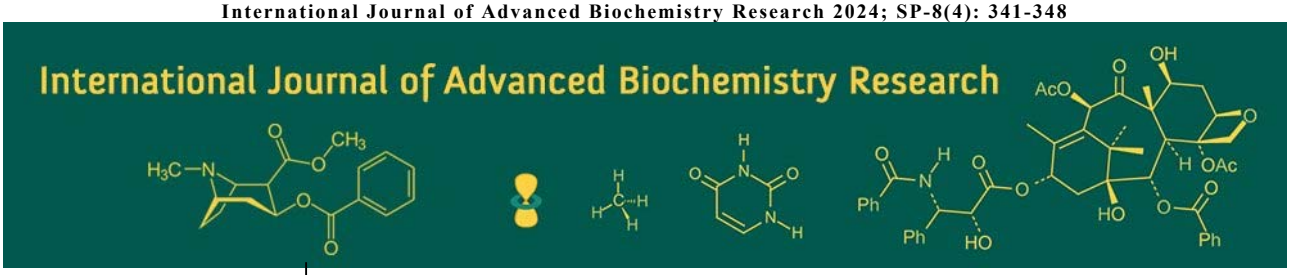

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(4): 341-348
www.biochemjournal.com
Received: 01-01-2024
Accepted: 05-02-2024

Dibyajyoti Mohanty
Ph.D., Research Scholar,
RPCAU, Pusa, Bihar, India

Rashmi Misra
Lecturer in Home Science,
Kujang College,
Jagatsinghpur, Odisha, India

Dr. Diptimayee Jena
Associate Professor,
Department of Food and Nutrition, CCS, OUAT, BBSR,
Bhubaneswar, Odisha, India

Corresponding Author:
Dibyajyoti Mohanty
Ph.D., Research Scholar,
RPCAU, Pusa, Bihar, India

Nutritional content analysis of formulated cupcakes prepared for pre-school children

Dibyajyoti Mohanty, Rashmi Misra and Dr. Diptimayee Jena

DOI: https://doi.org/10.33545/26174693.2024.v8.i4Se.987

Abstract
In some nations, cupcakes are a very popular food item since they are convenient and delicious for consumers. In the current study, "Development of fortified cupcake for preschool children," finger millet flour, soy flour, and Bengal gram flour were used to create nutrient-rich cupcake. Using established techniques, the generated goods were examined for their sensory qualities, nutritional value, shelf life, and microbiological analyses. Whole wheat flour and refined wheat flour were used to make the cupcake to create seven formulations as C0(control) - 50WWF:50RWF, C1-28WWF:28RWF:44SF, C2-28WWF: 28RWF: 44BGF, C3-28WWF: 28RWF: 44FMF, C4-28WWF: 28RWF: 22SF:22BGF, C5- 28WWF: 28RWF: 22BGF: 22FMF, and C6-28WWF:28RWF:22SF:22FMF. The best product was determined to be the formulation containing C0(control) -50WWF:50RWF, C3-28WWF: 28RWF: 44FMF, C4-28WWF: 28RWF: 22SF: 22BGF, and C5-28WWF: 28RWF: 22BGF: 22FMF. In the organoleptic examination, it was discovered that there was a significant (p<0.05) difference in the overall acceptability of all the nutrient-rich cupcakes. With increased levels of finger millet flour, soy flour, and Bengal gram flour supplementation, it was shown that the nutritional content of all cupcakes significantly improved (p<0.05). Results showed that C3 -28WWF:28RWF:44FMF fortified cupcake obtained higher overall acceptability than all the formulated cupcake. However, C4 - 28WWF:28RWF:22SF+22 gF fortified cupcake had higher nutritional value (Moisture, total Ash, Crude protein, Crude fat, Crude fibre. Except for the fortified cupcake products C5-28WWF:28RWF:22BGF:22FMF and C4-28WWF:28RWF:22SF:22 gF, all the nutrient-rich cupcakes were still in the acceptable category after 4 days of storage.

Keywords: Gluten free, shelf-life, microbial analysis, proximate composition, nutrient-rich cupcakes

Introduction
Today, maintaining optimal diet and health is the most difficult and demanding task. The importance of adding nutritious ingredients that are high in iron, calcium, fiber, protein, and other nutrients to food products has increased as people become more conscious of the role that food plays in health promotion. All age groups of people enjoy cupcakes because they are convenient, but children particularly enjoy them. Because they are convenient and appealing to kids, cupcakes are growing in popularity. To give youngsters with convenient foods, it is simple to fortify the flour with protein- and calcium-rich ingredients. Numerous research has examined the idea of incorporating healthy components into cupcakes to improve their nutritional value. Cupcakes made with soy, ragi, and gram flour have the potential to be nutrient carriers. Commercially produced cupcakes made with white flour are less nutrient-dense than other cupcakes made with kids in mind.

