Assessment of nutritional and phytochemical composition of composite flour rich in functional compounds

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ABSTRACT

Functional food is a modified food that claims to improve health or well-being by providing benefits. Functional foods may include such items as cereals, breads and beverages these are fortified with vitamins, some herbs, and nutraceuticals. It was observed that T showed highest protein, fat and ash content among various treatments. T has highest oxylate content with respect to anti nutritional content. Here expect proximate value fibre impart functional properties to the food which has therapeutic value. T has highest phytic acid, flavonoids and tannin had highest amount moisture, fibre, carbohydrate and energy content while T has highest total phenol and DPPH scavenging activity with respect to antioxidant. The study suggests that wheat flour, barley flour, garlic powder and black cumin seed powder can be used for ready to eat functional food products and commercial purpose because of its exotic flavour and nutritive value was higher to the products than market products and helps in many metabolic diseases.

Key words: Anti nutritional, Antioxidants, Flavonoids, Functional foods, Therapeutic value.

INTRODUCTION

The knowledge of herbals has accumulated over thousands of years so that today we have many effective means of ensuring health care such as barley, black cumin and garlic or pods cure several common ailments. These seeds are considered as an important source of nutrition and as a result of that they are recommended for their therapeutic values. Herbs contain low amounts of protein and carbohydrate, and are rich in water, vitamins and minerals. Their fat content is low, but they taste good because of aromatic compounds, by specific definition they can also be foods that have additional physiologic benefits that may reduce the risk of disease or provide health benefits. For example, the free radical scavenging ability of antioxidants vitamin C, E, carotenoids etc. is deemed as a functional food.

Barley is a healthful grain providing a low fat, excellent source of dietary fibre in the form of beta glucan, B vitamins as well as tococtrienols and tocopherols. This combination of nutrients has many health benefits. Soluble fibre from barley has been recognized as beneficial in decreasing blood cholesterol levels. Although barley contains high amounts of soluble fibre, it is not consumed as extensively as oats. So it is concluded that increasing soluble fibre through consumption of barley in a healthy diet can reduce cardiovascular risk factors (Behall, 2004).

Allium sativum, commonly known as garlic, is condiment, used as one of common components of foods. (Aviello, et al., 2009). Many reports showed that A. sativum has variety of pharmacological activities such as antihypertensive, anti hypercholesterolaemic, cardioprotective, antiplatelet, hypoglycaemic, antimicrobial, antineoplastic, etc. Garlic contains alliin, allicin diallyl disulphide, S-allylcysteine and diallyl trisulfide organosulfur compounds and allicin is responsible for characteristic garlic odour. Allicin is the compound responsible for the different types of pharmacological effects (Mikaili, et al., and Padiya, et al., 2013).

Nigella sativa has been extensively studied for its biological activities and therapeutic potential and shown to possess wide spectrum of activities such as diuretic, antihypertensive, antidiabetic, anticancer and immunomodulatory, analgesic, antimicrobial, antihelminthic, analgesics and anti-inflammatory, spasmylytic, bronchodilator, gastroprotective, hepatoprotective, renal protective and antioxidant properties (Ahmad et al., 2013). They are also used as a natural remedy for treatment of hypertension, diabetes, hypercholesterolemia, arthritis, tumour, and gynecological disorders for over 2000 years (Ali and Blunden, (2003), El-Din et al., (2006), Ramdan (2007).

In recent years there is a growing interest in functional foods which provide health benefits and are alternative to modern medicine. Nutrients, herbs and dietary supplements are major constituents of functional foods which maintain health, act against various disease conditions and thus promote the quality of life.
MATERIALS AND METHODS

The present study “Assessment of Nutritional and Phytochemical Composition of Composite Flour rich in Functional Compounds.” was concluded in the Department of Foods, Nutrition and Public Health, Ethelind College of Home science, Sam Higginbottom University of Agriculture, Technology and Science (SHUATS), Allahabad.

Barley, garlic and black cumin seed were procured from local market of Allahabad district, for the preparation of composite flour. Blends were prepared by mixing barley seed, garlic seed and black cumin seed in different ratios such as T<sub>1</sub> (60:27:10:3), T<sub>2</sub> (50:37:10:3), T<sub>3</sub> (40:47:10:3) and T<sub>4</sub> (30:57:10:3) on a dry to dry basis to develop composite flour.

