- value	2.74	0.92	0.71	1.13	0.93

** Significant at 1 per cent *Significant at 5 per cent NS - Non significant

Sensory score for colour was decreased from 5 to 4.7 from 1st to 8th day where statistical analysis revealed that all the score were differed non significantly from each other except the score reduced significantly on 8th day for colour.

The scores for the texture, taste, flavor and overall acceptability of cupcake were decreased from 5 to 4.8, 5 to 4.9, 5 to 4.8 and 5 to 4.8 respectively from 1st day to 8th day of storage period.

Statistical analysis showed that the scores for texture, taste, flavor and overall acceptability decreased non significant and significant difference was noticed in colour from 1st to 8th days of storage.

It was noticed that stored cup cake was well accepted up to 8 days. Hence it can be suggested that cupcake prepared with 15 per cent incorporation of pumpkin seeds flour can be stored up to 8 days at room temperature.

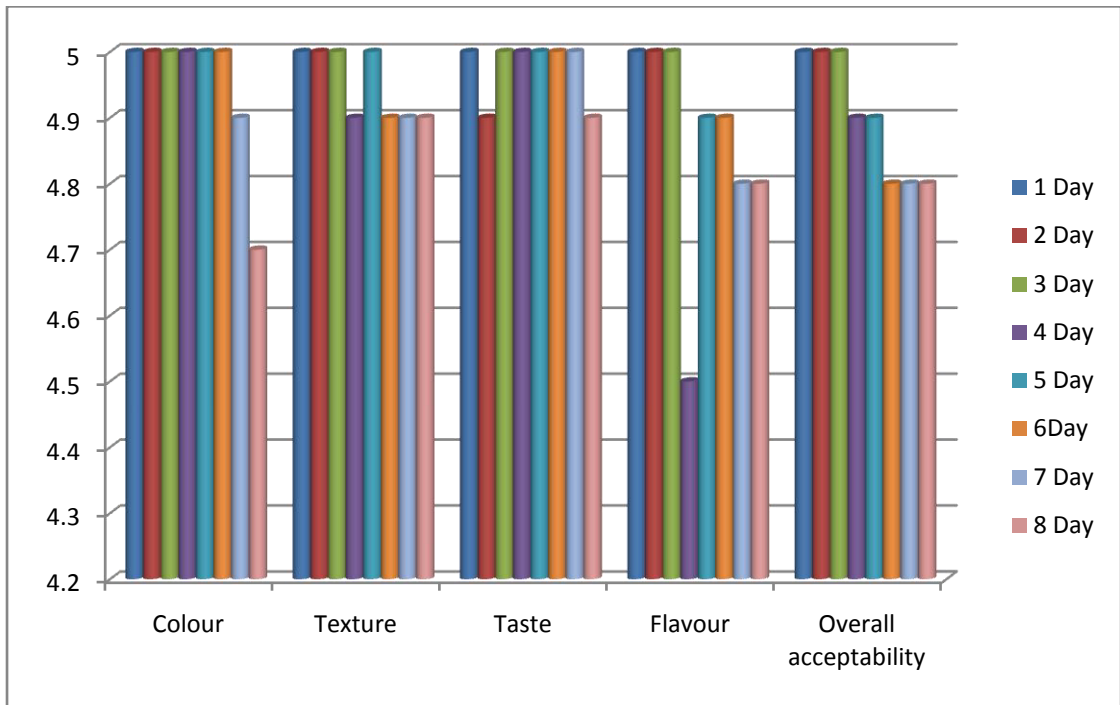


Fig 4.1: Shelf life study of Cup cake prepared with incorporation of pumpkin seeds flour

CHAPTER -V
SUMMARY AND CONCLUSION

CHAPTER - V

SUMMARY AND CONCLUSION

Pumpkin seeds are loaded with nutrients and medicinal properties due to which these seeds are used for remedial purposes all over the world (Al-khalifa et al 1996)

