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Proximate Composition and Sensory Evaluation of Developed Cakes from Composite Flour

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ABSTRACT:

Cakes produced from composite flour were investigated for proximate and sensory qualities. The attributes were developed and evaluated by using standard laboratory procedures. The composite flour was prepared with using Finger millet flour, Soya flour, oats flour & refined wheat flour. Five different varieties of cakes were prepared. Refined wheat flour to composite flour proportion in preparation of cakes were as follows: A_0 (100%:0), A_1 (80%:20%), A_2 (60%:40%) , A_3 (40%:60%) and A_4 (20%:80%) .The data generated were analyzed statistically by one way analysis of variance (ANOVA). Theproximate composition for the developed cakes were shown an increase in energy value(387.68–397.50 kcal/100 g), protein (6.20-14.30%),ash content from (1.41–2.98%), fat (12.95–16.51%), crude fibre (1.08–4.77%) as well as decrease in moisture (16.78–13.51%) & carbohydrate content (61.59–47.92%). The above results indicated that as the substitution level of flour mixture increases, there will be increase in protein, fat, fiber & ash percentage and decrease in carbohydrate and moisture percentage. The sensory test was conducted by using 9- point hedonic scale rating for acceptance of the developed products. These results found that the cakes varied in appearance (8.2-6.6), colour (8.0–6.1), taste (8.4–6.6), flavour (8.8–7.0), texture (8.4–6.4) and overall acceptability (6.46–8.34). The control sample had the highest sensory scores for colour than all other attributes. The proximate composition values for protein, fat, ash, fiber and energy content increased as the composite flour quantity increases but on the basis of the sensory evaluation, at 40% incorporation of composite flour, the developed cake(A_2) is most acceptable in comparison to others. In conclusion, the developed cakes made with composite flour substitution are well accepted and also are rich in both micro and macronutrient. Hence it could make a significant contribution for the consumers as well as bakery industry.

Keywords: Composite flour, Formulation, cake, Quality assessment, Sensory evaluation.

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INTRODUCTION:

Cake is considered as one of the most relished and palatable baked products prepared from flour, sugar, shortening, baking powder, and essence as principal ingredients. Plain cakes are generally prepared from refined wheat flour & it is the conventional practice for the buyer and seller. Cakes have consistently secured top position because of its unique flavour. There are different varieties of cakes available in the Indian market like sponge cakes, muffins, cheese cakes, cake pops, red velvet, black forest etc. The cake market is changing vigorously on many angles, and it is anticipated to keep generating significant improvement that will be fuelled by shifting consumer preferences and the acceptance of global food trends. Baked products are gaining popularity because of their availability, ready to eat, convenience and reasonably good shelf life. As bakery products rich in fat, sugar, and calorie content and low in dietary fibre and protein content, regular consumption of bakery products can't be advisable. Keeping on view of this composite flour technology was accepted.

The terminology Composite flour is referred as "a process of mixing wheat flour with cereal and legume flour for preparation of bakery products". According to Dendy (1992), composite flour can also be used with regard to mixing of non-wheat flours, roots and tubers or other raw materials with wheat flour .Due to composite flour technology, it is possible to blend, mix or fortify one food material with others so that the resulting fortified mix has not only better nutritional quality but also the necessary attributes for consumer acceptance (Lupien, 1990). Many research findings states that, use of composite flour for preparation of bakery products are nutritionally more valuable than bakery products made up of with only wheat flour or refined wheat flour.

Seeing the importance of composite flour, here the research work was conducted by taking oats flour; ragi flour, soya flour & refined wheat flour is the base ingredient of composite flour for the preparation of healthy cakes. Combination of cereals and millets are an important constituent of the human diet. Acc.to Okarter *and Liu (*2010), consumption of whole grain foods has associated with decreased risk of cardiovascular disease, diabetes and certain cancers and favourable effects on blood lipids and blood glucose level. Being most of the bakery products are rich in oil & sugar, it is mostly recommended for children and underweight malnourished person. As composite flour is a mixture of grains of cereals, pulses & millets, it also protects from cardiovascular diseases, diabetes & certain type of cancers, it is recommended that use of composite flour could enhance the nutritional quality of bakery product.

Oat grains (Avenal sativa), a type of cereal, are well known for their nutritional value and have been used as functional foods. The different components of oats are glucan, proteins, unsaturated fatty acids, vitamins, minerals, and phytochemicals, etc. have many health advantages. The non starchy polysaccharide ß-glucan, which can be found in the cell walls of the aleuronic layer in bran, is a soluble dietary fibre that is best found in oats. The most

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significant advantages of ß-glucan are their role in decreasing serum blood cholesterol and regulating blood sugar in diabetics. However, the use of oats in baked products has been limited due to the inability of oat flour to form cohesiveness, elasticity property of dough to retain gas etc. Addition of wheat gluten to oat flour improves the processing properties of the dough and also the quality of bakery products as increased consumer demand for new and healthy food options, the industry is also trying to fortify bakery products to satisfy the appetite of the health-conscious people.

