

Development of different kinds of spiced cake and their shelf life analysis

Dissertation 2 Report

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Program- M. Sc. (Nutrition and Dietetics)

Section- H1731

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May 2018



CERTIFICATE

This is to that **Twinkle Paul** (Registration No.11719122) has personally completed M.Sc. dissertation 2 entitled “**Development of different kinds of spiced cake and their shelf life analysis**” under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of dissertation has ever been submitted for any other purpose at any University.

The project report is appropriate for the submission and the partial fulfillment of the conditions for the evaluation leading to the award of Master of Nutrition and Dietetics.

Date: 11th May, 2018

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Chapter 1: Introduction

A good cake should indicate a multitude of uniformly scattered tiny cells lacking any great holes. It should have attractive colour and should ingest moist, have a good and the general appearance should be appealing.

Flour conditions are taken up by the miller and are utilized by them to certify that the flour they are manufacturing will make in the baking process for which they are planned. Greater baking companies will purchase flour with a definite specification and some will taken up their own particularly. We will made different types of cakes like spiced cakes which will be made by different kinds of spices like ginger, garlic, cinnamon, cloves and cardamom and gluten free cakes which will be modified with some spices at different concentration. Then, these cakes will be evaluated using hedonic scale for consumer acceptance and preferability.

Spices are like food that have been used to increase the sensory value of food. At a distance from flavouring, these are utilized in preservatives, botanicals, pharmaceutical, beverages, and other industries.

Ginger is the greatest vital spice that is broadly utilized all over the world.

Garlic (*Allium sativum*) is a member of the family Alliaceae is the majorily vital second bulb yield that grownup in Bangladesh. It is extensively cultivated throughout winter season.

Garlic (*Allium sativum* L.) normally termed as “Lahsun”, is maximum vital spices, member of the family Amaryllidaceae.

Cinnamon is a actual exclusive spice generally utilized in some food preparation recipes. Cinnamon is invented from South India, Sri Lanka, China, Indonesia etc.

Indian clove (*Syzygium aromaticum* L.) is a plant, member of the Myrtaceae family which desiccated flower buds are quite valued in the world cuizine, by way of an fragrant condiment.

Cakes such as fruit cakes are popularly consumed by all the age groups all over the world as compared to other products. In addition, it is convenient to store, handle, package and utilize. Thus, present project will attempt to develop gluten free and spiced cakes. Spicy products are consumed more readily in India and also, spices possess various compounds that are beneficial to health. The objective is to develop gluten free cakes is that many people are allergic to gluten, thus in order to provide both taste and nutrition, gluten free cakes will be developed.

Chapter 2: Problem background

There are many kinds of flour which may be used for the production of different cakes. But we will use gluten free flour for the production of different spiced cakes because as such spices may not be acceptable to some peoples due to its bitterness or strong aroma so it can be used in some proportions for cake production so that it can be acceptable to the consumers. Some people may have allergy for gluten so they cannot consume refined wheat flour cake or its products so in this project, gluten free cake will made along with some spices so that celiac patients can also consume it very well along with some strong flavor.

Chapter 3: Review of Literature

Cake batter is an emulsion of the oil-in-water type with air bubbles entrapped in the fat phase, and the remainder of the constituents dissolved or dispersed in the water phase. By way of the temperature increases during baking, the batter gets thin and some coalescence of the bubbles take place with some misplacement of gas.

SPICES- Spices are like food that have been used to increase the sensory value of food. At a distance from flavouring, these are utilized in preservatives, botanicals, pharmaceutical, beverages, and other industries.

Along with flavor, spices are broadly utilized as medicinal uses, drugs, nutraceuticals, aroma therapy, preservers, drinks, natural colours, scents, dental preparations, cosmetics and botanicals as insecticide and have a large role in the budget of the making country. These contain some phytochemicals that helps to attract beneficial organisms and prevent harmful organisms. Terpenes and its derivatives are the most imp class for aroma compounds, particularly Monoterpenes which aids in paying fragrance.