The present study was carried out in two phases. In first phase of experiment, a survey of fifty households was conducted to elicit the information about socio economic status of households, consumption pattern of pumpkin seeds and awareness regarding nutritional health benefits of pumpkin seeds among the population. In the second phase four different products namely sweet biscuits, salt biscuits, *nankhatai* and cupcake were prepared without and with incorporation of 5, 10 and 15 percent pumpkin seeds flour. Major ingredient (*maida*) refined wheat flour was replaced by incorporating pumpkin seeds flour in the preparation of bakery products. The prepared bakery products were evaluated for their sensory characteristics by using 5 point hedonic scale. The nutrient analysis of highly accepted bakery products were stored in polyethylene bag at room temperature for evaluation of shelf life. Sweet biscuits, salt biscuits and *nankhatai* were stored up to 60 days and acceptability was evaluated at the interval of 15 days. While cupcake was stored up to 8 day and its acceptability was evaluated at every day.

Consumption pattern of pumpkin seeds showed that only (46%) household consumed pumpkin seed and mostly them (44%) consumed in the raw form.

Result showed that 92 percent households were unaware about value addition of pumpkin seeds in the bakery products, 16 percent household were aware about the usefulness of pumpkin seeds for health and only 18 percent were knew that pumpkin seeds are nutritious.

Sweet biscuits prepared with 10 per cent level of incorporation of pumpkin seeds flour was obtained highest score than the remaining variations. In terms of overall acceptability, sweet biscuits prepared with 10 percent level of incorporation of pumpkin seeds flour secured maximum score (4.9) than 5 and 15 percent level of incorporation of pumpkin seeds flour. Hence, it was noted that sweet biscuits prepared with 10 percent incorporation of pumpkin seeds flour was highly acceptable.

In case of salt biscuits, the score for overall acceptability of salt biscuit prepared without and with incorporation of pumpkin seeds flour at different were ranging from 5 to 4.7. Maximum score (5) for overall acceptability was secured by control salt biscuits. From the result of sensory evaluation it was observed that salt biscuits prepared with 10 percent incorporation of pumpkin seeds flour was found to be most acceptable.

Nankhatai prepared with 10 per cent level of incorporation of pumpkin seeds flour obtained highest score for all evaluated organoleptic characteristics. The score obtained for all sensory characteristics of *nankhatai* prepared with incorporation of 10 per cent level of pumpkin seeds flour was 4.9.

The cupcake prepared with 15 per cent level of incorporation of pumpkin seeds flour ranked higher than the remaining variations. The score obtained for colour, texture, taste, flavour and overall acceptability of cupcake were 4.8,4.9 ,4.9,& 4.9 respectively. The mean value of overall acceptability of cupcake prepared with different level of incorporating pumpkin seeds flour were ranging from 5 to 4.7. Cupcake prepared with 15 per cent level of incorporation of pumpkin seeds flour was highly acceptable in terms of all sensory characteristics.

The nutrient analysis of pumpkin seeds flour incorporated sweet biscuits showed that the of ash (1.20%), fat (24.89%), protein (10.26), energy (516), and crude fiber (0.14%) respectively and minerals such as phosphorus (192%), sodium (335%), potassium (162%), calcium (116.5%), magnesium (97.9%), iron (7.4%), manganese (0.01%), copper (1.6%) and zinc (1.0%) content of sweet biscuits prepared with incorporation of pumpkin seeds flour were more in sweet biscuits prepared without incorporation of pumpkin seeds flour. While moisture (0.83%) and carbohydrate (62.81%) content of sweet biscuits prepared with incorporation of pumpkin seeds flour were decrease.

The observations recorded for nutrient analysis of control and incorporated salt biscuits proved that the moisture (1.85%), ash (2.64%), fat (29.59) , protein (12.43%), fiber (0.46%) respectively whereas phosphorus (247.2%), sodium (796%), potassium (232%), magnesium (73.2%), calcium (183%), iron (15.2%), manganese (0.03%), copper (4.4%) and zinc (1.2%) Content of salt biscuits prepared with incorporation of pumpkin seeds flour was more than that of salt biscuits prepared

without incorporation of pumpkin seeds flour. Whereas, carbohydrate and energy value of salt biscuits prepared with incorporation of pumpkin seeds flour was found less than that of salt biscuits prepared without incorporation of pumpkin seeds flour. It was found that moisture, ash, fat, protein, energy, fiber content of salt biscuits prepared with incorporation of pumpkin seeds flour were increased non significantly. The phosphorus, sodium, calcium, iron, manganese and zinc increased non significantly.