Preparation of composite flour:

- Washing of all seeds to remove dust and impurities
- Sorting
- Drying at a temperature of 50-60°C for 8-10 hours.
- Preparation of homogenous powders from dried seeds
- Sieving of powders from a fine mesh (55 micron)
- Mixing of all seeds powders together in a definite ratio.
- Storing of seeds Mixture in Air tight containers till further analysis.

**Flow Diagram of the Preparation of Composite Flour.**

**Analytical Methods:** The proximate parameters, viz. moisture, protein, fat, total ash, crude fibre, energy and carbohydrate contents and functional compounds such as oxylate, phytic acid, tannin and Flavonoids, total phenol, DPPH contents of composite flour were determined by following the standard methods as given in A.O.A.C. (2007).

**Data analysis:** After collecting all data, data entry was performed using Microsoft Excel. Data were organized and presented by applying principles of descriptive statistics. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp was used for analysis. Logistic Average mean and SD were applied in the presence of considered data.

**Reference Value of Each Parameters on the basis of RDI:**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Reference value (RDI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>64g/day (0.8g/kg)</td>
</tr>
<tr>
<td>Total Fat</td>
<td>65g/day</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>300g/day</td>
</tr>
<tr>
<td>Energy</td>
<td>4200kcal/day</td>
</tr>
<tr>
<td>fibre</td>
<td>25g/day</td>
</tr>
<tr>
<td>Phytic acid</td>
<td>1000-2000mg/day</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>100-200mg/day</td>
</tr>
<tr>
<td>oxylate</td>
<td>75-100mg/day</td>
</tr>
<tr>
<td>Tannin</td>
<td>90.5% DM</td>
</tr>
<tr>
<td>Total phenol</td>
<td>1172±354 mg/d</td>
</tr>
</tbody>
</table>

**RESULTS AND DISCUSSION**

Composite flour was prepared by using barley flour, black cumin seed and garlic powder. Wheat flour was replaced by barley flour 27%, 37%, 47% and 57% respectively. The study deals with the nutritional composition, antioxidants and anti-nutritional activities of the composite flour. Blends were prepared by mixing wheat

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T&lt;sub&gt;1&lt;/sub&gt;</th>
<th>T&lt;sub&gt;2&lt;/sub&gt;</th>
<th>T&lt;sub&gt;3&lt;/sub&gt;</th>
<th>T&lt;sub&gt;4&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>12.39±0.01</td>
<td>12.44±0.02</td>
<td>12.50±0.05</td>
<td>12.52±0.02</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>14.52±0.01</td>
<td>14.45±0.01</td>
<td>14.38±0.015</td>
<td>14.31±0.015</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>2.64±0.025</td>
<td>2.60±0.01</td>
<td>2.58±0.02</td>
<td>2.54±0.015</td>
</tr>
<tr>
<td>Total Ash (g)</td>
<td>2.73±0.015</td>
<td>2.58±0.01</td>
<td>2.45±0.03</td>
<td>2.29±0.02</td>
</tr>
<tr>
<td>Crude Fibre (g)</td>
<td>1.78±0.01</td>
<td>1.89±0.02</td>
<td>1.98±0.015</td>
<td>2.09±0.02</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>67.8±0.04</td>
<td>67.99±0.015</td>
<td>68.28±0.11</td>
<td>69.12±0.17</td>
</tr>
<tr>
<td>Energy (Kcal)</td>
<td>352.75±0.05</td>
<td>353.18±0.19</td>
<td>353.52±0.28</td>
<td>355.90±0.19</td>
</tr>
</tbody>
</table>

*Results are mean ± SD of three determinations.
flour, barley seed, garlic seed and black cumin seed in different ratios such as T₁ (60:27:10:3), T₂ (50:37:10:3), T₃ (40:47:10:3) and T₄ (30:57:10:3) on a dry to dry basis to develop composite flour.

**Nutritional Composition, Anti-Nutritional Factors and Antioxidants Activity of Composite Flour.**

**Nutritional composition of composite flour:** Table 1. represents information regarding the mean nutrient composition of developed composite flour (100g). Results showed that the moisture content was highest in treatment (T₄) i.e. 12.52 percent and least were found in treatment (T₁) i.e. 12.39 percent.

Protein content of prepared composite flour ranged between 14.31g to 14.52g /100g. Protein content of the sample was found highest in treatment (T₄) i.e. 14.52g/100g, followed by (T₁) i.e. 14.45g/100g, (T₂) i.e. 14.38g/100g, (T₃) i.e. 14.31g/100g.

Highest fat content was found in treatment (T₄) i.e. 2.64g/100g followed by (T₂) i.e. 2.60g/100g, (T₃) i.e 2.58g/100g, (T₁) i.e. 2.54 g/100g.