Table 1: Some phytochemicals with their sources

Category of phytochemicals	Their sources
Terpenes – Monoterpenes	Cumin, caraway
Tetraterpenes (carotenoids)	Saffron, paprika
Sesquiterpenes	Ginger, turmeric, cinnamon
Terpene derivatives	Coriander
Phenylpropanoids- Cinnamic acid	Cinnamon
Eugenol	Clove
Vanillin	Vanilla bean

Diarylheptanoids- curcumin	Turmeric
Sulphur compounds- thiols, sulphides, di and poly -sulphides	Garlic and asfoetida

Spice as botanical- Spice cuttings can be utilized by way of natural botanical owing to the occurrence of energetic principles, which aids in preventing pests. Senegal pepper, Industrial pepper and black pepper spice cuttings at 10% scattered during harvesting period aids in preventing aphids, thrips and whitefly infestation in green bean. Black pepper (0.5%) and red pepper dust (5%) were operative in decreasing major packaged pest viz. granary weevil (*Sitophilus granarius*) and Grain borer (*Rhizoper thadominica*) in wheat.

Spices as natural preservative- Chemical compounds like flavonoids, phenolic compounds etc. take out from pure sources that provide essential capacity to defend the goods by retardation of microbial progression, oxidation and certain enzymatic reactions happening in the products. Clove, garlic, ginger, cinnamon, thyme, oregano and rosemary are mainly worked by way of preservative agents.

Spices used as beverages- Beverages discover of spices are of pure products valued greatly owing to pure antioxidant and antimicrobial uses. It considered as a pure health drink. Cardamom, black pepper, ginger, mint, cumin, cinnamon, ginger, ko-kum and curry leaf are used in beverage trade.

Spice as Nutraceutical- Increasing desire from the evolving section of nutraceuticals is moving the universal intake of Indian spices further to assemble the desires of old-style food segment. Chawanprash is the maximum advertising nutraceutical goods in India. It involves spices as ingredients such as cinnamon, clove, curcuma spp, saffron and long pepper. As these are good source of vitamin C and rich in antioxidants, helps in increasing the immunity, increases digestion and prevents cough, asthma, fever, heart disease, impotency and coarseness speech.

Spices in pharmaceutical industry- Spices plays significant task in pharmaceutical trade. The energetic principle existing in spices will take actions averse to human diseases and heal many diseases like hypocholesterolemia, diabetes, inflammation, arthritis, act as pure antioxidants.

Table 2: Some spices and their health beneficial effects

Spices	Used as
Ginger, garlic, turmeric, fenugreek, red pepper	Hypocholesterolemic
garlic, cinnamon, turmeric, fenugreek, cumin	Antidiabetic
Ginger, fenugreek	Antioxidant effect
Turmeric	Anti-inflammatory and anti-arthritic
Ginger, garlic, turmeric, mustard	Anticarcinogenic
Ginger, mint, coriander, ajowan, cumin, black pepper	Digestive stimulant action
Garlic, turmeric	Antimicrobial

3.1 Ginger (*Zingiber officinale*) member of family Zingiberaceae and has been widely utilized as spice and seasonings agent in foods from about 2000 years (Bartley & Jacobs, 2000). Ginger has helpful uses in traditional as well as present medicine for the cure purposes of nausea, vomiting, motion sickness, diarrhea, and digestive and respiratory disorders. Ginger apart from this, possesses many important pharmacological properties like anti-inflammatory, antimicrobial, anticarcinogenic, analgesic and antioxidant activities (Ali et al., 2008; Butt & Sultan, 2011). Gingerols, its desiccated derivatives like shogaols, and degenerated derivative like zingerone, are take into account the main active constituents responsible for antiemetic, antipyretic, anti-cancer and anti-inflammatory activities of ginger (Grzanna et al., 2005; Shukla & Singh, 2007).

3.1.1 Nutritional composition- Ginger (*Zingiber officinale*) is widely used everywhere the world in foods by means of a spice (Sharma and Sharma, 2013).