In many Arabian countries with low to medium wages and high rates of nutrient deficit, which affects more than a third of the world's population, nutrition deficit is still regarded as one of the most dangerous issues for children before they reach school age and is the primary cause of their deaths. We tried to introduce food products that were enhanced by good nutrient value needed by kids for growth and doing the daily activities with optimum form since kids are eating at this stage of growth many of the sweetened food products that have low nutrient value while kids need the important nutrients for growth. Millets are utilized in a variety of food compositions because they are high in antioxidants, phytochemicals, and other nutrients that are good for you. One of the 2 most popular minor millets farmed in India is finger millet, also known as ragi (*Eleusine coracana*). Compared to other cereals, it has higher levels of minerals such dietary fiber, calcium, and phytochemicals.

Ragi is therefore a healthy food source for growing children, elderly individuals, women, and patients (Desai *et al*., 2010) [18]. As a result, adding finger millet to wheat flour when making cupcakes will improve both the nutritional value and the cupcakes' acceptability to the senses.

The high protein content of soybeans used in value addition is combined with lysine, which not only boosts protein levels but also improves the diet's amino acid balance. With higher levels of soy flour inclusion, soy flour contributes more nutrients. One of the most popular legumes in the world and a significant pulse crop, particularly in tropical and subtropical regions, are chickpeas (*Cicer arietinum* L.) (Bulbula & Urga, 2018) [19]. According to the review study by Hirdyani (2014) [20], chickpeas are a great source of protein and carbs since they are thought to have higher-quality protein than other kinds of pulse crops. Chickpeas are currently farmed in more than 50 nations worldwide, from North Africa to the Americas, and they are the third-most important pulse crop produced worldwide, after dry beans and field peas **(**Hirdyani, 2014) [20]. However, India produces 66 percent of the world's chickpeas, making it the greatest producer in the world. Chickpeas are a rich source of carbohydrate, proteins, dietary fiber, minerals, and vitamins, according to their nutritional makeup. Chickpea seeds include the important minerals calcium, magnesium, phosphorus, selenium, potassium, and iron (Hirdyani, 2014) [20]. A good supply of vitamins like folate, riboflavin (B2), niacin (B3), thiamine (B1), and alpha carotene is found in chickpeas (Hirdyani, 2014) [20]. Therefore, there is a good chance to use these nutritious food ingredients in the creation of high-quality food products to satisfy the nutritional needs of preschoolers.

it is crucial to preserve the items' stability during storage, transportation, and distribution. Product makers can ensure that consumers will receive high-quality items for a long period after creation thanks to studies on the self-life of their products. Keeping these above facts in view, the present investigation was carried out with an attempt made to develop nutritionally enriched Cupcakes for Pre Schoolers.

Materials and Methods

The present investigation entitled “Nutritional content analysis of formulated cupcakes prepared for pre-school children” was carried out under the following headings and subheadings:

1. **Procurement of raw materials**
2. **Proximate composition of raw materials**
   - Moisture
   - Ash
   - Fat

Fiber

- Crude protein
- Carbohydrate

Mineral estimation

- Calcium
- Iron

3. **Procedure for preparation of fortified cupcake**
4. **Nutritional composition of developed cupcake**
   - Moistur
   - Ash
   - Fat
   - Fiber
   - Crude protein
   - Carbohydrate

5. **Mineral (calcium, iron) estimation of developed Cupcakes**

1. **Procurement of raw materials:** The whole wheat flour, finger millet flour, and gram flour were all obtained at the local market in Siripur, Bhubaneswar.
2. **Proximate composition of raw materials Moisture:** Moisture content was assessed using the approved analytical method (A.A.O.C 2000)

Procedure

A sample of five grams was obtained, weighed in advance in a Petri dish, and dried for six hours at 105 °C. Once the dried sample had cooled in a desiccator, it was reweighed. The calculation below was performed to get the sample's moisture% using the sample's weight loss.

Moisture (%) = w2−w1 w1 × 100

Where,
W1= weight of the sample
W2= weight of Petri dish with sample
W3= weight of Petri dish with sample after drying

Ash

The sample's ash content was determined using the approved analytical method suggested by the A.A.O.C. (2000).

Procedure

In a porcelain plate that had already been pre-weighed, five grams of the sample were weighed. The porcelain dish was first burned, followed by six hours of 500 °C ashing in a muffle furnace to produce grey or white ash. After cooling in desiccators, the porcelain dish was reweighed. The residue, whose ash content is determined by the weight loss and calculated using the supplied equation.

Ash (%) = w2−w3 w1 × 100

Where,
W1= weight of sample (g)
W2=weight of porcelain dish with sample
W3=weight of porcelain dish with ash

Crude fat

The automatic SOCS with solvent Extraction system was used in accordance with the

A.A.O.C. (2000) technique for estimating crude fat.