The result of nutrient analysis indicated that the content of moisture (0.86%), ash (0.75%), protein (9.24%), fiber (0.03%) were higher than that of *nankhatai* prepared with incorporation of pumpkin seeds flour were higher than that of *nankhatai* prepared without incorporation of pumpkin seeds flour. Whereas fat, carbohydrate and energy decreased in *nankhatai* prepared with incorporation of pumpkin seeds flour. Phosphorus, potassium, calcium, magnesium, iron, copper and zinc were increased in incorporated pumpkin seeds flour than the control. All statistical analysis showed that nutrient are non significant except phosphorus and potassium and zinc.

Carbohydrate (48.19%), sodium (303.1%), calcium (326.1), copper (1.3%). The value obtained for moisture, ash, fat, protein, fiber phosphorus, sodium, potassium, magnesium, manganese, and zinc were increased in cupcake prepared with incorporation of pumpkin seeds flour was found to higher than control except moisture (20.8%), carbohydrate (48.19%) and iron (10.3) .

It was observed that Moisture, ash, fat, manganese, copper were non significant but remaining all nutrient are significantly increased.

The storage study indicated that sweet biscuits, salt biscuits and *nankhatai* prepared with 10 per cent incorporation of pumpkin seeds flour can be stored up to 60 days at room temperature in zip lock bag . The sweet biscuits, salt biscuits and *nankhatai* prepared with 10 per cent level of incorporation of pumpkin seeds flour had good storage stability.

The shelf life study indicated that cup cake prepared with 15 per cent level of incorporation of pumpkin seeds flour could be stored up to 8 days in polyethylene bag at room temperature.

The nutrient composition analysis of pumpkin seeds showed that these are very nutritious and provide many essential nutrients for health. However, the pumpkin seeds have been used for medicinal purpose and these possess also nutritional and therapeutic importance. The pumpkin seeds play a significant role in providing of micronutrients and also used in treatment and management of diabetes, inflammation, hyperlipidemia, hypertension, cancer management and protect heart etc. (Kalogropoulos, 2013).

The above research confirmed that the pumpkin seeds have nutritional and therapeutic importance as well as these are also served as delicious food in many regions of the globe.

From the present research study it can be concluded that Pumpkin seeds flour using bakery products improved the nutritional composition and also it can be incorporated up to 10 to 15 per cent in selected bakery products and the sensory scores of all selected bakery products were more than 4.5 per cent with incorporation of pumpkin seeds flour.

The pumpkin seeds flour incorporated bakery products can be stored up to 60 days in the acceptable range except cup cake.

- Pumpkin seeds are uncommon, low cost seeds, most of households not aware about value addition of pumpkin seeds flour.
- Pumpkin seeds is contained high amounts of nutrients, they can be consumed raw, roasted, and powder formed.
- Consumption of Pumpkin seeds flour supplemented products should be encouraged in routine diet so as to improve the nutritional status of the individuals.
- Pumpkin seeds are rich natural source of protein with the range of (25% to 37%) and oil with range of (37 to 45%). They are renowned as valuable oil seeds loaded with protein for human consumption (Milovanic et al.,2008)
- Pumpkin seeds are loaded with amino acids like tryptophan, lysine, methionine, tyrosine and also rich in iron, therefore these seeds are beneficial to adolescents to cure anemia caused due to iron deficiencies (El-Adawy et al.,2001).

- Seeds are excellent nutrient source filled with minerals mainly zinc, phosphorus, magnesium, potassium and selenium that can act as weapon for fighting diseases such as arthrities, inflammation, prostate cancer etc (Patel and Rauf,2017)
- Pumpkin seeds contain (31.48%) crude fiber (Nyamet et al,2013) and it will prevent constipation, diabetes, prolong intestinal transit time, lower cholesterol level and provide satiety.
- Inclusion of pumpkin seeds in our regular diet have been associated to lower the chances of occurrence of many types of cancer like colorectal, lung, breast, breast and gastric cancer (Huang et al.2004)
- In addition they are good sources of vitamins and mono unsaturated fatty acids which are good for heart health (Kairi et al, 2014)
- Consumption of pumpkin seeds flour value added products should be encouraged for supplementary feeding program to improve the nutritional status of the individuals
- Developed value added products can be very much useful in combating the macronutrients and micronutrients deficiency problems.