Nutrient composition of Ginger root powder –

Table 3: Nutritive value of ginger root powder (Per 100g)

Nutritive value	Ginger root powder
Moisture (%)	13.03
Ash (g)	4.05
Protein (g)	6.08
Fat (g)	3.6
Crude fibre (g)	20.1
Energy (g)	214
Carbohydrate (g)	39.35
Iron (mg)	9.8
Calcium (mg)	88.7
Total carotene (ug)	76.7
Vit C (mg)	9.2

3.2 Garlic (*Allium Sativum*) acts as a therapeutic plant. Epidemiological studies show that the danger for varied malignant diseases, particularly of the gastro-intestinal tract is meaningfully reduced by regular ingestion of huge quantity of garlic. In many examinations it was likely to demonstrate diverse pharmacological properties, for specific cysteine sulphoxides, like antimicrobial, anticancer, and antioxidant activity.

3.2.1 Compounds of the garlic bulb: Apart from compounds, garlic bulb comprises a dominant collection of secondary plantparts, which are visible through their sulphur content. These are mainly cysteine sulphoxides like alliin and derivatives of gamma-glutamyl cysteine. Moreover compounds existing in a minor quantity are flavonoids, steroids and triterpene saponins from the beta-sitosterol or F-gitogenin type (Kreuter et al., 1997).

3.2.2 Pharmacological uses-

Garlic has a extraordinary medicinal possibilities. The most significant of which are antibiotic, cardiovascular and anticancer effects.

- **Antimicrobial activity-** From traditional medication and experimental treatment it has been learned that enough amounts of renewed garlic can have a helpful effect on the human intestinal bacterias. In accordance with the present state of knowledge, the main substances accountable for the antibacterial success of garlic are the thiosulphinates, particularly allicin.
- **Anticancer effects-** Epidemiological studies shows that a repeated ingestion of huge quantities of garlic is related with a minor danger for cancer, particularly cancer of the gastro-intestinal tract.
- **Cardiovascular protective effects-** The active constituents of garlic control the creation of free radicals, reinforce the endogenous radical rummaging mechanism and defend LDL against oxidation. These effect pay to clarify the cardioprotective effects of garlic. Human and in vivo educations agree that allicin or allicin-derived compounds are accountable for the antiaggregatory activity

3.3 Cinnamon- Is one of the greatest commonly utilized spices universal succeeding to black pepper. It is formed from the dehydrated inner bay of evergreen plants full-grown in South Asia (Ceylon cinnamon, *Cinnamomum zeylanicum*) and Southeast Asia (Chinese cinnamon or cassia, *Cinnamomum cassium*). It is used for flavoring, food preservation, and medicines. Presently, cinnamon has chief uses in foods and perfumes. In foods, utilized as perception of sweetness and hotness and is establish as a additive agent in varied products such as baked goods, beverages, meat dishes, cereals, and fruit preparations.

3.3.1 Chemical composition- The chemical construction of cinnamon has been involved with cinnamaldehyde (cinnamic aldehyde, 3-phenyl-2-propenal) being recognized as the chief component from the bark and eugenol (2-methoxy-4-(2-propenyl) phenol) as the main constituent in cuttings from the leaves. Other components in cinnamon are cinnamyl alcohol, coumarin, phenolic acids, terpenes, carbohydrates, and tannins.