Procedure

Five grams of a moisture-free sample were obtained and dried overnight in a pre-weighed extraction thimble. After being washed, the beaker was dried for 20 minutes in a hot air oven at 60 °C, and then it was weighed. The sample and thimble holder were both kept in the beaker. As a solvent, 90 ml of petroleum ether with a boiling range of 40 to 60 °C was used. The extraction was performed for 1 hour at 90 °C, after which the temperature was raised to 110 °C and the stopper was closed to collect the solvent, the beaker with the

extracted fat was removed and placed in a hot air oven at 60 °C for a short period of time. A desiccator was used to chill the beaker containing the fat collection before weighing it. The formula below was used to compute the fat percentage.

Fat (%) = w2−w1 w1 × 100

Where,
W1= weight of sample (g)
W2= weight of empty beaker
W3= Weight of beaker with fat Fiber

The crude fiber content was calculated using the A.A.O.C. technique (2005).

Reagents
1. Sulphuric acid working solution (1.25%), 6.7 ml in one-litre distilled water.
2. NaOH working solution (1.25) Diluted 12.5 g in one litre distilled water.

Procedure
One gram of a defatted, moisture-free sample was weighed and maintained in a crucible that had already been weighted. The crude fiber device was filled with the crucible. After that, 150 ml of sulphuric acid (1.25%) was added, and the mixture was then brought to a boil for exactly 30 minutes. linked to a vacuum after boiling to drain 17 sulfuric acid After draining was finished, 150 ml of sodium hydroxide solution (1.25%) was added, and the mixture was allowed to boil for 30 minutes. Crucible was taken out after cooling and weighed again with the insoluble material before being put in an oven to dry at 105 °C for one hour until it reached a steady weight. After cooling in a desiccator, the crucible with the ash was reweighed. Following is how the crude fiber percentage was determined.

Crude fiber (%) = w1−w2 w1 × 100

Where
W= weight of sample (g)
W1= weigh of crucible with insoluble matter
W2=weight of crucible with ash

Crude protein
Kjeldahl technique was employed to calculate the sample's crude protein content. The digestion, distillation, and titration utilizing the KEL PLUS Automatic Nitrogen Estimation system are all included in this.

Reagents
- Boric acid (4%)'=
- Commercial grade sulphuric acid
- Sulphuric acid (0.025 N)
- Sodium hydroxide (40%)
- Digestion mixture: copper sulphate: Sodium sulphate (1:9)
- Indicator: 3 drops of methyl red solution + 5 drops of bromocresol green solution

Procedure
- **Digestion:** The nitrogen content of the sample was determined using the traditional Kjeldahl method. The controller was set to 420 C for the temperature. After adding 5 ml of commercial- grade sulphuric acid and 1.5 gm of the digestion mixture, 0.25 to 0.3 gm of the sample was taken and digested on the KEL PLUS equipment until it was clear. Water was carefully poured along the tube's neck once it had cooled. in order for the contents on the tube's neck to mingle with the digested contents on the tube's bottom. The sample was then put through the distillation process.
- **Distillation:** An empty conical flask was placed on the receiver side of the apparatus once the digested sample had been loaded there. Then, the equipment's programme was allowed to begin the distillation process. Automatically, 20 ml of boric acid were added to the conical flask, and then 40 ml of 40% NaOH were slowly added to the tube, 10 ml at a time. After fully incorporating 40% NaOH into the tube, the precipitate's colour changed from bluish green to brown. Then the procedure was started, and the conical flask's colour changed from pink to green to signify the completion of the distillation process.
- **Titration:** The conical flask's solution was titrated with 0.025N sulfuric acid until the color changed from green to a stable shade of pale pink. Readings from the samples were adjusted for the value of the blank. These formulas were used to estimate the sample's crude protein content.

Crude protein (%) =14.01×(ml titrant−ml blank)×N×6.25 / W×1000 × 100

Where,
N= Normality (0.025)
W= Weight of oven dried sample taken for digestion
6.25= Factor for converting Nitrogen into crude protein of sample

Carbohydrate by difference
The sample's carbohydrate content was calculated using the difference in value that resulted from subtracting 100% from all of the proximate composition values. To do this, remove 100% from the total of the numbers for moisture, total ash, crude fat, crude fiber, and crude protein.

Carbohydrate (%)= 100-(Moisture% + ash% + Crude fat% + Crude protein% + Crude fat%)

Minerals Calcium
Acid digestion of sample
A 10 ml conical flask was filled with 0.5 grams of sample material. Each flask received 10 cc of pure HNO3, which was added, and was left alone for the whole night. On a hot plate, samples in the flask were heated until a brown flame appeared. Each flask received an addition of 5 ml of the di-acid mixture (HNO3:HCLO4 (70%)::3:2 by volume), which was heated until a white fume emerged, lowering the volume of the contents to around 2 ml. Conical flasks were then taken off the hot griddle and left to cool. Then, each flask received 15 cc of warm, distilled water. Conical flask contents were transferred to a 50 ml volumetric flask, twice rinsed with distilled water, and the volume was increased to 50 ml. The aliquot was filtered using Whatman No. 42 filter paper, and an extract was saved for using Jackson's methods to estimate the presence of minerals like calcium, iron (1973).

