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# Nutrient analysis of the developed low glycemic composite flour for the effective management of diabetes

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The food composition to guide food choices for better management and prevention of chronic diseases such as type 2 diabetes. Now a days most of people are consuming more refined flour or refined products, which are high in glycemic value, low in micronutrients and fibre. In India where cereals and pulses are the main sources of energy, whole grains consumption can be easily promoted through appropriate nutrition education. Diabetes is closely linked to diet and nutrition both with respect to its causation and management. All nutrition factors, either excess factor or cardohydrates, which contribute to higher intake of calories and enhance body weight have been etiologically associated with diabetes (Bamji *et al.*, 2003). Present study was carried out to develop low glycemic composite flour for the Effective management of diebetes. The investigation was done to prepare composite flour useing Oat, Barley, Soybean, Bengal gram, Wheat and Pearl Millet in the ratio of 20:20:20:20:5:15. Nutrient analysis of control and developed composite flour revealed that moisture, crude protein, crude fat, crude fibre, ash, total carbohydrate and total energy were estimated to be 5.6 and 6.3 per cent, 11.97 and 18.48 per cent, 3.27 and 6.05 per cent, 3.0 and 5.3 per cent, 1.4 and 2.3 per cent, 70.37 and 54.26 per cent and 385.8 and 349.7 kcal/100g, respectively. Results of nutritional analysis observed the highly significant difference in nutrient content of both control and experimental flours.

**Key Words :** Diabetes mellitus, Composite flour, Nutrient, Diet, Low glycemic.

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## INTRODUCTION

Diabetes mellitus is one of the most common chronic diseases across the world and number of diabetic patients is on rise. In 2011 there were 366 million people with diabetes globally, and this is expected to rise to 552 million by 2030. Most people with diabetes live in low- and middle-income countries like India, and these countries will also see the greatest increase over the next 19 years (Whiting *et al.,* 2011). The recently published ICMR-INDIAB national study reported that there are 62.4 million people with type 2 diabetes ($T_2$DM) and 77 million people with pre-diabetes in India (Anjana *et al.,* 2011). These numbers are projected to increase to 101 million by the year 2030. In India, the Chennai-based Diabetes Research Centre says that over 50 per cent of diabetes cases in rural India and about 30 per cent in urban areas go undiagnosed. In another study, screening has shown that the unknown to- known diabetes ratio is about 1.8:1 in urban areas, whilst it is as high as 3.3:1 in rural places as reported by Kumar *et al*. (2013).

Diabetes is closely linked to diet and nutrition both with respect to its causation and management. A low-

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glycemic index diet plays a protective role against the development of type-2 diabetes. Use of composite flour based on wheat and other cereals including minor millets in bakery products is becoming popular because of the economic and nutritional advantages. Diet rich in dietary fibre is considered to be generally low in saturated fat and have several other health benefits. Dietary fibres promote beneficial physiological effects including laxation, blood cholesterol and blood glucose attenuation.

Composite flour technology initially referred to the process of mixing wheat flour with other cereal and legume flours for making bread, biscuits and chapatti. Bijlani *et al.* (1993) studied the glycemic index of composite flour from wheat, bengalgram and barley in equal proportion and recommended for diabetics. Finger millet based pasta products with good cooking quality, storage stability, acceptability and higher nutritive values were developed by Devaraju *et al.* (2003). Composite Finger millet flour (50%), refined Wheat flour (40%), defatted Soy/whey protein concentrate (10%), and hot water (75°C) were used for pasta making. The mean protein, energy, calcium and iron in the experimental pasta ranged from 14-18 g, 365-372 k cal, 102-148 mg and 3-5 mg, respectively. Similarly Mittal (2003) planned a study with the objective of developing Finger millet based nutritious biscuit mix. Malted Finger millet, roasted black Soybean and dehydrated spinach powder were mixed in definite proportion Results revealed that biscuit mix had 183.33 mg/100g calcium and 2.27mg/100g iron, safe upto three months of the storage period. Whereas, Naureen *et al.* (2006) reported to probe the hypocholesterolemic effect of legumes dietary fibre through ''chapattis'' a staple diet of the South Asia. Commercial wheat flour (atta) was blended with legumes *i.e.* lentil, chickpea and guar gum in various combinations to make composite flour for the preparation of chapattis. Maximum dietary fibre (8.85%) was observed in composite flour with 3g/100 g guar gum. Highest per cent increase in dietary fibre (35.3%) was in flour with 3g/100 g guar gum followed by guar gum 2g/100 g (24.1%). However, Shanmugam *et al.* (2007) found that food formulations suitable as dietary supplements to diabetic Formulations contained 13.0-18.3 per cent protein, 11.3-11.8 per cent fat, 59.9-67.5 per cent starch and 13.2-18.0 per cent dietary fibre. The foods were given to healthy subjects (N=8) as thick porridge. The investigation was done to prepare dosa by Poongodi and Jemima (2011) using composite flour. The total carbohydrate, starch, and total sugar content were decreased and protein, amylose/amylopectin ratio and crude fibre content were increased significantly while increasing the incorporation of millet flour blend.