3.3.2 Uses of cinnamon-

- Antidiabetic agent- Preclinical animal studies provide indication that components of cinnamon may reduce blood sugar and insulin levels both in rats hereditarily predisposed to diabetes and in rats provided high dosages of sugars. It should be well-known that in 2 studies, cinnamon intake improved in vivo glucose acceptance in well human subjects (Solomon 2007, Hlebowicz 2007).
- Cholesterol-lowering actions- Human trials of cinnamon cutting do not constantly reveal a advantage in dropping diabetes-related blood cholesterol levels or make better blood lipid profiles (Khan 2003, Vanschoonbeek 2006, Baker 2008, Dugoua 2007).
- Blood pressure lowering effect- Cinnamon dropped glucose-induced BP rise in one study of rats make prone to HTN.(Preuss 2006).
- Anti-inflammatory and antioxidant effects- Antioxidant constituents of cinnamon have been recognized. There are numerous reports by means of cell culture models and an experiment in rats signifying that cinnamon and cinnamaldehyde have antioxidant activity and scavenge free radicals (Dugoua 2007, Jayaprakasha 2006, Singh 2007). There is little indication that cinnamon and cinnamaldehyde have immunomodulatory uses and can decrease swelling processes (Dugoua 2007, kim 2007, youn 2008).
- Antimicrobial properties- There are many of stories in cell culture experiments representing that cinnamon can stop the development of bacteria related with food blot and human infections (Dugoua 2007, Singh 2007). There is absence of indication of an antimicrobial advantage in humans.
- Anticancer actions- There is very little scientific data indicating to a cancer-defensive benefit of cinnamon constituents (Dugoua 2007, Schoene 2005, Lampe 2003).

3.4 Cardamom- Cardamoms are desiccated fruits of the perennial herb *Elettaria cardamomum* Maton, member of the ginger family Zingiberaceae. These are identified as small cardamom or

true cardamom, and are denoted to as 'Queen of Spices'. The Cardamom seeds have a enjoyable smell and a distinctive warm, to some extent pungent taste.

It is vital component in garam masala and is also utilized to freshen the breath. It also helps in digestion. New studies suggest that cardamom may heal teeth cavities.

3.4.1 Nutritional composition-

Cardamom pills on a dry basis contain about 10% crude protein, 42% carbohydrate, and 20% crude fiber, with B vitamins, ascorbic acid, and minerals. As flavoring material, the most vital constituent is the essential oil, which is existing to the extent of 5 – 11% depending on the region. The main component of the volatile oil is 1,8 - cineole. The constituent is well-known for its natural resin and cool odor.

3.4.2 Uses-

Cardamom oil is majorily appreciated as a food savour. It confound well in baked products, dairy products, ice cream, sweet preparations, confectionery, and a variety of food products. It is very suitable for forming cardamom - flavored tea and coffee. When heating is done, care should be taken that substitution of oil is completed toward the finish of processing; else, oil may evaporate. Oleoresin will be at ease to utilized in ice cream, candies, and some confectionery, where water dispersibility is helpful.

3.5 Cloves (*Syzygium aromaticum*) are desiccated flower buds of tropical *Syzygium aromaticum*, given to the Indochina-Indonesia Center of Diversity.

3.5.1 Medicinal Uses (Clove)- used as analgesic, anesthetic, antibacterial, antidotal, antioxidant, antiperspirant, antiseptic, carminative, deodorant, digestive, rubefacient, stimulant, stomachic, tonic, and vermifuge. By way of aromatic, grounded cloves or an infusion thereof have been provide for emesis, gas, and dyspepsia. Clove oil is irritant and stimulates peristalsis. A strong antiseptic and it has been applied as anesthetic for dental caries.

3.5.2 Other uses- Cloves are utilized by means of a condiment and spice in cordials, curries, hams, mincemeat, sausages, soups, sauces, tobaccos, masticatories, curries, pickles, preserves, desserts, cakes, and puddings. Crushed cloves enter numerous spice mixtures, curry powders,

pumpkin-pie spice, and sausage seasonings. In India, we can have cloves after meals. Cloves have been utilized in alcoholic as well as nonalcoholic beverages, e.g., Benedictine and cola.