Total Ash content of the prepared composite flour increased with substitution of different flour varied from 2.29 to 2.73 g/100g. Composite flour prepared with wheat flour, barley flour, garlic powder and black cumin powder (60:27:10:3) had highest ash content 2.73g/100g, while the lowest value was observed in (30:57:10:3) i.e. 2.29g/100g. The increased noted in the ash content of the composite flour may be attributed to the higher mineral content of grain. The ash content was found almost same amount in barley flour and wheat flour. Generally the ash content of composite flour increases as the level of incorporation increases.

The fibre content of composite flour varied from 1.78g/100g to 2.09g/100g. Treatment (T₁) (Wheat flour, barley flour, garlic powder and black cumin powder in the ratio of 30:57:10:3) had highest crude fibre i.e. 2.09g/100g, while the lowest fibre 1.78g/100g.

Carbohydrate content of prepared composite flour was found to be in range of 67.80g/100g to 69.12 g /100g.

Energy value ranged between 352.75 to 355.90 Kcal/100g. The maximum energy values was observed in treatment T₄ (355.90 kcal /100g) followed by T₂ (353.52 kcal/100g), T₃ (353.18 kcal/100g) and T₁ (352.75 kcal /100g).

Composite flour prepared by wheat flour, barley flour, garlic powder and black cumin powder was analysed for various nutrients and results were presented in table 1 wide range of nutrients performs various functions in the body. Most grain seeds contain almost all the nutrient in various proportions whereas some medicinal seeds are rich either or deficient in specific nutrients. It is rich in Antioxidants, the B vitamins, folate and pantothenic acid; and the minerals, potassium and calcium and fibre. Together, these nutrients promote the health of the cardiovascular system and also provide protection against diabetes and give hypcholestermeric effects. The chemical composition of the composite flours have been shown to affect both physico-chemical properties and nutritional quality of their products (Akhtar et al., 2008; Mashayekh et al., 2008). Moisture content of flour is very important for its shelf life, lower the flour moisture, the better its storage stability Butt et al., (2004). Theobald et al. (2006) analysed that similar study of protein content of barley flour 9.9g. The high oil content of the composite flour ill affect the shelf stability (Weiss, 2000; Potter and Hotchkiss, 2006). Fibre content of composite flour was ranging between 1.78-2.09, which is similar to the reported values of Sudha et al., (1995) and Gopalan et al., (1989). Fibre regulates digestion, detoxifies and normalizes bowel function, reduces blood cholesterol and prevents colon cancer. This observation may be attributed to the high content of carbohydate in barley flour. Similar study was done by Enwere, (1998) of all the solid nutrients in roots and tubers, carbohydrate predominates. Carbohydrate supplies quick source of metabolizable energy and assists in fat metabolism.

**Anti- nutritional factors of prepared composite flour:** Table 2. observed that the phytic acid content of composite flour was observed highest in treatment (T₄) i.e. 40.07±0.03mg/100g followed by (T₂) i.e. 36.42±0.01 mg/100g, (T₃) i.e.36.28±0.02mg/100g and (T₁) i.e. 31.06±0.03mg/100g respectively.

Flavonoids content of composite flour ranged between 29.42±0.025mg /100g to 39.60±0.02 mg/100g. The maximum flavonoids content of composite flour was observed in treatment T₄ (39.60 ± 0.02 mg /100g) and least were found in treatment (T₁) i.e.29.42±0.025mg/100g.

Oxylate content of composite flour ranged between 43.13 mg/100 to 51.08 mg /100g. Maximum oxylate content of composite flour was found in treatment (T₄) i.e. 51.08mg/100g and least was found in treatment (T₁) i.e 43.13mg/100g.

<table>
<thead>
<tr>
<th><strong>Anti nutritional Factors</strong></th>
<th><strong>T₁</strong></th>
<th><strong>T₂</strong></th>
<th><strong>T₃</strong></th>
<th><strong>T₄</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytic acid (mg/100g)</td>
<td>31.06±0.03</td>
<td>36.28±0.02</td>
<td>38.42±0.01</td>
<td>40.07±0.03</td>
</tr>
<tr>
<td>Flavonoids(mg RE /100g)</td>
<td>29.42±0.025</td>
<td>36.14±0.015</td>
<td>37.13±0.03</td>
<td>39.60±0.02</td>
</tr>
<tr>
<td>Oxylate (mg/100g)</td>
<td>51.08±0.03</td>
<td>46.29±0.015</td>
<td>45.14±0.02</td>
<td>43.13±0.04</td>
</tr>
<tr>
<td>Tannin (mg/100g)</td>
<td>20.15±0.015</td>
<td>22.23±0.02</td>
<td>22.67±0.015</td>
<td>24.13±0.04</td>
</tr>
</tbody>
</table>

*Results are mean ± SD of three determinations.