The nutritive value of millet is comparable to other staple cereals like wheat and rice, some of them are even better with regard to average protein, fat and mineral contents (Gopalan *et al.*, 2007). Legumes on the other hand, are higher in proteins (18 to 24%) than cereal grains and can be used to support certain amino acids such as lysine, tryptophan, or methionine (Rababah *et al.*, 2006). Soy protein is preferred because of widely varying functional properties and high content of good quality protein. While soy protein is rich in lysine, cereals are rich in sulphur containing amino acids, especially methionine (Prasad *et al.*, 2007).

### Objective :

The present investigation was conducted to study the nutritient analysis of developed low glycemic composite flour for the effective management of diabetes.

## METHODOLOGY

Composite Flour for The Effective Management of Diabetes" was carried out to standardize multigrain flour and its products. The study was conducted in the Department of Food and Nutrition, College of Home Science, Swami Keshwanand Rajasthan Agricultural University, Bikaner.

Composite flour technology makes it possible to blend, mix and fortify one food material with other so that the resulting fortified mix has not only better nutritional quality but also the necessary attributes for consumer acceptance (Dendy, 1992). In view of the facts regarding nutritional quality of cereal, pulses, oil seed combination of different ratio of various ingredients (ICMR, 2002) were made to develop acceptable composite flour for better management of diabetes. Hence along with Oat, Barley, Bengal gram, Soybean, Wheat and Pearl Millet were also added for the purpose of diabetes prevention, also with encountered the flour on their local availability, low cost, greater beta glucan fibre contents and rich PUFA, isoflavones etc. Flour was prepared in different combinations using Oats, Barley, Bengal gram, Soybean, Wheat, and Pearl Millet and best composite flour combination was selected by panel members.

**Nutritional analysis of developed low glycemic composite flour:**

The most acceptable multigrain flour was analyzed for its proximate composition *i.e.* moisture, crude protein, crude fat, crude fibre, ash, total carbohydrate and energy as follows:

**Proximate composition:**

The nutritional parameters included the determination of Moisture and Ash in the sample was estimated by employing the standard method of analysis (NIN, 2003). The total dietary fibre by acid-alkali digestion method; Crude protein was determined by macrkjeldahl method and Crude fat was estimated by employing the standard method of analysis (NIN, 2003) using the Soxhlet extraction apparatus. The total Carbohydrate and energy was calculed by AOAC (1995) method. [Total carbohydrate = 100 - (crude protein + crude fat + crude fibre + total ash)]; [Energy (Kcal/ 100g) = (4 x protein) + (9 x fat) + (4 x total carbohydrate)].

**Statistical analysis:**

Observations collected on the various aspects of the study have been statistically analyzed by using suitable statistics to find out significance of the result (Gupta, 1998).

## OBSERVATIONS AND ASSESSMENT

The nutritional analysis of the best acceptable composite flour ($CF_1$) was analyzed for its nutrient composition such as moisture, crude protein, crude fat, ash, crude fibre, total carbohydrate and energy content as per the standard procedures. The result of the analysis is depicted in Table 1 and Fig. 1.

**Proximate composition:**

The proximate composition of the low glycemic composite flour samples are documented in Table 1 and Fig. 1.