3. Procedure for preparation of fortified cupcake Procedure

Sunflower oil, icing sugar, vanilla extract, milk, and milk powder are combined until smooth and light. Instead, combine whole wheat flour, refined wheat flour, baking soda, and baking powder. Next, combine the wet and dry components. Put cupcake liners inside the cupcake tin. Fill the muffin liners with the batter. Bake the cupcakes at 160 °C for 25 minutes. Take them out of the pan when they have cooled for a few minutes.

Table 1: Ingredients required for cupcake:

Name of the ingredients	Amount
Whole wheat flour	50 g
Refined wheat flour	50 g
Milk	80 ml
Milk powder	10 g
Baking soda	1.5 g
Baking powder	3 g
Oil	46 ml
Icing sugar	50 gm
Vanilla essence	I tsp

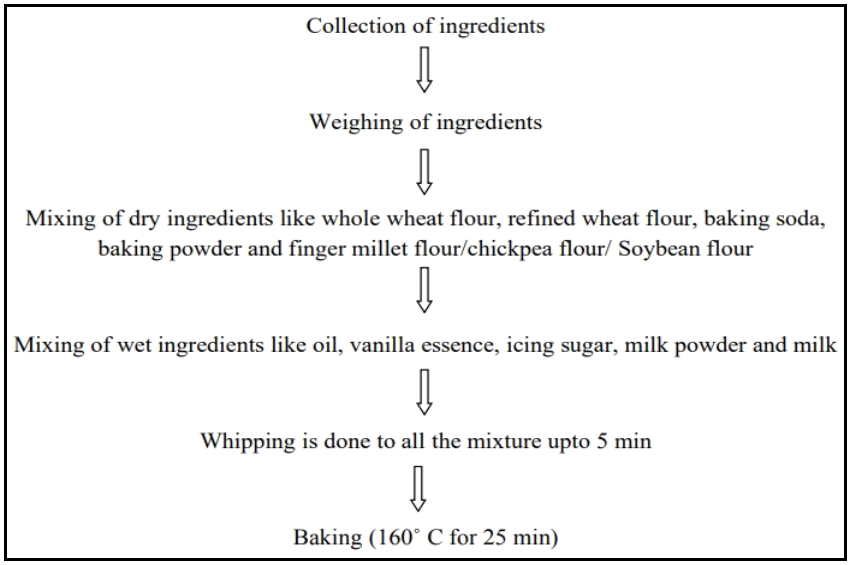

Fig 1: Flowchart of cupcake preparation

Fig 2: Preparation of Cup Cake

Results and Discussion

Table 2: Formulation of ingredients for cup cake

Ingredients	Co	C1	C2	C3	C4	C5	C6
Refined wheat flour	50 g	28 g	28 g	28 g	28 g	28 g	28 g
Whole wheat flour	50 g	28 g	28 g	28 g	28 g	28 g	28 g
Soy flour	-	44 g	-	-	22 g	-	22 g
Bengal gram flour	-	-	44 g	-	22 g	22 g	-
Finger millet flour	-	-	-	44 g	-	22 g	22 g

In table 2, different formulations of raw ingredients for making cupcakes were presented. In C0, refined wheat flour and whole wheat four were taken in equal amount for cupcakes as control group. By blending finger millet flour (FMF), soy flour (SF), Bengal gram flour (BGF) in refined wheat flour (RWF) and whole wheat flour (WWF) seven types of composite flour were formulated for preparation of cupcake in different proportion as shown in the above table.

Table 3: Proximate composition of raw ingredients (per 100 g on dry matter basis)

	Moisture	total Ash	Crude protein	Crude fat	Crude fiber	Carbohydrate
Refined wheat flour	12.3.0.05	0.5±0.05	10:0.05	0.8±0.05	0.2±0.05	72.90.05
Whole wheat flour	11.2±0.05	1.7±0.05	11.1±0.05	1.3±0.05	1.5±0.05	68.4±0.05
Finger millet flour	12.1±0.05	1.7±0.05	6.3±0.05	0.9±40.05	2.6±0.06	71±0.47
Gram flour	9.7±0.05	1.5±0.05	21.5±0.05	4.2±0.05	0.5±0.05	56.1±0.05
Soy flour	7.1±0.05	3.6±0.05	42.2±0.05	17.5±0.05	2.7±0.05	18.9±0.05
Note: values are mean ± SE of three independent replications						