Chapter 4: PROPOSED RESEARCH OBJECTIVE

1. To standardize the process for different spiced cakes production
2. To standardize the process for gluten free cake production
3. To study shelf life analysis of packaged spiced cake formulation

Chapter 5: PROPOSED RESEARCH METHODOLOGY

5.1 Detailed plan work

5.1.1 Objective 1:

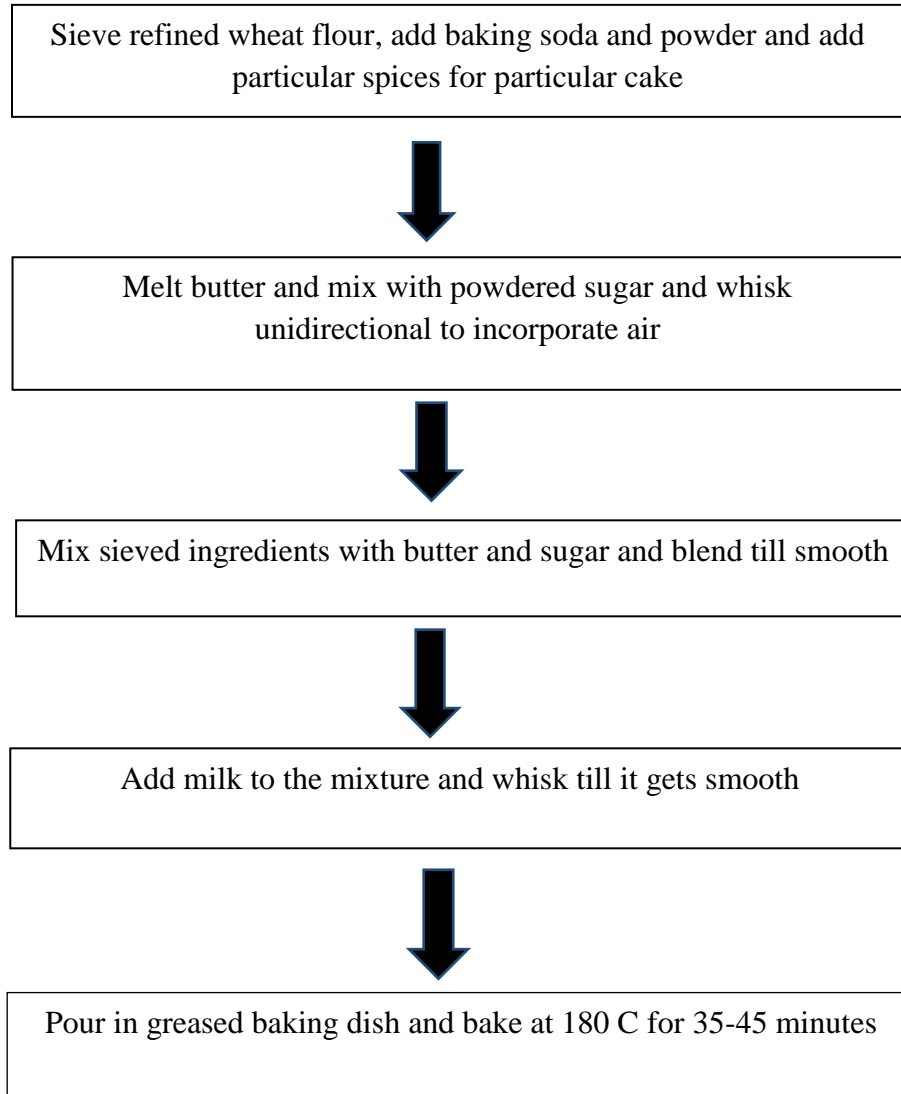
To standardize the process for different spiced cakes production

Standardization of refined wheat flour along with different spices (ginger, garlic, cinnamon, cloves and cardamom) at their different concentration. Cake will be prepared by using refined wheat flour along with variable concentrations of different spices. Preliminary trials for the optimization of the spiced cake will be done by using different concentration of different spices.