**Moisture:**

As per Table 1 and Fig. 1 the moisture content was highest in experimental sample (6.3) and lowest in control sample (5.6). Difference between moisture content in both flour observed to be highly significant. The result of the present study are lower than the study done by Chaudhary and Jood (2008), who reported the higher (9.25) moisture content in wheat flour. These differences in moisture content of flour may be due to the temperature, post harvest period, relative humidity, variety and manure (Matilla *et al*., 2004 and Gupta *et al*., 2004)

**Protein:**

Values regarding protein content of experimental flour showed that per cent crude protein values reported higher (18.48) in experimental sample as compared to control sample (11.97). Highly significant difference was observed in protein content of both sample of flour (Table 1 and Fig. 1). Whereas Srivastava *et al*. (2001) reported somewhat lower protein content (14.32g) in convenience mix. Difference in protein content of flours might be due to higher protein content of soybean (Gopalan *et al*., 1989).

**Fat:**

While analyzing fat content, significant difference was found between the mean values of both flour (experimental and control flours). Table 1. and Fig. 1 unfurl the data regarding fat content was 6.5 per cent in experimental sample and 3.27 per cent in control sample. Whereas, Kadam *et al*. (2012) reported somewhat lower fat (3.45 %) in composite flour developed for diabetic patient. Diffrence in fat content might be due to invisible fat of seed grain used for developing flour (Gopalan *et al.,* 1989).

**Crude fibre:**

Analysis of crude fibre content showed that the developed composite flour contained maximum (5.3) and minimum in control (3.0) (Table 1 and Fig. 1). The statistical analysis of data also revealed significant difference between control and experimental samples. High value of fibre content might be due to incorporation of fibre rich Oat and Barley in composite flour (Slavin, 2003).

**Ash:**

The ash content of the flour prepared using low glycemic grains significantly different from control sample as depicted in Table 1 and Fig. 1. The percentage of ash content was highest (2.3) in experimental flour but lowest (1.4) in control sample. Similar to present study Kunckles *et al*. (2000) developed β-glucan rich barley bread analyzed 2.13 per cent of ash content. The high

**Table 1 : Nutritional analysis of developed composite flour (g/ 100 g on dry weight basis)**

| Flour | Moisture (%) | Crude protein (%) | Crude fat (%) | Crude fibre (%) | Ash (%) | Carbohydrate (%) | Energy (Kcal/100g) |
|---|---|---|---|---|---|---|---|
| | Mean± SD | Mean± SD | Mean± SD | Mean± SD | Mean± SD | Mean± SD | Mean± SD |
| Control (wheat) | 5.6 ± 0.05 | 11.97 ± 0.00 | 3.27 ± 0.01 | 3.0 ± 0.01 | 1.4 ± 0.00 | 70.37 ± 0.45 | 385.8 ± 0.00 |
| Experimental (Composite) | 6.3 ±0.13 | 18.48 ± 0.00 | 6.5 ± 0.01 | 5.3 ± 0.00 | 2.3 ± 0.00 | 54.26 ± 0.01 | 349.7 ± 0.09 |
| 'T' value | 07.14** | 07.70** | 06.27** | 58.68** | 41.98** | 25.58** | 24.48** |

