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Effect of enrichment on quality evaluation of finger millet mix carrot cake

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Abstract
Cake is a form of food that is baked and usually sweet in taste. It provides fats, carbohydrates and body building protein. Carrots are good source of β-carotene and carotene content ranges from 60–120 mg/100 g. A study was conducted on Effect of Enrichment on Quality Evaluation of Finger millet Mix Carrot Cake. The sponge cake methods were used to prepare this enriched mixed cake. The aim of this study to evaluate nutritional properties of finger mixed carrot cake and its utilization as partially substituted of wheat flour in cake making for school and college age. The present investigation indicates that the finger millet cake increase in the protein content in cake Sample 1 contains 3.56% and that of sample 2 was 3. 1%, sample 3, was 5.08%. The variation in the protein content in cake sample is due to the finger millet soy flour. The result showed that there was decrease in crude fiber of the samples. Sample 1 contains crude fiber 4%, where samples 2, shows 3.5%, and sample contain reflect 3%. This decrease in the crude fiber was due to variation in the formula of the cake. The total acceptability, taste and colour of cake were increase with addition of finger millet and carrot.

Keywords: *Eleusine coracana*, β-carotene, cake, sensory evaluation, crude fiber

1. Introduction
Consumption of bakery product in international food market is at very high rate [24]. Baking industry covers major area among food processing industry [1, 2]. Easy availability, good shelf life and reedy to eat convenience makes baked good popular among people [43].
Cake is one of the popular bakery good among all and is like by everyone [3]. Cake is a form of food that is baked and usually sweet in taste. It provides fats [4]. carbohydrates and body building protein. Preparation of cake is done with refined wheat flour, sweating agent such as sugar, fat, binding agent, egg, flavors, milk, leavening agent such as baking powder or baking soda [16] Finger millet (*Eleusine coracana*) is also known as ragi, mandua (major crop of Uttarakhand) nagli and nachani and is widely grown on hilly areas and southern part of India. It is a staple crop of eastern and central Africa and is also popular in certain part India [32] Among all cereals calcium content is higher in ragi as well as iodine content is also rich in ragi among all food grains. It is rich in protein, vitamin, fiber; iron, calcium, phosphorus and all essential amino acid are found. So it is a good source of diet for growing children, women and old age people. It is consumed in the form of roti, pudding, porridge and preparation of flour [15]. Ragi is easily digestible as it contains higher level of antioxidants, phytochemicals and calcium.
Carrot are good source of β-carotene and carotene content ranges from 60–120 mg/100 g, but there m 60–120 mg/100 g, but there may be variation in some variety and can contain up to 300 mg/100 g [44] Carotenes contain large part of.β-carotene and that is up to 80% [23] Carotenoids are also known as pro vitamin A, and they also play their role as antioxidants [12] Health benefits of β-carotene include anti-cancer activity and also help in cataract prevention as well as preventing against cardio vascular disease [18].

2. Material and Method
The study was conducted in the advance Food Technology Laboratory of Uttaranchal University Premnagar, Dehradun in the year 2017.

2.1 Procurement of raw materials
Carrot, refined wheat flour, soy flour, ragi and other ingredients were procured from the local market Prem Nagar of Dehradun Uttrakhand India.

2.2 Processing of carrot powder
Carrot powder was prepared by firstly washing of carrot, peeling, and then grading. They were dried in tray drier at 55°-60°C for about 8- 10 hours. The ground material was passed through 60 mesh sieve and packed in packets for further use.

2.3 Cake Formulation
Carrot cakes were prepared by using various flours with carrot powder. Cake was prepared by three formulation of different proportion of wheat flour, soy flour, ragi and carrot powder. The cakes were prepared by the cut and fold method. The ingredients used for the preparation of cakes were fat (80g) +sugar (80g) +egg (2in no.)+ baking powder (1/2 tsp)+ baking soda (1/4 tsp) + milk(10 – 15 ml)+ vanilla essence (few drops).Cakes were baked at 180 °C for 50 minutes in a conventional oven which was pre-heated. The formulations

are given in the table 1.