Soybean (Glycine max) belongs to the leguminosae family and is a member of the papillionnideae subfamily. It is also known as "Miracle bean," for its high nutritional content as well as its health benefits. In the central region of India, soybean is an important crop that is widely farmed. Most of it is used to make oil or for animal feed, with only a very minute quantity being used directly as human food. It provides a good balance of all essential amino acids, making it preferable to all other plant foods. Compared to the expensive meat proteins, it is cheaper and acts as a superior food for vegetarian diet. Taking into account of its nutritional qualities, it is superior to all other plant foods as it contains essential macro nutrients, well balanced of all essential amino acids, high protein and fat content, helps in substantial reduction of protein-energy malnutrition. It contains protein (40 percent), carbohydrates (18 percent) and fat (18 percent). The moisture content is 9 percent and fibre about 10 percent with other micronutrients like folic acid, calcium, potassium and iron is 5percent (Singh, 2009).

Finger millet (*Eleusine coracana L.*) is commonly known as ragi. The major ragi growing states of India are Karnatak, Maharashtra, Utarakhand, Tamilnadu, Andhrapradesh, Jharkhand, Odisha, Chhatisgarh & Gujurat . About 60% of global production of ragi is produced from India & considered as an ideal food for human being. Due to high fiber content in grain checks constipation, high blood cholesterol formation and intestinal cancer (Usha 2004). Ragi has low glycemic index value. It reduces plasma cholesterol, total serum cholesterol and LDL cholesterol by 9% each and triglycerides by 15% and increased HDL cholesterol, thus showing a significant beneficial effect on the plasma profile (Enas *et al.* 2003).Different studies revealed that iincorporation of finger millet flour in the preparation of bakery products like biscuit, nankhatai, muffins and bread has been accepted by the consumer irrespective of the product quality. The use of millets in bakery products will not only superior in terms of fiber content, micronutrients but also create a good potential for millets to enter in the bakery world for series of value added products. According to Desai et.al (2010), supplementing with malted finger millet flour improvse the nutritional quality of cakes with respect to the minerals and fiber content.

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MATERIALS AND METHODS:

2.1 Procurement of raw material: The raw ingredients used for development of composite flour for cakes are white wheat flour, oats flour, Finger millet flour, soya flour, leavening agents, oil, Milk powder, Milk etc. purchased from local market of Bhubaneswar.

2.2. Formulation of Flour mixture for development of Composite flour:

Ingredients	Quantity (gms)
Ragi Flour	50
Soya Flour	30
Oat Flour	20
Total	100

2.2 Processing of raw material: Cleaning, grinding, and sieving of dry flours for removing extraneous materials. Dry roasting is required for ragi flour.

2.3 Preparation of Cakes: Cakes were prepared by creaming method. The flour was sieved with baking powder, baking soda, amul powder. In a container,oil and sugar was creamed with hand blender followed by addition of essence. Then sieved flour mixture was added to cream. Proper beating was required to prepare batter & a proper consistency maintained with use of milk or water. Fix the mixing direction either clockwise or anticlockwise. After preparation of batter pour the batter in a greased cake mold and baking was done at 180^0C & allow the cake to cool then store it at ambient temperature.

Process flow chart for Cake Preparation:

Weighing of different ingredients as per recipe

↓

Sifting of flour and other powdered ingredients

↓

Creaming of oil and sugar till it becomes soft, light and fluffy

↓

Addition of Vanilla essence

↓

Addition of flour and other ingredients to make batter

↓

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Addition of milk for required consistency

↓

Preheating oven & cake mould

↓

Poured the batter to cake mould

↓

Baking at 170°C for 25min

↓

Cooling

↓

Packaging

↓

Labelling

↓

Storage for further study

Recipes for preparation of Cakes

Ingredients (gm)	**Control(A_0)**	**A_1**	**A_2**	**A_3**	**A_4**
RWF	100	80	60	40	20
CF	0	20	40	60	60
Sugar	50	50	50	50	50
Oil (ml)	50	50	50	50	50
Baking Powder	2.5	2.5	2.5	2.5	2.5
Baking Soda	0.5	0.5	0.5	0.5	0.5
Vanilla essence (tsp)	1	1	1	1	1
Milk (ml)	25	25	25	25	25
Milk Powder	15	15	15	15	15

RWF: Refined wheat flour, CF: Composite Flour

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2.5 Proximate Analysis

Estimation of total ash was carried out using muffle furnace at 550^0C for 4 Hrs. Moisture content was determined by using standard oven drying method. The protein estimation was done by Nitrogen analayzer, Kel Plus(Pelican). Fat estimation was done by using petroleum ether, as solvent extraction method using Socs Plus equipment (Pelican). Fiber was estimated by Fibraplus equipment (Pelican). Carbohydrate content was calculated by differential method i.e.