Table 4: Standardized measurements for cake production

Ingredients for cake preparation	Amount (in grams)	(T1) (in grams)	(T2) (in grams)	(T3) (in grams)	(T4) (in grams)	(T5) (in grams)
Refined wheat flour	93	93	93	93	93	93
Butter	63	63	63	63	63	63
Milk	125ml	125ml	125ml	125ml	125ml	125ml
Sugar	125	125	125	125	125	125
Baking soda	1.25	1.25	1.25	1.25	1.25	1.25
Baking powder	1.25	1.25	1.25	1.25	1.25	1.25
Spices (Ginger, garlic, cinnamon, cardamom and cloves)	Different concentrations of ginger powder will be used to observe the range for production					

Flow chart for the preparation of different kinds of spiced cakes



The trial samples obtained from the experimental setup mentioned above will be analyzed for sensory, physical, chemical and functional properties. The following tests will be performed.

(A) SENSORY EVALUATION:

The most widely used scale for measuring food acceptability is the 9-hedonic scale. A 9 point hedonic scale will be used to evaluate the different cake samples using 100 semi trained panelists.

- Color and appearance
- Flavor and sweetness
- Body and texture
- Mouth feel
- Overall acceptability

Expression	Points to be assigned
Liked extremely	9
Liked very much	8
Liked moderately	7
Liked slightly	6
Neither liked nor disliked	5
Disliked slightly	4
Disliked moderately	3
Disliked very much	2
Disliked extremely	1

Sample code	Color and appearance	Flavor and sweetness	Body and texture	Mouth feel	Overall acceptability	Remarks (if any)

(B) PHYSICAL PROPERTIES:

- Texture (Curti et al., 2013)
- Thickness (Mattsson et al., 2017)

(C) CHEMICAL PROPERTIES:

- Moisture (AOAC 2005)
- Ash (AOAC 2005)
- Protein (Ranganna 1986)

- Carbohydrates (Ranganna 1986)
- Dietary fiber (AOAC 2005)
- Free fatty acids (Ranganna 1986)

(D) FUNCTIONAL PROPERTIES

- Total phenols (Wolfe et al., 2003)
- Carotenoid content (Ranganna 1986)
- Ascorbic acid (Ranganna 1986)
- Antioxidant activity
 - a) DPPH (Anwar et al., 2009)
 - b) Metal chelating activity (Anwar et al., 2009)

Optimized product will be obtained by analyzing through sensory evaluation, physical properties, chemical properties and functional properties.

5.2. Objective 2

To standardize the process for gluten free cake production with legume flour (50:50)

Cake will be prepared by using variable concentrations of gluten free flour (Gularte et al., 2011). Preliminary trials have been taken to obtain a standardized recipe of gluten free cake.

Table 5: Ingredients used while preparing gluten free cake.

Ingredients	Amount (in grams)
Butter	87.5
Sunflower oil	52.5
Sugar	157.5
Milk	105 ml
Baking powder	5.25
Gluten free flour	87.5

Temperature used: 190° C for 30 min

Table 6: Trials for obtaining a standardized recipe:

Ingredients for cake preparation	Amount (in grams)	(T1) (in grams)	(T2) (in grams)	(T3) (in grams)	(T4) (in grams)	(T5) (in grams)
Butter	87.5	87.5	87.5	87.5	87.5	87.5
Milk (ml)	105	105	105	105	105	105
Sugar	157.5	157.5	157.5	157.5	157.5	157.5
Baking powder	5.25	5.25	5.25	5.25	5.25	5.25
Sunflower oil	52.5	52.5	52.5	52.5	52.5	52.5
Gluten free flour	87.5	87.5	87.5	87.5	87.5	87.5
Spices (Ginger, garlic, cinnamon, cardamom and cloves)	Different concentrations of ginger powder will be used to observe the range for production					

Optimized product will be obtained by analyzing through sensory evaluation, physical properties, chemical properties and functional properties. Then, spices will be added to the best optimized product and again the sensory evaluation, physical properties, chemical properties and functional properties will be taken in an account.

(A) SENSORY EVALUATION:

The most widely used scale for measuring food acceptability is the 9-hedonic scale. A 9 point hedonic scale will be used to evaluate the different cake samples using 100 semi trained panelists.