Table 1: Different formulations of cake

Ingredients	Sample 1	Sample 2	Sample 3
Carrot powder	5 gm	8 gm	10 gm
Finger millet flour	20 gm	10 gm	10 gm
Soybean flour	20 gm	10 gm	10 gm
Wheat flour	60 gm	80 gm	80 gm
Sugar	100 gm	80 gm	80 gm
Butter	80 gm	60 gm	80 gm
Eggs	3	2	3

The raw materials required for preparation of cake was weighed according to the specified formulation. The very first step was the mixing of butter with sugar. Then all the sieved dry ingredients were added where the flours were prepared as a self-rising flour and mixed properly. Beaten egg white was added and mixed properly by cut and fold method. Milk and vanilla essence was added to the mixture to enhance the texture and taste of the product respectively. Then pour the mixture carefully in a previously greased pan and bake at temperature 180° C for about 60 to 75 minutes and cool at room temperature.

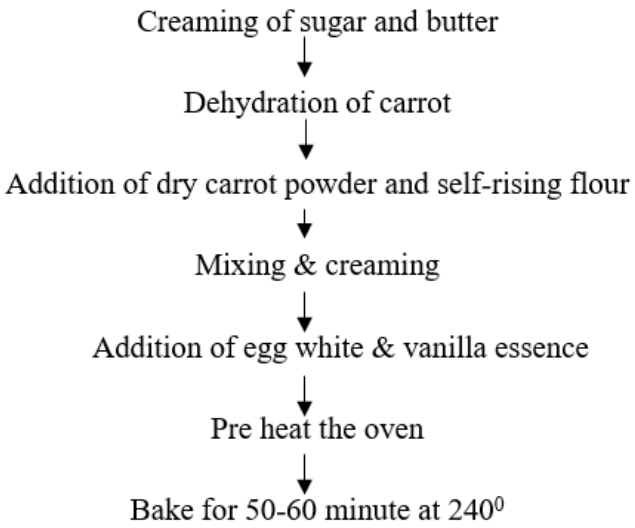

Fig 1

Fig 2: Bfore

Fig 3: After

2.4. Analytical Procedure

2.4.1 Moisture Content

In oven drying method the sample is heated under specific condition and the loss of weight is used to calculate the moisture content of the sample. Dry the empty dish in the oven at 105°C for 3 hours and transfer it to desiccator to cool. Weigh the empty dish. Weigh 5 g of sample to the dish. Spread the sample uniformly. Place the dish with the sample in the oven and dry it for 3 hours 105°C after drying, transform the dish with partially covered lid to the desiccator to cool. Reweigh the dish and its dried sample.

Hot air oven

Air oven methods of various types are widely used in laboratories for the determination of moisture content, due to their convenience. Either forced-draft ovens or convection type can be used for determination of moisture content.

2.4.2 Ash Content

Dry ashing refers to the use of muffle furnace capable of maintaining temperature of 500-600 the use of muffle furnace capable of maintaining temperature of 500-600°C. Water and volatile compound are vaporized and organic substances are burnt in the presence of oxygen.

Weight of sample was taken in a dried and preweighed (W_1) silica crucible and the weight is recorded as W_2. The crucible was then ignited over heater until fumes ceased off. Ashing was done in a muffle furnace at 550 ± 5^0C until sample was become carbon free. The sample was then removed and weighed and its weight recorded as W3. Difference in weight of sample before and after ashing, expressed as % total ash as follows:

$$\% \text{ Total ash} = \frac{W_2\text{-}W_1}{W_3\text{-}W_1}$$

Where,

W1 = Weight of empty Petri dish in grams

W2 = Weight of sample before ashing + Petri dish in grams

W3 = Weight of sample after ashing + Petri dish in grams.

2.4.3 Fat Content

A soxhlet extractor is a piece of laboratory apparatus invented in 1879 by Franz von Soxhlet. It is a procedure to remove fats from food. A solvent is used to wash the solid using a reflux apparatus. The sample is dried and ground and placed in a tube above the extraction solvent. When heated, the solvent evaporates into a gas, and then cools into a liquid in condenser. It then leaks into the sample tube. This continues several hours until the liquid is removed from the sample. The solvent is evaporated off, and the amount of fat is determined.

The cake sample was completely dried and around 10 grams was allowed to fit inside the extraction thimble. Be sure that the end of the thimble is packed with a small piece of wool and it prevents the sample from escaping the thimble. Measure between 100-150 ml of petroleum ether solvent into the round bottle flask. Assemble the soxhlet apparatus properly and turn

on the tap making sure to clamp everything together.
Turn on the heat source and place the assembly over it and allow the solvent to come at its boiling temperature. Allow the apparatus to operate for a minimum 4-5 cycles. Record the time for each cycle, and adjust the heat setting so that the recommended interval is reached. Once the extraction is concluded, disassemble your apparatus and turn off the power source. Allow the sample to evaporate. Determine the mass of the dish and residue. Calculate the % fat content in the cake sample.