The result on the proximate composition of the raw materials i.e. refined wheat flour, whole wheat flour, finger millet flour, soy flour, Bengal gram flour was shown in Table 3. It was found that the moisture, total ash, crude protein, fat, fiber and carbohydrate contents of refined wheat flour were 12.3, 0.5, 10, 0.8, 0.2, 72.9 percent respectively. Likewise whole wheat flour contains 11.2% moisture, 1.7% total ash, 11.1% crude protein, 1.3% crude fat, 1.5% crude fiber, 68.4% carbohydrate respectively. Finger millet flour contains 12.1% moisture, 1.7% total ash, 6.3% crude protein, 0.9% crude fat, 2.6% crude fiber, 71% carbohydrate. Bengal Gram flour contains 9.7% moisture, 1.5% total ash, 21.5% crude protein, 4.2% crude fat, 0.5% crude fiber,56.1% carbohydrate. Soy flour contains 7.1% moisture, 3.6% total ash, 42.2% crude protein, 17.5% crude fat, 2.7% crude fiber, 18.9% carbohydrate. Refined wheat flour has a maximum moisture level of 12.3%, while soy flour has a minimum moisture content of 7.1. Soy flour has a maximum total ash content of 3.6%, while refined wheat flour has a minimum total ash concentration of 0.5%. The largest amount of crude protein was found in soy flour, at 42.2%, and the lowest amount was in finger millet flour, at 6.3%. Soy flour has a maximum crude fat level of 17.5%, while refined wheat flour has a minimum crude fat content of 0.8%. The largest amount of crude fiber, 2.7%, was identified in soy flour, and the least amount, 0.2%, was found in refined wheat flour. The maximum carbohydrate content found in refined wheat flour i.e. 72.9% and the minimum content found in soy flour i.e. 18.9%. All the raw material differs significantly (p<0.05) in their proximate composition.

Table 4: Mineral content of raw ingredients (per 100 g on dry matter basis)

Ingredients	Calcium	Iron
Refined wheat flour	21±0.47	2.7±0.05
Whole wheat flour	46±0.47	4.9±0.05
Finger millet flour	334±0.47	3.9±0.05
Bengal Gram flour	56±0.47	9.5±0.05
Soy flour	235±0.47	10.4±0.05
Note: values are mean ± SE of three independent replications		

The result on the mineral content of the of the raw materials i.e., refined wheat flour, whole wheat flour, finger millet flour, soy flour, Bengal gram flour is shown in Table 4. It has been found that the calcium and iron contents of refined wheat flour were 21, 2.7 mg/100 g percent respectively. Likewise whole wheat flour contains 46mg/100 g calcium, 4.9 mg/100 g iron. Finger millet flour contains 334mg/100 g calcium, 3.9 mg/100 g iron. Gram flour contains 56mg/100 g calcium, 9.5 mg/100 g iron. Soy flour contains 235mg/100 g calcium, 10.4 mg/100 g iron. The maximum calcium content found in finger millet flour i.e. 334 mg/100 g and minimum calcium content found in refined wheat flour i.e. 21 mg/100 g. The maximum iron content found in soy flour i.e. 10.4 mg/100 g and minimum iron content found in refined wheat flour i.e. 2.7 mg/100 g.

Table 5: Proximate composition of cupcakes (per 100 g on dry matter basis)

Types of cupcakes	Moisture	Total Ash	Crude protein	Fat	Crude fiber	Carbohydrate
Co	$28.03^{a\pm}$0.26	2.05^{b}±0.16	$6.55^{b\pm}$0.03	$23.44^{d\pm}$0.21	1.62^{b}±0.01	$36.32^{c\pm}$0.16
C3	23.12^{b}±0.01	2.13^{b}±0.11	$5.14^{c\pm}$0.07	$26.75^{b\pm}$0.02	$3.27^{a\pm}$0.02	$39.07^{a\pm}$0.16
C4	$21.68^{c\pm}$0.02	$2.48^{a\pm}$0.02	$10.33^{a\pm}$0.02	$27.28^{a\pm}$0.02	$3.32^{a\pm}$0.02	$34.48^{d\pm}$0.05
C5	$28.13^{a\pm}$0.01	$2.23^{a\pm}$0.02	$6.63^{b\pm}$0.02	$23.81^{c\pm}$0.01	$3.34^{a\pm}$0.02	$37.45^{b\pm}$0.40
CD at 5%	0.25	0.29	0.12	0.32	0.11	0.16
Note: values are mean ± SE of three independent replications. Mean with same superscript (a, b, c, d) in the same column differ significantly (p<0.05)						

The results of proximate compositions of fortified cupcakes are presented in the Table 5. It was discovered that finger millet flour developed cupcakes had 23.11% moisture, 2.13% total ash, 5.14% crude protein, 26.75% fat, 3.27% crude fiber, and 39.07% carbohydrates. In contrast, C3 and C4 fortified cupcakes had moisture percentages that were

significantly lower (p<0.05), crude protein percentages that were lower, and carbohydrate percentages that were lower. C3 fortified cupcake obtained highest carbohydrate value i:e 39.07 where C4 fortified cupcake obtained lowest carbohydrate content i;e 34.48.