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APPENDICES

APPNMDIX-I

Interview schedule to study the awareness and frequency of Consumption pattern of pumpkin seeds

A) General Information

1. Name :

2. Age:

3. Gender

4. Address :

5. Type of family: 1) Nuclear 2) Joint 3) Extended

6. Size of family: 1) Small family (1-4)
2) Medium family (5-8)
3) Large (above 8)

7. Monthly Income :

Group I (< Rs 10,000)	
Group II (Rs.10,000-20,000)	
Group III (Rs.20,000-30,000)	
Group IV (>Rs. 40,000)	

8. Information about family

Sr . No.	Name of the family member	Age	Sex	Education	Occupation

9. Food habit : 1) Vegetarian 2) Non vegetarian

B) Information regarding consumption

10. Do you know about uncommon edible seeds? Yes /No

8. If yes, what are those?

.....
.....

9. Do you consume pumpkin seeds? Yes /No

10. Do you know the nutrient content of pumpkin seeds? Yes/No

11. Where do you most often purchase pumpkin seeds

Grocery Store

Own Farm

Farmers

Other

12. In which form you consumed pumpkin seeds?

Raw

Powder

Any other

13. Do you know about value addition of products with pumpkin seeds?

Yes /No

14. If yes, what are those?

Sr. No	Name of the pumpkin seeds product	Yes/No
1.	<i>Ladoo</i>	
2.	<i>Chikki</i>	
3.	<i>Kheer</i>	
4.	<i>Halwa</i>	
5.	Bakery products	
6.	<i>Mathri</i>	
7.	Any other	

15. Do you know the price of pumpkin seeds? Yes/No

16. Do you know the pumpkin seeds are useful for health? Yes/No

18. If yes, how they are useful?

.....

APPENDIX-II

1. Sweet biscuits

Ingredients	Amount
Refined wheat flour	40
Fat	16
Sugar	21
Baking powder	1
Milk	12
Pumpkin seeds flour	10

Method

- Sift flour and baking powder together 3 times
- Cream fat and sugar till light and fluffy.
- Add milk little by little and mix well
- Work in flour with using hands as much as necessary to make pliable dough.
- Roll out and cut even number of biscuits using medium cutter.
- Bake at 375⁰ f till light brown

Salt Biscuits

Ingredients	Amount
Refined wheat flour	47
Fat	15
Sugar	5
Baking powder	0.5
Omum	0.5
Cumin	0.25
salt	0.5
Milk	10
Pumpkin seeds flour	10

Method

- Sift flour and baking powder together 3 times
- Cream fat and add sugar, cumin, omum salt till light and fluffy .
- Add milk little by little and mix well
- Work in flour with using hands as much as necessary to make pliable dough.
- Roll out and cut even number of biscuits using medium cutter.
- Bake at 375⁰ f till light brown

Nankhatai

Ingredients	Amount
Refined wheat flour	45
Fat	20
Sugar	25
Baking powder	0.5
Pumpkin seeds flour	10

Method

- Sift flour and baking powder together 3 times
- Cream fat and sugar till light and fluffy.
- Works in flour make dough.
- Roll out and cut even number of balls.
- Bake at 375⁰ f till light brown

Cup cake

Ingredients	Amount
Refined wheat flour	17.5
Milk powder	15
Fat	12.5
Sugar	15
Baking powder	0.5
Vanilla essence	few drops
Milk	25
Pumpkin seeds flour	15

Method

- Sift flour and baking powder together 3 times
- Cream fat and sugar till light and fluffy.
- Add milk powder then pumpkin seeds flour
- Work in flour with thin consistency

APPENDIX III

Five Point Ranking Scale

Sensory Analysis

Name of product

Name of panel Member

Date:

Variation	Color	Texture	Taste	Flavour	Overall acceptability
Basic					
I					
II					
III					
VI					

5- Excellent

4- Very good

3- Good

2- Fair

1 – poor

Signature

APPENDIX - IV

Determination of moisture content

Moisture content of the products was determined by oven drying method of (A.O.A.C.,1975).

