

PHYSICO-CHEMICAL CHARACTERISTICS OF MILLET BASED COMPOSITE FLOUR

Vandana Choubey¹, S. Patel² and S. Uprit³

*BRSM College of Agricultural Engineering and Technology, Mungeli, IGKV Raipur¹,
(APFE), Faculty of Agricultural Engineering, IGKV Raipur²
College of Dairy Science and Food Technology, Raipur³
Email-choubey.vandana222@gmail.com*

Abstract: *Ragi* is considered to be ideal food for diabetic individuals due to its low sugar content. A composite flour utilizing *ragi* and wheat flour is used to prepare composite flour ratio being 70:30 (Wheat: Finger millet). The composite flour contains fairly good amount protein (10.49%), ash (1.38%) and 251.724 (mg/ 100 g) calcium which shows that the product is nutritionally rich especially in terms of calcium and protein. The fat content (1.5%) is quite low. Therefore, it is also a low fat food which is also good for the peoples suffering from the obesity. For good human health the requirement of calcium and protein is 16:1 (mg: g). The calcium and protein ratio of the developed product is 23.99:1 which is quite higher than the recommended value and also its calcium contain is 251.724 mg/ 100 g. Therefore, it can be able to protect human body from calcium deficiency.

Keywords: Composite flour, *ragi*, physico-chemical characteristics

INTRODUCTION

A large shift from consumption of coarse grains such as sorghum, barley, rye, maize and millet to more refined cereals, like polished rice and wheat is seen especially among the urban population and higher income groups. These changes could result in a significant decrease in the overall fiber content of the diet (Popkin *et al.*, 2001) and associated with rising affluence induced by developmental transition contributed to increasing prevalence of overweight/obesity (Sindhi and Jain, 2006). One viable strategy for improving public health is appropriate modification of the food supply to give products that deliver substantiated health benefits while retaining consumer appeal. Cereals are prime targets in this regard. As dietary staples, relatively small improvements in grain composition (especially in starch and fiber) have the potential to translate into significant health gains at the population level when they are incorporated into food (Regina *et al.*, 2007). Awasthi and Mishra (2004) reported that millet based diet are helpful in lowering the blood glucose levels than wheat or rice diet and also reported that high intake of fiber is associated with a low CHD incidence.

The bulkiness of the fibers and the slower digestion rate makes us feel fuller on, fewer calories and therefore, may help to prevent us from eating excess calories. Therefore, *ragi* is considered to be ideal food for diabetic individuals due to its low sugar content and slow release of glucose/sugar in the body (Kang *et al.*, 2008 and Lakshmi and Sumathi, 2002). On addition of millet flour to wheat flour or other flours, there would be changes in physico-chemical, nutritional and functional characteristics of wheat flour. A composite flour utilizing *ragi* is prepared. To prepare this wheat flour is fortified with *ragi* flour

in the ratio of 70:30 (Wheat: Finger millet). Such a ratio provide the consumer with the benefits of *ragi* flour without much altering their well adapted flavor of wheat flour thus making it suitable for human consumption.

The present study aims to study the physico-chemical characteristics of millet based composite flour.

MATERIAL AND METHOD

To study the physico-chemical characteristics of millet based composite flour

Analysis of raw materials

The wheat and *ragi* which was used for the development of the product was analyzed for the following tests

Moisture content

The moisture content was analyzed by the method described in A.O.A.C. (1995) method no. 977.11. Oven was kept at 100°C for 10 – 15 min in order to attain complete removal of initial moisture. 5 g of sample was weighed in the moisture pan and it was kept into the oven for 3 hours at 100±1°C. Then percent moisture content was calculated by the following formula.

$$\text{Moisture content (\%)} = \frac{\text{weight of moisture}}{\text{weight of sample}} \times 100$$

$$\text{Moisture content (\%)} = 100 \times (W_1 - W_2) / (W_1 - W)$$

Where,

W_1 = weight of the dish with the material before drying, g

W_2 = weight of the dish with the material after drying, g

W = weight of the empty dish, g

Protein content

Protein was calculated by the micro – kjeldahl method as described in A.O.A.C. (1995) method no. 976.06. The total protein was calculated as follows
Total Nitrogen % = (A-B) x N/W

Where,

A = volume of 0.1 NaOH used for sample

B = volume of 0.1 NaOH used for blank

N = normality of the NaOH

W = weight in gm of sample

Protein content (%) = Total Nitrogen percent x 6.25 (for millet) and 5.70 (for wheat)