- Color and appearance
- Flavor and sweetness

- Body and texture
- Mouth feel
- Overall acceptability

Expression	Points to be assigned
Liked extremely	9
Liked very much	8
Liked moderately	7
Liked slightly	6
Neither liked nor disliked	5
Disliked slightly	4
Disliked moderately	3
Disliked very much	2
Disliked extremely	1

Sample code	Color and appearance	Flavor and sweetness	Body and texture	Mouth feel	Overall acceptability	Remarks (if any)

Optimized product will be obtained using the experimental setup below.

Best one of the gluten free cake will be treated for physical properties, chemical properties and functional properties.

(B) PHYSICAL PROPERTIES:

- Texture (Curti et al., 2013)
- Thickness (Mattsson et al., 2017)

(C) CHEMICAL PROPERTIES:

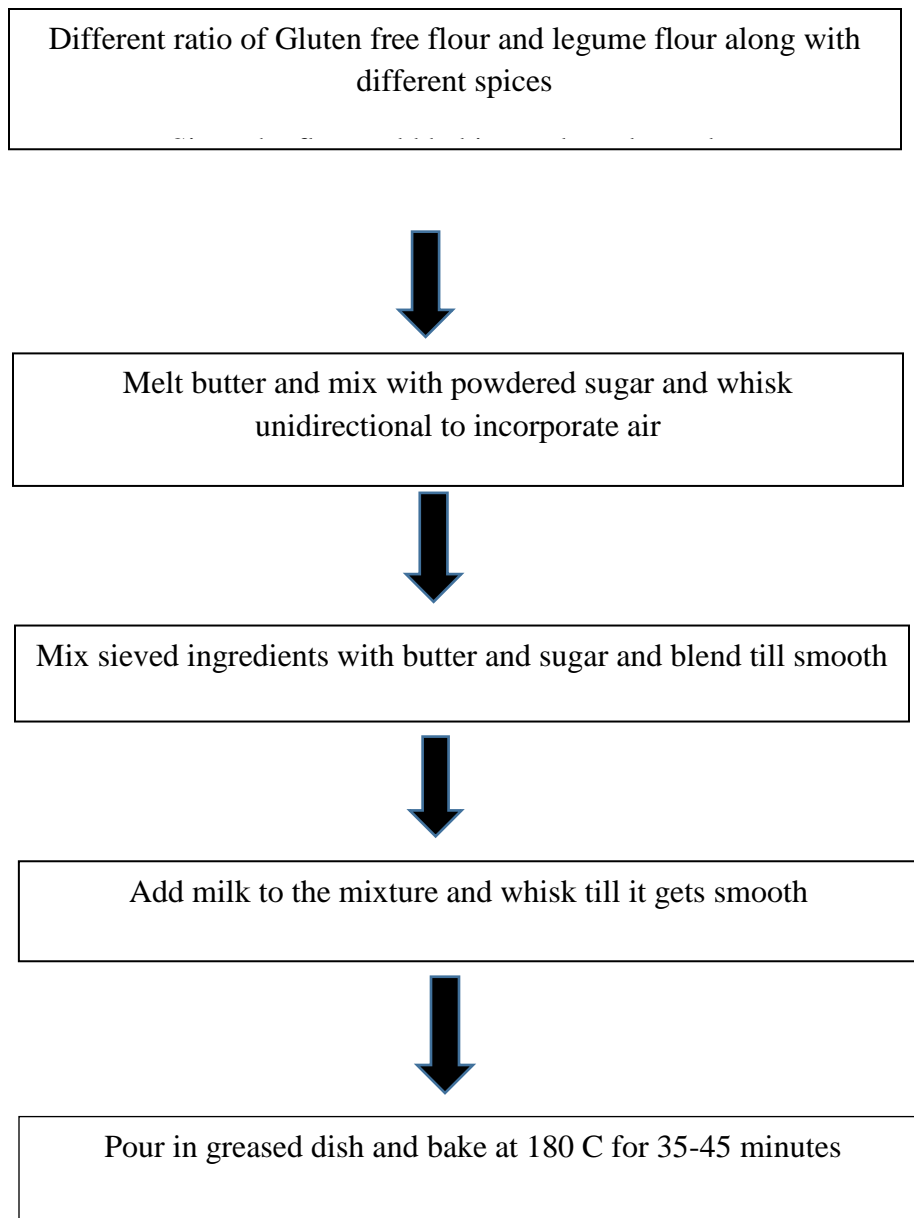
- Moisture (AOAC 2005)
- Ash (AOAC 2005)