Table 6: Mineral content of cupcakes (per 100 g on dry matter basis)

Ingredients	Caleium (mg/100 g)	Iron(mg/100 g)
Co	$0.22^{d\pm}$0.01	$3.8^{c\pm}$0.06
C3	0.74^{a}±0.02	$3.83^{c\pm}$0.01
Co	0.43^{c}±0.02	$6.49^{a\pm}$0.01
Cs	0.58^{b}±0.02	$5.06^{b\pm}$10.01
CD at 5%	0.4	0.09
Note: Values are mean ± SE of three independent replications. Mean with same superscript (a, b, c, d) in the same column differ significantly (p<0.05). Control(C0)-RWF:WWF(50:50), C3-RWF:WWF:SF(28:28:44), C4-RWF:WWF:SF:BGF(28:28:22:22), C5-RWF:WWF:BGF:FMF(28:28:22:22), RWF-Refined wheat flour, VVWF-Whole wheat flour, FMF-Finger millet flour, BGF-Bengal Gram flour, SF-Soy flour		

It was discovered that the C0 fortified cupcake contains 3.8% iron and 0.22% calcium. Cupcakes supplemented with C3 have 3.83% iron and 0.74% calcium. A C4 fortified cupcake had 6.49% iron and 0.43% calcium. There were 0.58% calcium and 5.06% iron in C5 supplemented cupcake, respectively.

The C3 fortified cupcake has a maximum calcium level of 0.74 mg/100 g, while the C0 fortified cupcake has a minimum calcium content of 0.22 mg/100 g. In comparison to C0 fortified cupcakes, which have a minimum iron level of 3.8 mg/100 g, C4 fortified cupcakes have a maximum iron content of 6.49 mg/100 g. It was discovered that the C0 fortified cupcake contains 3.8% iron and 0.22% calcium. Cupcakes supplemented with C3 have 3.83% iron and 0.74% calcium. A C4 fortified cupcake had 6.49% iron and 0.43% calcium.

A C5 enriched cupcake contains 5.06% iron and 0.58% calcium. The C3 fortified cupcake has a maximum calcium level of 0.74 mg/100 g, while the C0 fortified cupcake has a minimum calcium content of 0.22 mg/100 g. In comparison to C0 fortified cupcakes, which have a minimum iron level of 3.8 mg/100 g, C4 fortified cupcakes have a maximum iron content of 6.49 mg/100 g.

Discussion

The discussion of the study's findings is illustrated in the current chapter. The following subheadings have been used to describe the pertinent discussions of the current study:

Nutritional compositions of raw materials

Refined wheat flour had 12.3% moisture, 0.5% total ash, 10% crude protein, 0.8% crude fat, 0.2% crude fiber, 72.9% carbohydrate, 21% calcium, and 2.7% iron, According to results in tables, Similar findings for the proximal contents of 13.3% moisture, 0.6% total ash, 0.9% fat, 11.0% protein, 73.9% carbohydrate, and 0.3% ash were also published in Nutritive Value of Indian Foods (2018).

Finger millet flour has the following nutritional and mineral compositions: 12.1% moisture, 1.7% total ash, 6.3% crude protein, 0.9% crude fat, 2.6% crude fiber, 71% carbohydrate, 334% calcium, and 3.9% iron. Mane and Kadam (2021) discuss findings for proximal and mineral contents that are equivalent to those of the current investigation.

Soy flour was found to have 7.1% moisture, 3.6% total ash, 42.2% crude protein, 17.5% crude fat, 2.7% crude fiber, 18.9% carbohydrate, 235% calcium, and 10.4% iron, according to the results Similar figures for proximal contents were also published in Nutritive Value of Indian Foods (2018) for 8.1% moisture, 4.6% total ash, 43.2% protein, 19.5% fat, 3.7 fiber, and 20.9% carbohydrate, respectively.

The Bengal gram flour's nutritional breakdown was as follows: 56.1% carbohydrate, 56% calcium, 9.5% iron, 21.5% crude protein, 4.2% crude fat, and 1.5% total ash. Srestha (2022) explores findings for proximal and mineral contents that are equivalent to those of the current investigation.

According to the data in tables, whole wheat flour has the following composition: 68.4% carbohydrates, 46% calcium, 4.9% iron, 11.2% moisture, 1.7% total ash, 11.1% crude protein, 1.3% crude fat, and 1.4% crude fiber. Similar findings for the proximal contents of 12.2% moisture, 2.7% total ash, 12.1% protein, 1.7% fat, 1.9% fiber, and 69.4% carbohydrate were also published in Nutritive Value of Indian Foods (2018).