Fat content

The total fat content was calculated by the Soxhlet method as described in the A.O.A.C. (1995) method no. 920.39C. In this technique 2g of sample was taken into the thimble. With the help of anhydrous ether (boiling point 60 – 80°C) and “Socs Plus” (extraction equipment) fat was extracted. The amount of fat was calculated by the following formula

$$\text{Fat content (\%)} = \frac{\text{weight of fat}}{\text{weight of sample}} \times 100$$

$$\text{Fat content (\%)} = (B - A) \times 100 / W$$

Where,

A= Initial weight of beaker, g

B=Final weight of beaker, g

W= Weight of sample taken, g

Ash content

Ash content of the raw materials was estimated by the dry ashing method as described in the A.O.A.C.(1995) method no 900.02 A. 5 g of sample was taken into the pre – dried crucible and it was kept into the muffle furnace at 550°C for 18 – 19 hours. Calculation was done by the following formula:

$$\text{Ash content (\%)} = \frac{\text{weight of ash}}{\text{weight of sample}} \times 100$$

$$\text{Ash content (\%)} = 100 \times (W_1 - W) / (W_2 - W)$$

Where,

W = weight of the empty crucible, g

W₁ = weight of the crucible with the ash, g

W₂ = weight of the crucible with the dried material taken for the test, g

Total carbohydrate

The total carbohydrates were calculated by the “By – difference” method as described in the A.O.A.C. (1995). After determining the percentage of moisture, protein, fat and total ash content in the developed sample it was calculated as follows:

Total carbohydrates, including sucrose, dextrose and dextrins, maltose or lactose, percent

$$\text{Total carbohydrate (\%)} = \{100 - (A+B+C+D)\} \%$$

Where,

A = moisture, %

B = total protein, %

C = fat, %

D = total ash, %

Total Calcium

The total calcium in the product was estimated by precipitation and titration method (Raghuram *et al.*, 2003). Add 0.5 to 1 ml distilled water in ash. Add 5 ml conc. HCl acid and evaporate to dryness in water bath. Again add 5 ml conc. HCl acid and evaporate to dryness in water bath. Add 4 ml of conc. HCl acid and filter in 100 ml volumetric flask with Whatman filter 40. After cooling, volume is made up to 100 ml. Take 2 ml of above solution in 15 ml centrifuge tube. Add 2 ml distilled water and 1 ml of ammonium oxalate. Allow it to stand for over night. Centrifuge at 1500 rpm for 5 min. without disturbing the precipitate pour off the supernatant liquid. Mouth and the sides of the tube are washed with 3 ml of 2% ammonia solution. It is centrifuged, drained and washed as before. Precipitate is dissolved with 2 ml of 1N sulphuric acid. The tube is heated for 1 min in boiling water bath and titrated against 0.01N potassium permanganate to a definite pink end point.

Calculation

$$\text{mg of calcium/ 100 ml of serum} = (X-b) \times 0.2004 \times (100/2)$$

Where,

X = volume in ml of 0.01 N potassium permanganate required to titrate the sample.

b = volume in ml of 0.01 N potassium permanganate required to titrate 2 ml of sulphuric acid (blank).

Chemical analysis of composite flour

The chemical analysis of the composite flour is carried off for the same parameter and using the same method as described above for moisture, fat, ash, protein, carbohydrate and calcium. Colour of the developed product was also analyzed.

Colour

A Hunter Lab Color Flex spectrophotometer in the port-up orientation is used to measure the reflectance of powders held in a glass sample cup. This is the method advocated by Hunter Lab for the measurement of finely-ground material if a Labscan XE_with UV control is not available. Following is the procedure for proper colour measurement in hunter lab.

1. Standardize the instrument using the black and calibrated white standards that come with the instrument.

2. Scoop up powder from the sample batch and fill the glass sample cup (Hunter Lab Part Number 04-7209-00) to the top. The 2-inch (50-mm) sample thickness makes the translucent powder effectively opaque for reflectance measurement.

3. Tap the sample cup once on a hard surface to settle the loose powder and then place the sample cup in the port insert so that the powder will be read through the glass bottom of the cup.

Note: Be careful to keep the powder out of the instrument port.

4. Cover the sample cup with the opaque cover (HunterLab Part Number 04-4000-00). The cover minimizes the possibility of ambient light reaching the detector through the powder sample when the instrument is in the port-up orientation.

5. Take a single color reading of the powder through the bottom of the sample cup. Remove the sample cup from the instrument port, dump and refill it, and read the powder at least three times from the same batch

RESULT AND DISCUSSION

Composition of raw materials

In order to develop the standard product two raw materials viz; *ragi* and wheat were used. These two raw materials were analyzed for different parameters to ensure the best possible quality of the developed product.

Composition of wheat

The chemical composition of wheat was determined for the manufacturing of the finger millet based composite flour. This analysis was done to determine the various chemical parameters of wheat like moisture, protein, fat, ash and calcium using method described in materials and method section. The composition of wheat is given in the following Table 1.

Table 1. Proximate Composition of wheat

S.No.	Constituents	Value (%)
1.	Moisture	11.30
2.	Protein	10.85
3.	Fat	1.50
4.	Ash	0.94
5.	Calcium(mg/100g)	48.00

Composition of finger millet

The chemical composition of the finger millet was determined for the development of finger millet based flour. This analysis was done to determine the

various chemical parameters of finger millet like moisture, protein, fat, ash and calcium. The compositions of finger millet analyzed are given in the following Table 2.