Procedure

Three samples from each developed product were accurately weighed in an amount of 5.0 g each weighing bottle (Previously heated to 90⁰C to 100⁰C and cooled in a desicator). The bottles were loosely covered with lids and heated in dry air oven for 3 hours at 105⁰ C. After 3 hours bottles were removed from oven, allowed to cool in desicator and weighed accurately. Then again bottles were heated in oven for 1 hour and weighed. This procedure was repeated until the constant weight was observed. Moisture content of sample was calculated by the formula

$$\text{Moisture content of the sample (\%)} = \frac{W_1 - W_2}{W}$$

Where,

W₁ = Initial weight of bottle with sample before drying

W₂ = Final weight of bottle with sample after drying

W = Weight of sample

2. Determination of total protein content of selected samples

Total protein content of the samples was estimated by determining total nitrogen content using standard macro-kjeldhal method (N.I.N.1983). Total protein content was calculated by multiplying the estimated total nitrogen content with a factor 6.25.

2.1 Preparation of reagents

Catalyst mixture

It was prepared by grinding together 98 parts of potassium sulphate (K₂S₀₄) and 2 parts of copper sulphate (CuSO₄). 40 percent sodium hydroxide solution An amount of 40 g sodium hydroxide pellets were dissolved in distilled water and diluted up to 100 ml.

Methyl red indicator

2 per cent boric acid solution

A weighed amount of 2 gm of boric acid was dissolved in distilled water and the volume was made up to 100 ml.

0.1 N Sulphuric acid

A measured quantity of 27.8 ml of concentrated sulphuric acid was dissolved in distilled water and the volume was made up to 100 ml. This solution gives 1 N sulphuric acid. Then 100 ml of N sulphuric acid solution was diluted up to 1000 ml with distilled water.

Procedure

One gram of defatted powdered sample of each developed product was weighed on a butter paper, in triplicate and placed in 500 ml kjeldhal flask. An amount of 5.0 g of catalyst mixture, 20 ml of concentrate sulphuric acid and 2-3 glass beads were added into each flask. Similarly blank was also prepared using other reagents except sample. The contents in the flask were digested by heating for about 8 hours until the digested material was clear. The contents were allowed to cool and diluted by rinsing down the neck of the flask with distilled water. The content were then transferred to a 100 ml. volumetric flask and the volume was made up to mark with distilled water.

10 ml of boric acid solution was delivered in to a 100 ml conical flask and two drops of methyl red indicator were added and mixed well. The flask was then placed under the condenser with the tip of condenser extending below the surface of boric acid solution; 5 ml of digested sample was delivered into the distillation apparatus. Then 10 ml of 40 per cent NaOH was added and the funnel was washed with 2 to 3 ml of distilled water. Steam distillation was carried out and it was continued for 15 min, until about 40 ml of distillate was collected in boric acid solution. The tip of condenser was washed with distilled water and the flask was removed.

The ammonia collected in boric acid was titrated against the standard 0.1 N sulphuric acid solution. The end point of the titration was noted when 0.1 N sulphuric acid produced a light pink colour. Then the volume of 0.1 N sulphuric acid required to neutralize the collected sample was noted.

Total protein content of sample was calculated by formula.

$$\text{Protein (\%)} = \text{Nitrogen (\%)} \times 6.25$$

Where,

$$\text{Nitrogen (\%)} = \frac{(\text{Titrate value of sample}) - (\text{Titrate value of blank})}{\text{Normality of sulphuric acid} \times 14 \times 100 \times \text{dilution factor}} \times \text{Wt. of sample (mg)}$$

3. Determination of total fat content

The fat content of selected sample was estimated by the Soxhlet method of A.O.A.C.(1975).