2.4.4 Crude Fibre
During the acid and subsequent alkali treatment, oxidative hydrolytic degradation of the native cellulose and considerable degradation of lignin occur. The residue obtained after final filtration is weighed, incinerated, cooled and weighed again. The loss in weight gives the crude fiber content.
The defatted sample was digested with 200 ml of 1.25% sulphuric acid for 30 min.
After filtration through a linen cloth, the residue was washed with boiled distilled water until it free from acid.
The acid free residue was digested with 200 ml of 1.25% sodium hydroxide for 30 min. the content was filtrate through a linen cloth.
The residue was then transfer to gooch crucible and washed with boiled distilled water until it alkali gets free.
Finally the residue was washed with 15 ml of 95% ethyl alcohol.
The contents of crucible were dried to a content weight at 100 ºC. The dried residue was then ignited in a muffle furnace at 550 ºC for 3-4 hours.
The percent loss in weight was expressed as crude fiber.

2.4.5 Protein
Protein content in grains was determined using Bradford method (Bradford, 1976).
Weigh 1gm of sample, macerate the sample in pestle mortar in 5 ml of phosphate buffer and transfer the material to centrifugal tubes. Centrifuge the homogenate at 4000rpm for 5 minutes. Collect the supernatant and repeat the process for 4-5 times. Combine the supernatant and make the volume to 50 ml with phosphate buffer. Take 0. 1ml of sample solution and make the volume to1 ml with 0. 1M phosphate buffer (pH 7.5) Pipette appropriate aliquots of bovine serum albumen solutions containing 0-100 µg protein. Make the volume to 1ml with 0. 1M phosphate buffer (pH 7.5) in all the tubes. Add 5 ml of Bradford reagent to all the tubes and mix thoroughly. Record the absorbance at 595 nm against the reagent black. Plot a standard curve of A595 versus µg of protein in the standards. Determine the protein content in the sample extract from the standard curve. Calculate the amount of protein per ml of sample preparation.

$$\text{Protein concentration} = \frac{\text{Amount of sample in µg} * 1000}{\text{V (µl)}}$$

2.4.6 Penetration
Hardness is determined by force of heavy metal to check the softness and hardness of cake. It is most common that the prob is penetrated in the sample to a given distance and the peak force encountered during the test is measured. Penetration prob comes in a multitude of size and shape and the selection of correct one depend on sample. There are cynclinderical prob with sharp edges and in a same conical shape probes. For present study conical shape probe with sharp wide 2 angle perform this test

Penetration = N/ 10
Where, N = no. of divisions

2.5 Sensory Evaluation
Nine point hedonic scale method was used for evaluation of sensory characteristics of different samples of cakes. The sensory characteristics of cakes such as color, taste, flavor, texture, appearance, aftertaste and the overall acceptability is judged by the panel of nine faculty members (Amerine *et al.*, 1965) [8], of the Food Technology Department.
Prepare the sample.
Each taster is asked to taste the sample and give remarks from 'like extremely' to 'dislike extremely'. It is either a 5 point hedonic scale or a 9 point hedonic scale.
Remarks about the products appearance, taste, odour and texture could also be given by the taster.
Result is analyzed on the basis of which product received the highest or lowest scores.

2.6 PH
A pH meter is used to determine whether the product is acid or alkaline in nature. pH is the concentration of hydrogen ions in the solution or a product. A solution or a product which contains more H+ ions is said to be acidic whereas the solution containing more OH- ions is alkaline in nature. Range of pH is from 1 to 14, where 7 is the neutral value.
The pH value of sample was measured directly by digital pH meter (Triode India). The least count of pH meter is 0.01 and can work between temperature ranges of 0-100^{0}C.The pH probe was calibrated using standard buffer solution (pH 4 and 7) prior to measurement of pH of sample at 30^{0}C.