**Table 2:** Mean score of anti-nutritional factors of prepared composite flour (100g).
100 g. Oxalate content was higher in wheat flour than barley flour. Present study shows that the mean score of tannin of composite flour was found to be ranged from 20.15±0.015mg/100g to 24.13±0.04mg/100g.

Tannin content was found higher in treatment (T₁) i.e. 20.15±0.015mg/100g and least were found in treatment (T₄) i.e. 24.13±0.04mg/100g. Tannin content was higher in barley flour than wheat flour.

The phytic acid content was found in outer layers of the kernel (Boland, et al., 1975; Ravindran, et al., 1994) and therefore, present in higher amounts in bran products. The phytic acid content was higher in barley flour than wheat flour. The values reported for white wheat flour were between 1.54 and 3.2 mg/g (Graf & Dintzis, 1982; Harland, 1993; Ober-leas & Harland, 1981). Phenolic and antioxidants found in cereals may act as free radical scavengers or reducing agents, chelating prooxidant metals and singlet oxygen quenchers (Ragaee et al., 2006). Oxidative stress has been associated with cardiovascular diseases, certain cancers and neurodegenerative diseases (Gulcin, 2012). Dietary antioxidants such as phenolic compounds provide bioactive mechanism to reduce these lifestyle related diseases. There was a 65% reduction in oxalate content of the 48 h fermented flour when compared with the unfermented flour. The oxalate content of the 24 h fermented flour was also reduced by 58%. The observed marked reduction caused by fermentation may be due to the effect of leaching and enzyme, acid hydrolysis of the starch granule during fermentation. Iwuoha and Kalu,(1995) also reported 82.1% and 61.9% oxalate reduction in cocoyam flour produced from boiled and roasted cocoyam respectively. Foods rich in tannins are considered to be of low nutritional value. However, recent findings indicate that the major effect of tannins was not due to their inhibition on food consumption or digestion but rather the decreased efficiency in converting the absorbed nutrients to new body substances.

Antioxidant activity of prepared composite flour: Table 3 shows that the total phenol content was observed highest in treatment (T₁) i.e. 101± 0.04mg/100g and least in control (T₄) i.e. 79±0.02 mg/100g in composite flour incorporated with, barley flour, black cumin seed powder, garlic powder were rich in total phenol content they provide a good amount of polyphenols in the prepared composite flour. It can be concluded that content of total phenol of barley is richer in phenols than wheat.

Highest DPPH activity was found in treatment (T₁) i.e. 86.94 ± 0.025 Percent and lowest was observed in treatment (T₄) i.e. 84.21 ± 0.015 Percent. Garlic has received special attention for its beneficial properties.

The present study revealed that buckwheat has very good antioxidant characteristics (Zielinski and Kozlowska, 2000; Adom and Liu, 2002). Some types of cereals are sources of large number of different phenolic compounds. Number of hydroxyl groups in phenolic compounds, so as their spatial orientation are proportional to molar response of this method (Frankel et al., 1995). Misharina et al.(2009) has reported on 14 essential oil and assessed the antioxidant properties by the oxidation of aliphatic aldehyde to corresponding carbonic acid and found that garlic, clove, ginger and cinnamon leaves show maximum activity (80%-93%). The antiradical capacities noted in this study were much stronger than those of the extracts prepared from rye or wheat as well as triticale caryopses and embryos (Amarowicz et al. 2002, Karamae et al., 2004).

**CONCLUSION**

Grain seeds such as barley, black cumin and garlic are considered as important source of nutrition and as a result of that they are recommended for their therapeutic values. It is concluded that T₁ has highest moisture, fibre, carbohydrate and energy content while T₄ showed highest protein, fat and ash content among various treatments. Now a day these functional food item like barley, wheat etc. are easily available low cost with a functional properties which help in elimination of some diseases like CVD, diabetes and gastrointestinal problem etc. So functional foods play an outstanding role, as demonstrated by their increasing demand derived from the increasing cost of healthcare, the steady increase of life expectancy, and the desire of older people for improved quality of their later years.

**REFERENCES**


properties of Indian Foods.  