Table 2. Proximate Composition of finger millet

S.No.	Constituents	Value (%)
1.	Moisture	9.20
2.	Protein	7.52
3.	Fat	1.30
4.	Ash	1.76
5.	Total carbohydrate	80.22
6.	Calcium (mg/ 100g)	359.40

Chemical Composition of the composite flour

The chemical composition of the composite flour was analyzed by the methods described in the materials and methods section. The composite flour

was analyzed for the moisture, fat, protein, ash, total carbohydrate and calcium. The results of the analysis are given in the Table 3.

Table 3. Proximate Chemical composition of the composite flour

S.No.	Constituents	Value (%)
1.	Moisture	8.19
2.	Protein	10.49
3.	Fat	1.50
4.	Ash	1.38
5.	Total carbohydrate	78.44
6.	Calcium (mg/ 100g)	251.724

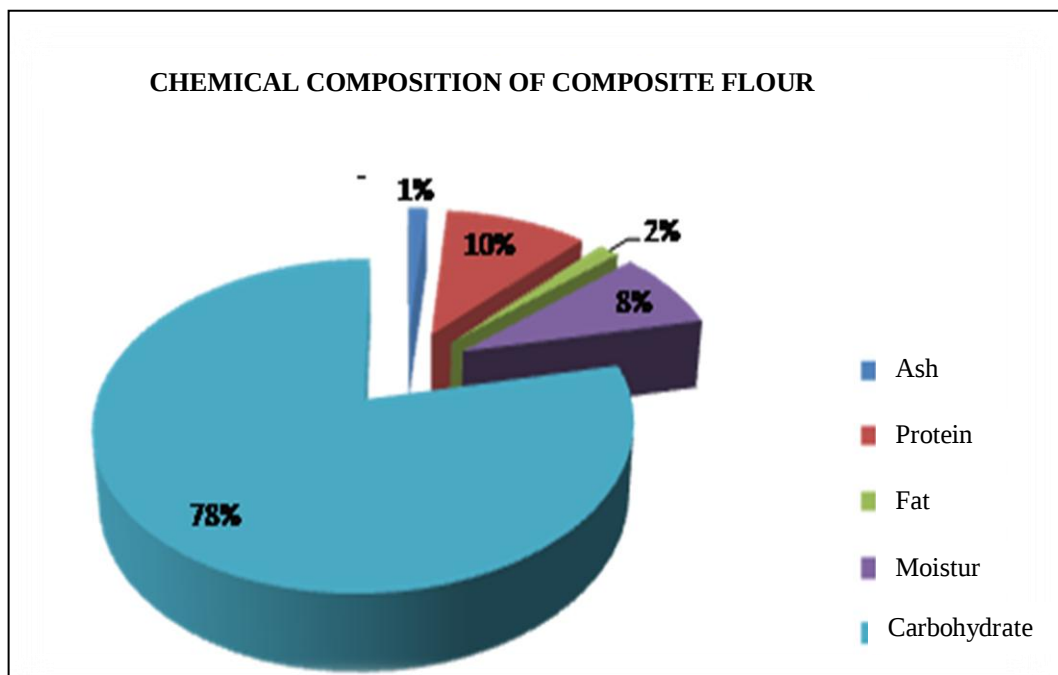


Fig 1. Proximate composition of Composite Flour

In the absence of the related work on finger millet the above results cannot be compared and discussed. The finally developed product contains fairly good amount protein (10.49%), ash (1.38%) and 251.724 (mg/ 100 g) calcium which shows that the product is nutritionally rich especially in terms of calcium and protein. The fat content (1.5%) is quite low. Therefore, it is also a low fat food which is also good for the peoples suffering from the obesity.

Due variation in the ratio of amount of wheat and proso millet, it was found that the variation in colour was occurred which was represented as Hunter colour difference meter. Due to the absence of research of similar product no colour data is available for the comparison. In this current research of colour, the standard is taken as $L^*=83.64$, $a^*=2.47$ and $b^*=10.59$ which is the initial value of the colour of the product.

Anna and Patel (1998) observed that for good human health the requirement of calcium and protein is 16:1 (mg: g). The calcium and protein ratio of the developed product is 23.99:1 which is quite higher than the recommended value and also its calcium contain is 251.724 mg/ 100 g. Therefore, it can be able to protect human body from calcium deficiency.

CONCLUSION

Wheat flour is an excellent source of complex carbohydrates. Other than gluten flour, all types of wheat flour derive at least 80 per cent of their calories from carbohydrates. Depending on the flour type, the per cent of calories from protein ranges from 9 to 15 per cent, except from gluten content.

Calories from fat are never more than 5 per cent. Wheat flour contains B-vitamins, calcium, folacin, iron, magnesium, phosphorus, potassium, zinc, minimal amounts of sodium and other trace elements. The finally developed product (wheat and ragi flour) contains fairly good amount protein (10.49%), ash (1.38%) and 251.724 (mg/ 100 g) calcium which shows that the product is nutritionally rich especially in terms of calcium and protein. The fat content (1.5%) is quite low. Therefore, it is also a low fat food which is also good for the peoples suffering from the obesity.

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