Summary and Conclusion

Due to its palatability, flavour, convenience, nutritional content, and organoleptic value, cupcakes are regarded as food products in many nations. It is a suitable food for nutritional improvement when nutrients are supplemented by enrichment and fortification. Preschoolers are becoming more interested in cakes that have elements that are good for them. Consequently, it is an excellent chance to create and popularize nutrient-rich cupcakes among preschoolers at Angan Wadi Centres (AWCs) in our state.

The nutritional profiles of Bengal gram flour, soy flour, and finger millet flour were also examined. The refined wheat flour's moisture, total ash, crude protein, crude fat, crude fiber, and carbohydrate content were 12.3%, 0.5%, 10%, 0.8%, and 72.9%, respectively. Similar to whole wheat flour, which has 68.4% of carbohydrates, 11.2% moisture, 1.7% total ash, 11.1% crude protein, 1.3% crude fat, and 1.5% crude fiber. 12.1% moisture, 1.7% total ash, 6.3% crude protein, 0.9% crude fat, 2.6% crude fiber, and 71% carbohydrates are included in finger millet flour. Bengal Gram flour includes 56.1% carbohydrates, 9.7% moisture, 1.5% total ash, 21.5% crude protein, 4.2% crude fat, and 0.5% crude fiber. 7.1% moisture, 3.6% total ash, 42.2% crude protein, 17.5% crude fat, 2.7% crude fiber, and 18.9% carbohydrate make up soy flour.

Refined wheat flour has a maximum moisture level of 12.3%, while soy flour has a minimum moisture content of

7.1. This means that it may be maintained for a longer period of time because the moisture content, an essential medium for microbial growth, is quite low. Soy flour's high crude protein (42.2%) and crude fat (17.5%) concentrations allow it to be employed in the treatment of protein insufficiency. The amount of carbohydrates in refined wheat flour was high (72.9%). The greatest amount of crude fiber in soy flour, 2.7%, is comparable to other raw materials. Foods high in fiber are good for fecal bulk, bile acid removal, and lowering blood cholesterol levels. Finger millet was discovered to have a higher 49 calcium content, which suggests it could be used as a supplement to other foods for susceptible populations. The higher levels of calcium (334 mg/100 g) and iron (10.4 mg/100 g) in finger millet flour and soy flour, respectively, may suggest that these two grains are significant sources of minerals.

The proximate compositions, mineral compositions, organoleptic acceptability, storability, and microbiological load of control cupcake (C0) and finger millet cupcake(C3) were studied. It was found that the properties of cupcake made from refined wheat flour and whole wheat flour, including moisture 28.03 percent, total ash 2.05%, crude protein 6.55%, crude fat 23.44 percent, crude fiber 1.62%, and carbohydrate 36.32%, were significantly (p<0.05) increased with increasing levels of finger millet flour substitution in refined wheat flour, including total ash (2.05 to 2.13), crude fiber (1.62 to 3.27) and carbohydrate (36.32 to 39.0). The fortified cupcakes C4 and C0 had the highest proximal and mineral levels, respectively, while cupcake C3, produced with finger millet flour, whole wheat flour, and refined wheat flour, received higher ratings from the panellists and had superior sensory characteristics than the control. All of the sensory qualities of the finger millet flour-based Cupcake and the control both significantly declined with longer storage times at days 2, 4, 6, and 8.

The proximate compositions, mineral compositions, organoleptic acceptability, storability, and microbiological load of control and C4 (soy flour+ Bengal gram flour) fortified cupcakes were also examined. The nutritional value of the C0 cupcake was found to be 28.03% moisture, 2.05% total ash, 6.55% crude protein, 23.44% crude fat, 1.62% crude fiber, and 36.32% carbohydrate, while the addition of soy flour to Bengal gram flour significantly (p<0.01) increased the nutritional quality of the control cupcakes in terms of total ash, crude fat, crude protein, and crude fiber. Due to the existence of both volatile and non-volatile oxygenated fatty acids in soy flour, the greater concentration of soy flour incorporation on cupcake results in a fragile, bitter, and beany taste compared to the control.

Recommendations

- It may be recommended that cupcakes should be made from refined wheat flour, whole wheat flour, finger millet flour in the proportion of (28:28:44) for better nutritional supplementation for the children.
- It is recommended for the Children to consume finger millet fortified cupcakes.
- Other ingredients may be explored to prepare cupcake.

Acknowledgement

First and foremost, I want to give thanks and praise to God, the Almighty, for his gifts that helped me complete my research successfully. I extend my sincere gratitude to Dr. (Mrs.) Diptimayee Jena, associate professor in the department of food science and nutrition and head of my advisory for helping me finish my work because of her commitment, sharp attention, and most importantly, her overpowering attitude toward her students.

I owe a deep sense of regards to Dr. (Mrs) Snehalata Nanda, Professor and Head Department of food science and Nutrition, CCS, OUAT, Bhubaneswar, member of my advisory committee for her keen interest on me at every stage of my research work.