{ 100-(Moisture%+Ash%+Protein%+fat%+Fiber %) }

Total energy was calculated by using formula : **Energy**= (Carbohydrate)×4+(fat) ×9+(protein) ×4.

Sensory Analysis

Sensory analysis of composite flour cake was done by 9-point hedonic scale parameter by semi trained panel members of College of Community Science, OUAT in Department of FSN. Appearance, colour, texture, taste, flavour, and overall Acceptance were evaluated by 9-point hedonic Scale. The panelists were asked to score the samples for all the sensory parameters (Rangana, 2002). The degree to which developed product was liked, will be expressed with scores as: 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 and disliked extremely-1.

2.7 Statistical analysis

The collected data was analyzed with the help of statistical tools such as mean and standard deviation. To analyse the test the significance difference between control and experimental samples of value-added products, ANOVA was conducted by using MS-Excel.

RESULT AND DISCUSSIONS:

3.1 Proximate Composition:

The different chemical properties such as moisture, ash, proteins, fat, fiber, Carbohydrate, and energy value of the prepared composite flour cakes were determined. As the different grains have used are rich in different nutrients which ultimately contribute to the nutritional value of developed cakes. The results pertaining to the chemical analysis are depicted in Table 1.

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Table-1 Proximate Composition of Developed cakes:

	A_0	A_1	A_2	A_3	A_4	CD at 5%
Moisture (%)	**16.78^{a}±0.27**	**16.55^{a}±0.20**	**15.94^{a}±0.27**	**14.74^{b}±0.46**	**13.51^{c}±0.19**	**1.14**
Ash (%)	**1.41^{e}±0.01**	**1.69^{d}±0.01**	**1.94^{c}±0.02**	**2.31^{b}±0.01**	**2.98^{a}±0.01**	**0.05**
Crude Protein (%)	**6.20^{e}±0.04**	**9.40^{d}±0.01**	**11.77^{c}±0.02**	**12.66^{b}±0.03**	**14.30^{a}±0.04**	**0.13**
Crude Fat (%)	**12.95^{e} ±0.04**	**14.15^{d}±0.04**	**15.01^{c}±0.07**	**15.91^{b}±0.02**	**16.51^{a}±0.03**	**0.18**
Crude Fiber (%)	**1.08^{e}±0.06**	**2.29^{d}±0.12**	**3.28^{c}±0.02**	**3.88^{b}±0.06**	**4.77^{a}±0.08**	**0.41**
Carbohydrate (%)	**61.59^{a}±0.11**	**55.91^{b}±0.04**	**52.06^{c}±0.26**	**50.50^{d}±0.65**	**47.92^{e}±0.22**	**1.2**
Energy (Kcal)	**387.68^{ba}±0.21**	**388.66^{ab}±0.51**	**390.41^{ab}±0.56**	**395.82±2.59**	**397.50^{a}±0.97**	**5.06**

(A_0=Control; A_1=20% Composite Flour,80% Refined Wheat Flour;A_2=40% Composite Flour,60% Refined Wheat Flour;A_3=60% Composite Flour,40% Refined Wheat Flour;A_4 =80% Composite Flour,20% Refined Wheat Flour)

The value with superscript a, b, c, d & e represents that higher value for 'a' and decreases to lowest value 'e' in a row. Values in the table are presented as mean ±SD; Values within rows sharing the same letters are not significantly different.

The estimated results recorded in table -1, showed that the moisture content for control sample is 16.78% to that of 80% substitution of composite flour was 13.51%, as the water absorption capacity of the composite flour increases the moisture content decreases so that the storage for the product is also increased. The values for ash content varied significantly from 1.41 to 2.98 % in different formulations. As the incorporation of composite flour increases, the ash content was also increased in control A_0 (1.41%) to A_4 (2.98%). Similarly, the Crude fibre contents was highest in A_4 (4.77%) and lowest in control cake A_0 (1.08%). Crude fibre content of composite flour cakes was higher than control because of incorporation of fibre rich ingredients like oats flour. Crude fat content was highest in A_4 (16.51%) and lowest in A_0 (12.95%). Again the protein content of developed cakes varies from 6.20% to14.30% as soy flour is rich in protein and utilisation up to 80% of composite flour increases the protein and fat content of the developed products. But the carbohydrate content is decreased from 61.59% to 47.92%. Similar findings is also seen in Ndife et al. (2011) that addition of soya flour to the wheat flour for formulation of bread increases protein, fat, crude fibre contents but decreased in moisture, carbohydrate and energy contents. Rana (2015) reported that significant ($p<0.05$) higher in protein crude fibre, ash & energy content of composite flour based cake than control sample but the carbohydrate, moisture content of control sample was found to be significantly ($p<0.05$) higher than composite flour based experimental cake.