- Protein (Ranganna 1986)
- Carbohydrates (Ranganna 1986)
- Dietary fiber (AOAC 2005)
- Free fatty acids (Ranganna 1986)

(D) FUNCTIONAL PROPERTIES

- Total phenols (Wolfe et al. 2003)
- Carotenoid content (Ranganna 1986)
- Ascorbic acid (Ranganna 1986)
- Antioxidant activity
 - a) DPPH (Anwar et al. 2009)
 - b) Metal chelating activity (Anwar et al. 2009)

Flow chart for the preparation of different kinds of spiced cakes



Optimized product will be obtained using the above experimental setup.

Best one of the spiced cake will be analyze for different kinds of properties like sensory evaluation, physical properties, chemical properties and functional properties. Following parameters will be used:

Objective 3:

5.3. To study the shelf life analysis of packaged spiced cakes formulation.

The shelf life of the optimized spiced cakes and gluten free cakes will be analyzed at different temperatures (5 °C, 10 °C, 15 °C and 27 °C) after every 2 days constantly till 2 months. The samples will be packed in 1 metallized polyester low density polyethylene (LDPE) and high density polyethylene (HDPE) bags.

Following responses will be studied during shelf life analysis

(A) Microbiological Studies

- E. coli count – MacConkey agar (Godbole et al., 2013)
- Mold and Yeast count- Sabouraud Dextrose Agar (Godbole et al., 2013)
- Total viable count – Plate count agar by Standard Plate Count (SPC) (Godbole et al., 2013)

(B) Sensory evaluation:

The most widely used scale for measuring food acceptability is the 9-hedonic scale. A 9 point hedonic scale will be used to evaluate the different cake samples using 100 semi trained panelists.

- Color and appearance
- Flavor and sweetness
- Body and texture
- Mouth feel
- Overall acceptability

Expression	Points to be assigned
Liked extremely	9
Liked very much	8
Liked moderately	7
Liked slightly	6
Neither liked nor disliked	5
Disliked slightly	4
Disliked moderately	3
Disliked very much	2
Disliked extremely	1

Sample code	Color and appearance	Flavor and sweetness	Body and texture	Mouth feel	Overall acceptability	Remarks (if any)

(C) Physical Properties:

- Texture (Curti et al., 2013)
- Thickness (Mattsson et al., 2017)

(D) Chemical Properties:

- Moisture (AOAC 2005)
- Ash (AOAC 2005)
- Protein (Ranganna 1986)
- Carbohydrates (Ranganna 1986)
- Dietary fiber (AOAC 2005) (Mehrjardi et al., 2012)
- Free Fatty Acids (FFA) (Balogun et al., 2017)
- Hydroxyl Methyl Furfural (HMF) (Capuano et al., 2009)
- Thiobarbituric acid value (TBA) (Rael et al., 2004)

(E) Functional Properties

- Total phenols (Wolfe et al., 2003)
- Carotenoid content (Ranganna 1986)
- Ascorbic acid (Ranganna 1986)
- Antioxidant activity
 - DPPH (Anwar et al., 2009) and
 - Metal chelating activity (Anwar et al., 2009)

Chapter 6: EXPECTED RESEARCH OUTCOME

1. Formulation of spices for the development of the spiced cakes.
2. Development of the gluten free cake with the help of chia seeds flours.
3. The obtained final product will be having good sensory characteristics and effect of processing on composition will evaluated
4. Developed products will be acceptable according to sensory and chemical properties which will conform.

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