I would also like to extend my gratitude and regards to Dr. (Mrs.) Kalpana Rayguru, Professor and Head, Department of Agricultural Processing and Food Engineering and Technology, O.U.A.T., Bhubaneswar, Dr. (Mrs.) Chitrotpola Devadarshini, Assistant Professor Department of Food Science and Nutrition, CCS, OUAT, Bhubaneswar and Mrs. Sumitra Chhotaray, Research Assistant, Department of Food Science and Nutrition, CCS, OUAT, Bhubaneswar for their support, consistent direction, infinite assistance, and provision of lab resources during this research.

References

1. Sadat AS. A brief review of risk-factors for growth and developmental delay among preschool children in developing countries. Advance Biomedical Research. 2013;2(4).
2. Nalinde A, Asish M. Haske, Bhagwat N, Borale S. "Formulations of Vitamin "A rich carrot Muffins. International Journal of Science and Research. 2016 Oct;7(10):1369.
3. Beatriz H, Canet W, Jimenez MJ, Fuentes R, Alvarez MD. Characterisation of chickpea flour-based gluten-free batters and muffins with added biopolymers: rheological, physical and sensory properties. International Journal of Food Science and Technology. 2016;51(5):1087-1097.
4. Dias João Carlos da Silva. Nutritional and Health Benefits of Carrots and Their Seed Extracts." Food and Nutrition Sciences. 2014 Nov;5:2147.
5. Emily PMT, Ramdath DD, Carson SJ, Hawke A, Blewett HJ. Liking of soy flour muffins over time and the impact of a health claim on willingness to consume. Food Research International; c2015.
6. Ester L, Mohandas A, Priya S, Monica SJ, Gajdacs M, Khusro A, *et al*. Physiochemical properties, nutrient profile, microbial stability and sensory evaluation of cupcakes enriched with pomegranate seed oil. Cellular and Molecular Biology; c2021. p. 33-38.
7. Jyoti SS, Bhosale MG. Nutritional analysis of cake formulated with ragi flour and peanut butter." International Journal of Innovation in Engineering and Technology. 2015 Aug;5(4):1-2.
8. Ladkat KS, Kotecha PM, Chavan UD, Bhise AH. Phytochemical properties of finger millet and malted finger millet muffins. Bioinfolet. 2019, 31.
9. Kavita M, Kadam M. Development and quality evaluation of ragi supplemented cupcakes." International Journal of Environment, Agriculture and Biotechnology (Infogain Publisher). 2021 Mar-Apr;83.
10. Datt SK, Karki S, Thakur NS, Attri S. Chemical composition, functional properties and properties of carrot. Journal of Food Science and Technology. 2012 Jan-Feb;22.

11. Neela BK, Dr. Sri SKV. Soyabean consumption and Health benefits. International Journal of Scientific and Technology Research. 2015, 50-52.
12. Madiha R, Sattar MA, Tahseen S, Saleem B. Ameliorative effect in nutritional and sensorial profile of muffins. Emirates Journal of Food and Agriculture. 2022 Feb;34(3):213.
13. Bruntha DP, Bharati RB, Sathyabama S, Nagappa Gurusiddappa Malleshi NG, Venketesan Brindha Priyadarshini. Health benefits of finger millet (*Eleusine coracana* L.) Polyphenols and dietary fibre: A review. Journal of Food Science and Technology. 2014;1027-1031.
14. Sahu Swaroop Kumar, Ganesh Kumar S, Vishnu Bhat V, Premarajan KC, Goutam Roy, Sonali Sarkar, *et al*. Malnutrition among under-five children in India and strategies for control. Journal of Natural Science, Biology, and Medicine, 2015, 2.
15. Traynham TL, Deland J, Myers EA, Carriquiry L, Johnson LA. Evaluation of Water-Holding Capacity for. Journal of the American Oil Chemists' Society. 2007, 151.
16. Thomas M, Yerxa K, Therrien M, Kamire ME. Whole Grain Muffin Acceptance by Young Adults. Foods. 2018;1(10).
17. Ujjwal M, Bisoi S, Nandi DK. Malnutrition among Tribal Preschool Children of Paschimanchal, West Bengal, India: A review. Journal of Global Research in Public Health. 2020 Dec;5:235.
18. Desai RA, Krishnan-Sarin S, Cavallo D, Potenza MN. Video-gaming among high school students: health correlates, gender differences, and problematic gaming. Pediatrics. 2010 Dec 1;126(6):e1414-1424.
19. Bulbula DD, Urga K. Study on the effect of traditional processing methods on nutritional composition and anti nutritional factors in chickpea (Cicer arietinum). Cogent Food & Agriculture. 2018 Jan 1;4(1):1422370.
20. Hirdyani H. Nutritional composition of Chickpea (*Cicer arietinum* L) and value added products-a review. Indian Journal of Community Health. 2014 Dec 31;26(Supp 2):102-106.