Procedure

Three Soxhlet flasks of 250 ml capacity were cleaned and dried in an oven to a constant weight. Then three samples in an amount of 5.0 g were accurately weighed on a butter paper from each selected product. Each weighed sample was placed in thimbles and plugged with fat free cotton. Then the thimbles with the weighed sample were placed in the syphon portion of soxhlet apparatus. The volume of 160 ml of analytical grade petroleum ether and diethyl ether mixture (1:1) was placed in each round bottom flask of the soxhlet apparatus and it was connected to the soxhlet syphon and condenser. The condenser was plugged with moistened cotton. It was refluxed for 5-7 times at 60⁰C. Then ether was distilled off and flasks were placed on hot plate for 3 hours at 105⁰ C for drying, cooled in a desiccator and weighed. Fat content of sample was calculated by using the formula.

$$\text{Fat content (\%)} = \frac{W_2 - W_1}{X} \times 100$$

Where,

W₂ = Weight of round bottom flask with fat

W₁ = Weight of empty round bottom flask

W = Weight of sample

4. Estimation of total minerals

The total minerals of selected samples were estimated by the ashing method of A.O.A.C.(1975).

Procedure

Exactly 2.0 g sample was taken in three silica crucibles which were heated previously at 100⁰C and cooled. The crucibles were placed on a clay pipe triangle and were heated on a low flame till the samples were completely charred. The charred samples were ignited by placing crucibles in muffle furnace for 5 hours at 600⁰C. There after crucibles were allowed to cool in desiccator and weighed. This procedure was repeated till the consecutive weights obtained were concurrent and the ash was in grayish white colour. Total mineral content of the samples was calculated by using the formula.

$$\text{Total mineral content of the sample (\%)} = \frac{W3 - W1}{W2} \times 100$$

Where,

W3 = Weight of crucible with ash

W1 = Weight of crucible

W2 = Weight of sample

5. Determination of crude fiber content

Crude fiber content of samples was determined by the method of A.O.A.C. (1975).

5.1 Preparation of reagents

0.255 N Sulphuric acid solutions

A measured quantity of 1.25 ml of concentrated sulphuric acid was dissolved in glass distilled water and volume was made up to 100 ml.

0.313N sodium hydroxide solution

A weighed amount of 1.25 g of sodium hydroxide was dissolved in glass distilled water and the volume was made up to 100 ml.

Procedure

Exactly 2.0 g of moisture and fat free sample was weighed in triplicate in a 500 ml of beaker. Then 200 ml of 0.255 N sulphuric acid solution was added into each beaker and the mixture was allowed to boil for 30 min keeping the volume

constant by the addition of water at frequent intervals, glass rod was used to stir the solution which helped for smooth boiling. Then the mixture was filtered through a muslin cloth and residue was washed with hot water to make it free from acid. The material was then transferred to the same beaker carefully; 200 ml of 0.313 N sodium hydroxide was added and boiled for 30 min keeping the volume constant by using distilled water. The mixture was again filtered through a muslin cloth and residue was washed with hot water till it was free from alkali. Then residue was transferred to crucible which was dried in an oven overnight at 80⁰C and weighed accurately (W1). The crucible was heated in a muffle furnace at 600⁰C for 2-3 hours, cooled in a desicator and weighed again accurately (W2). The difference between the two weights (W1 -W2) was considered as the weight of crude fibre in the moisture and fat free sample. The content of crude fibre in sample was calculated by using following formula

$$\text{Crude fibre content (\%)} = \frac{100 - (\text{Moisture} + \text{fat}) \times \text{weight of Fibre}}{\text{Wt. of sample taken}} \times 100$$

6. Determination of carbohydrate content (NIN,1983)

The content of carbohydrate in the samples was obtained by subtracting from 100, the sum of values of moisture, protein, fat, ash and crude fibre content per 100 g of the sample.

$$\text{Carbohydrate} = 100 - (\text{Moisture} + \text{protein} + \text{fat} + \text{ash} + \text{crude fibre})$$

7. Determination of calcium content

Calcium content of selected samples was estimated by EDTA method.

Preparation of Reagents

4 N sodium hydroxide

It was prepared by dissolving 160 gm of sodium hydroxide (NaOH) in glass distilled water and then volume was made up to 100 ml.