3. Observation and Results
Sensory characteristics of the cakes were judged by the panel of nine faculty members from the department of Advance Food Technology Lab Uttaranchal University. Different sensory attributes such as color, flavor/taste, texture, appearance, overall acceptability of the product was analyzed by the panelist. For evaluation of sensory characteristics of different cakes nine- point hedonic scale and score card method were used. (Amerine *et al*. 1965) [8]. The cake sample was prepared in the ratio of 1: 12, 1: 10 and 1:8 with carrot to the refined wheat flour. Panelists were nine faculty members from the Uttaranchal University. All the panelists were seated in a Sensory booth in the Advance Food Technology Lab. The cake was sliced at one-inch thickness, plated on black plates, and covered with clear plastic wrap and was presented to faculty members. Cake samples were given to panelists along with water samples to rinse between samples. Analysis of moisture content in food involves the whole coverage of the food because food comprises a considerable amount of water rather than other ingredients. Generally moisture content of cake varies between 36.14 to 28.48 % i.e. without storage.

There is variation in different sample of cake formulated with carrot powder and blends of different flour. Moisture content recorded in the three samples was, sample 1 contains moisture content 22.4%, where sample 2, 21.6%, and sample 3, 24%. The results showed that there was increase in moisture content in sample 3 and slightly decrease in moisture content in sample 2. Variation in moisture content is due to variation in carrot powder.

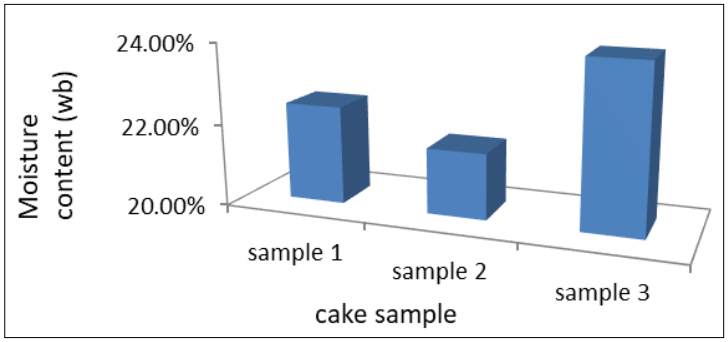

Fig 4: Determination of moisture content

Ash content is the measure of its mineral content. The result in the cake sample concluded that ash content of sample1 was 1.4%, sample 2 was 0.8%, and that of sample3 was 1.2%. It was observed that there was reduction in ash content of sample 2 as compare to sample1. And again there was increase in ash content in sample 3, as compare to sample2. This could be due to the difference in the amount of ingredients used.

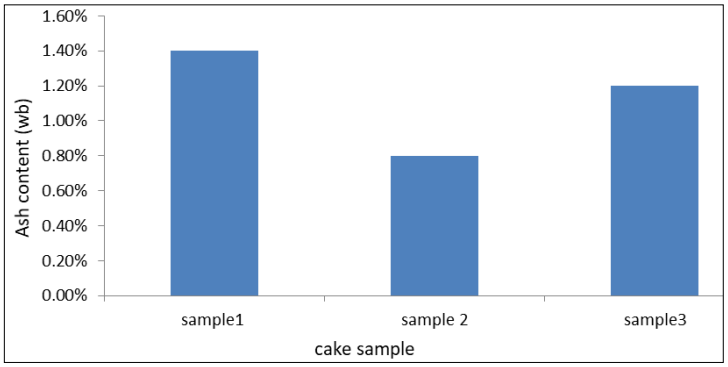

Fig 5

Determination of ash content

Proteins are the organic compounds made up of building blocks called "amino acids". Protein had a number of functions in human body. Protein varies in different food depending upon the ingredients used. There was increase in the protein content in cake Sample 1, contain 3.56% and that of sample 2 was 3. 1%, sample 3, 5.08%. The variation in the protein content in cake sample is due to the soy flour and the amount of eggs used. Sample 3 had highest protein content and this is due 3 eggs were used in sample 3 where in sample1 2 eggs were used.