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3.2 Sensory Evaluation:

Table-2 Sensory Evaluation

	A_0	A_1	A_2	A_3	A_4	CD at 5%
Apparance	8.1^{a}±0.23	8.2^{a}±0.13	8.2^{a}±0.29	7.2^{b}±0.29	6.6^{b}±0.22	0.68
Colour	8.4^{a}±0.16	8.0^{a}±0.30	7.9^{a}±0.18	6.8^{b}±0.39	6.1^{b}±0.28	0.77
Texture	8.0^{a}±0.21	7.8^{ab}±0.25	8.4^{a}±0.27	7.4^{b}±0.27	6.4^{c}±0.34	0.76
Flavour	8.2^{a}±0.25	7.0^{c}±0.21	8.8^{a}±0.13	7.2^{b}±0.25	7.4^{b}±0.37	0.72
Taste	8.3^{a}±0.26	7.4^{b}±0.34	8.4^{a}±0.27	6.8^{b}±0.25	6.6^{b}±0.34	0.84
OAA	8.2^{a}±.04	7.68^{b}±.08	8.34^{a}±.02	7.08^{c}±.02	6.46^{d}±.11	0.41

Values in the table are presented as mean±SD; The mean values with different notation (a, b, c and d) implies they are significantly different ($p<0.05$)

The sensory evaluation of composite flour based cake is presented in Table 2. The result showed that significantly highest scores of cake for all sensory parameters were obtained by experimental sample (A_2) with respect to all the parameters i.e. appearance, texture, taste & flavour i.e. 8.2, 8.4, 8.4, & 8.8 and ranging from 8.2-8.4with an overall acceptability scores of 8.34 and fell in the category of liked very much, followed by control A_0(8.2±0.4),then A_1, A_3 and $A_4$with an overall-acceptability scores of (7.68^{b}±.08), (7.08^{c}±0.02) and (6.46^{d}±0.11) respectively. There was a non-significant difference found in all sensory attributes for control and experimental sample A_2, but in over all acceptability, significant difference ($p\leq0.05$) was observed in the sensory scores of developed cake A_0, A_1, A_3 & A_4. The most accepted cake A_2 was prepared from 40 percent incorporation of composite flour with refined wheat flour scored slightly higher than cake A_1, A_3 and A_4. Seth *et.al* (2018) reported that the highest scores for all the sensory parameters of plain cake was obtained in S_2 by treatment of 10% of partially defatted peanut flour. The mean scores for colour, appearance, flavour, texture, and taste of S_2 were significantly higher than that of control S_1. Gupta and co-workers (2009) prepared sponge cakes by incorporating barley flour (10, 20, 30,and 40% w/w) into wheat flour which improved the appearance of the cake from pale cream to golden brown, even the texture was observed to be softer as indicated by the instrumental texture profile analysis of the resultant cake. P.Manisha(2019) reported that cake "S_3" sample scored highest with respect of all the parameters i.e. appearance (8.5), colour (8.3), texture (8.1),taste(8.2) & flavour (8.3) & also significantly scored highest with an overall acceptability score of 8.28 being liked very much. Hence the acceptability for the product from composite flour is accepted.

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CONCLUSION:

Researchers are paying close attention towards the growth of functional food products made from composite flour, especially in the creation of bakery food products. It was shown that food products manufactured from composite flour can nevertheless have properties like those of products developed from refined wheat flour. The development of food products using composite flour has increased and is attracting much attention from researchers for the production of bakery products. This article focuses on the use of composite flour to produce different varieties of cakes and its impact on nutritional value and sensory quality.

The composite flour technology for refined wheat flour supplemented with micronutrient & macronutrient enrich grains like ragi flour, soya flour, oat flour to overcome the Protein-energy malnutrition and various degenerative diseases like obesity, CVD. Developed cakes from composite flour (Reined wheat flour, ragi flour, soya flour, oats flour) were acceptable at all four level of composition of composite flour. Among developed cakes, the highest mean scores of 8.34 for all sensory parameters was obtained in experimental samples A_2. On the basis of results, it may be concluded that in order to combat malnutrition and other degenerative diseases through healthy diet. Consumption of value-added products developed from blends of flours could be beneficial for consumer and seller or also for commercialization purpose. Hence, the composite flour could be considered as cheap alternative flour to refined wheat flour and can be utilized by various food industries.

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