Ammonium purported indicator

0.5 g of ammonium purported thoroughly mixed with 100 gm of powdered potassium sulphate.

Ethylene diamine tetra acetic acid (Versenate) solution (0.01)

2 g of disodium dihydrogen ethylene diamine tetra acetate and 0.05 g of magnesium chloride hexahydrate were dissolved in water and volume was made up to 1000 ml.

Procedure for calcium estimation

0.5 ml of aliquot of ash solution was taken into beaker and 5 ml of water was added. Then 0.25 ml (5 drops) of 4 N sodium hydroxide and approximately 50 mg of ammonium purpurate indicator were added. It was titrated against 0.01 N EDTA. The end point of titration was noted when 0.01 EDTA produced a colour change from orange red to lavender to purple. The volume of 0.01 EDTA solution required to neutralize the sample was noted.

The calcium content of sample was calculated by formula

$$\text{Ca (me /lil)} = \frac{\text{Rx Normality of EDTA x 1000}}{\text{Aliquot (ml) taken}} \times \frac{5}{\text{wt. of sample}}$$

(a)

$$\text{Ca (me / 100g)} = \frac{100 \times a}{1000}$$

$$\text{Ca (mg /100g)} = b \times 20$$

Where,

R = volume (ml) of EDTA used in titration

7. Determination of iron

The trace elements (iron) from the ash solution of the samples were estimated by atomic absorption spectrophotometer (Perkin R. Elmer Model-3110). The aliquots of each solution were fed to atomic absorption spectrophotometer through a capillary and readings were obtained.

$$\text{Fe in ppm} = \frac{\text{R x 100}}{\text{Wt. of sample}}$$

Where,

R- the reading on atomic absorption Spectrophotometer

Ppm= mg/100g

$$\text{Fe in mg/100 g} = \frac{\text{ppm value of Fe}}{10}$$

8. 0.5 ml of aliquot of ash solution was in to beaker and 5 ml of water added. Then 0.5 ml of ammonium chloride – ammonium hydroxide buffer and 3 to 4 drops of ferrochrome black T indicator .it was treated against 0.01 N EDTA. The end point of titration was noted when 0.01 EDTA produced a color change from wine red to blue or green

$$\text{Ca} \pm \text{mg (me/lit)} = \frac{\text{Rx Normality of EDTA X 1000}}{\text{Aliquot (ml) taken}} \times \frac{5}{\text{Wt. of sample}}$$

$$\text{Ca} \pm \text{mg (me/ 100g)} = \frac{1000 \times a}{1000}$$

$$\text{Ca} \pm \text{Mg (mg /100g)} = b \times 20$$

$$\text{Mg} = \text{ca} - (\text{Ca} \pm \text{mg})$$

Where,

R = Reading (Observations)

CURRICULUM VITAE

CURRICULUM VITATE

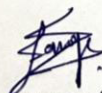
Full name of the candidate : Dhanashri Sudhakar Sangle
Date of Birth : 04/ 04/ 1998
Nationality : Indian
Department : Food science and Nutrition
Permanent address : At. Yeli post undegaon, Tq. Aundha , Dist.
Hingoli
Mobile No : 9823135403
Email id : dhanashrisangle12@gmail.com
Title of the thesis : Acceptability and nutritional evaluation of
pumpkin (*cucurbita*) seeds flour incorporated
bakery products

Academic Qualification

Course /Degree	Name of the college /institute	University Board	Year of Passing	Percentage (%) CGPA	Class/ Grade
SSC	CBT Sadhana Girls School, Hadapsar, Pune	Maharastra State And Higher Secondary Education, Pune	2014	71.20	A
HSC	Aannasaheb Magar Junior College, Hadapsar, Pune	Maharastra State And Higher Secondary Education, Pune	2016	65.08	A
B.Sc. (Home Science)	College Of Community Science, VNMKV, Parbhani	Vasanttrao Naik Marathwada Krishi Vidyapeeth , Parbhani.	2020	8.23	First Division

Place: *parbhani*

Date: *24/03/2023*



Signature of the candidate

(Dhanashri Sudhakar Sangle)