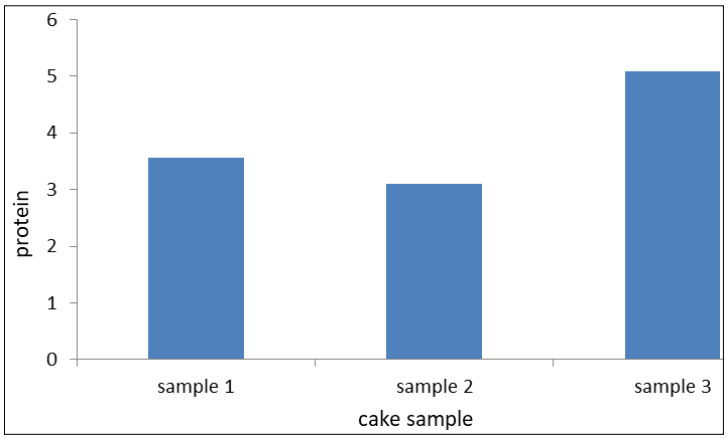

Fig 6: Determination of protein

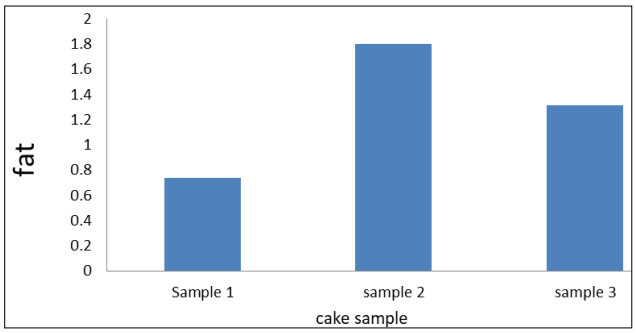

Fig 7: Determination of fat

Hardness and the softness of cake were determined by using penetrometer. The three samples had different value of penetration and the result showed that there was increase in the value. Hardness of sample 1 was 8.5, sample 2, 25 and that of sample 3 was 17.2. Due to the variation in formula of different cake sample and variation in the ingredients there was change in the hardness of the sample. Carbohydrates are the sources of energy in food. Absorption of digestible carbohydrate provides metabolic energy. By the study we concluded that there was decrease in the carbohydrate from 61. 24% to 46.28%. This decrease in carbohydrate is due to the change in the formulation of cake. It was observed that highest carbohydrate content in sample 1 was 61. 24% and sample 2 contain 53%, and sample 3 contains 46.28%. This variation in carbohydrate is due to the change in ratio of carrot powder in cake sample.

pH is the negative logarithm of hydrogen ion concentration. pH analysis of cake sample prepared with different formulation was done using pH meter. The results showed that was an increase in pH and then slight decrease in pH as pH of sample1 was 6.8, sample 2, 7.8 and sample 3, pH7. Variation in pH is due to the blend of different flours and variation in the formula of cake.

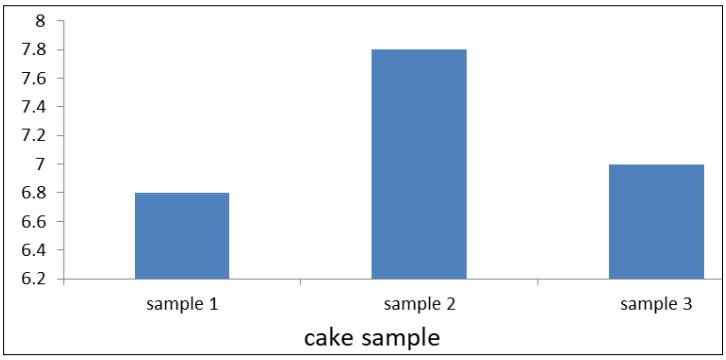

Fig 8: Determination of Ph

Table 2: Proximate analysis of carrot cake

Proximate analysis	Sample 1	Sample 2	Sample 3
Moisture	22.4%	21.6%	24%
Ash	1.4%	0.8%	1.2%
Fat	0.74%	1.8%	1.3%
Crude fibre	4%	3.5%	3%
Protein	3.56%	3. 1%	5.08%
Carbohydrate	61.24%	53%	46.28%
Energy	32.90kcal	26.92kcal	21.59kcal

4. Conclusion

Cake is requirement of future generation because it is one of popular in worldwide. cake can enriched and modified with nutrient. Present study concludes (Table 2) that total energy of sample one were 32.90 kcal, sample 26.92kcal and sample three were 21.59kcal. This reveals that there is enough amount of energy present in cake samples. There are many reasons to include carrots in human diet as it has a remarkable nutritional and health benefits. As carrot is rich source of carotenoids, phenolic compounds and vitamins and this may help in reducing the risk of disease. Other benefits of carrot have been reported as Anti-diabetic, cholesterol and cardiovascular disease lowering, anti-hypertensive.

5. Acknowledgment

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