Values are mean ± SD of three replicates (P<0.01)** = Highly significance

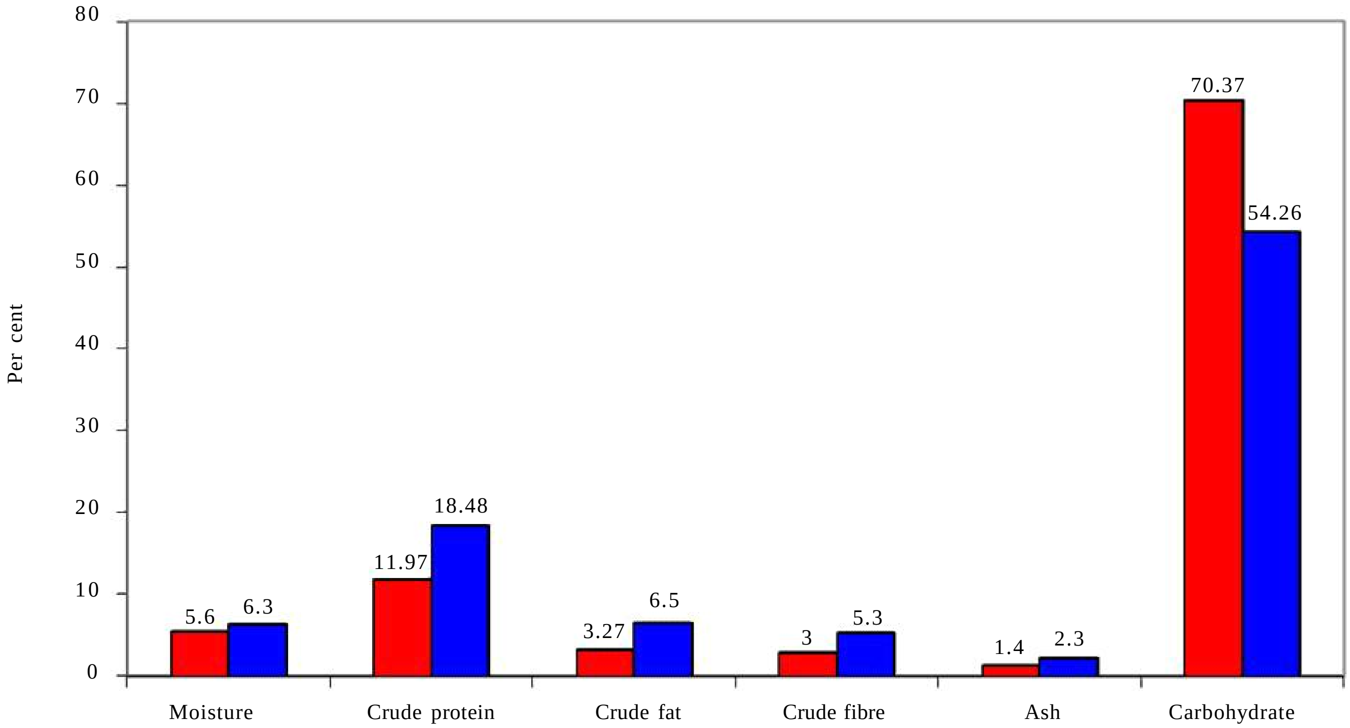


**Fig. 1 : Proximate composition in (control and composite) flours**

percentage of ash content of composite flour might be due to the high minerals content of Barley and Oat (Lifschitz *et al.*, 2002).

## Carbohydrate:

Wheat flour referred as control sample contained 70.37 per cent carbohydrate while 54.26 per cent noted in composite flour. Highly significant difference was observed in carbohydrate content of control and experimental flour at 1% level of significance as projected in the Table 1 and Fig. 1. Similar results were recorded by Poongodi and Jemima (2011) in developed composite flour using low glycemic grain. Difference in the carbohydrate contents may be due to the incorporation of low carbohydrate content cereals in composite flour (Gopalan *et al.*, 1989).

## Energy:

Statistical analysis of the result of energy revealed the significant difference between control and experimental flours. The energy value recorded highest in control *i.e.* 385.8 Kcal/100g and somewhat lower in experimental flour *i.e.* 349.7 Kcal/100g. Difference in energy content of both sample must be due to the high carbohydrate content of wheat flour (Gopalan *et al.*, 1989).

In summary the nutritional analysis of the most acceptable composite flour ($CF_1$) and control (wheat flour) were analyzed for moisture, crude protein, crude fat, crude fibre, ash, total carbohydrate and energy contents as per standard procedures. The moisture content was highest in experimental sample (6.3) and lowest in control sample (5.6). Values regarding protein content of experimental flour showed that per cent crude protein values reported higher (18.48) in experimental sample as compared to control sample (11.97). Per cent crude fat content was 6.5 per cent in experimental sample and 5.6 per cent in control sample. Analysis of crude fibre content showed that the developed composite flour contained maximum (5.3) and minimum in control (3.0). The percentage of ash content was highest (2.3) in experimental flour but lowest (1.4) in control sample. Wheat flour referred as control sample contained 70.37 per cent carbohydrate while 54.26 per cent noted in composite flour. The energy value recorded highest in control *i.e.* 385.8 Kcal/100g and somewhat lower in experimental flour *i.e.* 349.7 Kcal/100g. Results of nutritional analysis observed the highly significant difference in moisture, crude protein, crude fat, crude fibre, ash, total carbohydrate and energy content of both control and experimental flours.

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