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Study on development and quality evaluation of high rich nutrient multigrain bread

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Abstract
The present study was carried out to develop multigrain rich nutrient bread. The main aim for the development of multigrain breads was to meet the increasing demand of healthy diet for human. The processed of wheat flour, gram flour, barley flour, ragi flour and soya flour bread was used to develop fiber & protein multigrain processed for sample S1 with different ratio of wheat flour, gram flour, barley flour, ragi flour and soya flour (40.0: 13.4: 24.6: 20.0: and 2.0) S2 wheat flour, gram flour, barley, ragi and soya Flour (42.0: 15.4: 24.2: 16.4: and 2.0) and S3 wheat flour, gram flour, Barley, ragi and soya Flour (44.0: 16.4: 23.0: 14.6: and 2.0) and control wheat flour were subjected to estimate for moisture, crude protein, crude fat, ash, crude fiber and carbohydrate and sensory evaluation which rated as "liked extremely" by panel members on 9 point hedonic scale. On the basis of present study it can be concluded that multigrain Bread is the excellent source of fiber thus it helps in reducing weight.

Keywords: Moisture, fat and crude fiber

Introduction

Bread can be said to be embedded in the Norwegian food culture (Frølich, 2007), but currently bread is also one of our most hotly debated foods. While some claim we are better off ithout it (Lutz, Allan & Veiersted, 2010), others, among them the health authorities, recommend whole grain bread as an important component of a balanced and healthy diet (Nasjonalt råd for ernæring, 2011). The grocery stores offer a wide range of breads and many actors claim they have the recipe for the "ideal" bread. But who's right? What is actually an "ideal" bread? Or should we eat bread at all?

Barley is an underutilized crop that is a putative source for functional foods for many reasons. First of all it is a good source of soluble (SDF) and insoluble dietary fibre (Bhatty, 1999; Izydorczyk *et al.*, 2000) [5]. The respective dietary fibre content underlies a natural fluctuation depending on the variety and pre- and post-harvesting conditions. The soluble dietary fibre fractions that are mainly mixed-linkage (1-3), (1-4)-β- d-glucans (henceforth named β-glucans) are quantitatively more important. The level of β-glucans in high-amylose and waxy naked barleys is stated about 8% whereas regular naked barleys exhibit significantly less (Gao *et al.*, 2009 [3]; Tiwari and Cummins, 2008 [11]; (Xue *et al.*, 1997) [12] Recently, consumers' awareness of the need to eat high quality and healthy foods – known as functional foods, that is, foods which contain ingredients that provide additional health benefits beyond the basic nutritional requirements, is increasing (Ndife and Abbo, 2009) [8]. Therefore, the trend is to produce specialty breads made from whole grain flour and other functional ingredients known as health breads or functional foods (Dewettinck *et al.*, 2008) [2].

Bread is among the world's oldest processed foods, which also makes bread baking a handicraft with long traditions (Frølich, 2007; Meyer, 2009; Stampfli & Nersten, 1995). A lot has, however, happened since the first bread was baked in Egypt approximately 12 000 years ago (Meyer, 2009; Mondal & Datta, 2008). From the Egyptians random experimentation with flour, water and yeast, via the small, artisan bakeries established in almost every village supplying citizens with their daily rations of bread, to present were centralization and a high-technological industrialization have taken toll on the production practice. Today, bread is produced in a large scale by a few production units and then distributed and re-distributed over large distances to wholesalers, supermarkets and in-store-bakeries (Hy, 1998; Decock & Cappelle, 2005; Mondal & Datta, 2008; Nilsson, 2009; Stampfli & Nersten, 1995; Whitley, 2009).

Bread is one of the oldest products developed and still popular food in world. Bread may be described as a fermented confectionary product produced mainly from wheat flour, water, yeast and salt by a series of process involving mixing, kneading, proofing, shaping and baking (D. W. Kent and A. J. Amos 1967) [6]. Refined wheat flour is the chief component used for bread making from centuries (C. F. Klopfenstein and R. C. Hoseney 1995) [7]. The formation of whole wheat bread during recent times has involved a positive response from the society due to relatively high health benefits of the whole wheat flour. Breads from wheat and other mix flours particularly addition of high fiber flour forms have been formed and are available in the retail market.

Bread is one of the oldest and largest consumed foodstuffs and is consumed across the globe by all age groups, the present study, therefore, aims to formulate a functional or healthy bread. Bread may be described as a fermented confectionery product which is produced mainly from wheat flour, yeast, water, sugar, salt and other ingredients needed accordingly, by a series of process involving mixing, kneading, proofing, shaping, baking. Bakery products like bread and other bakery goods like biscuit, cake, muffins, etc. made from wheat flour is very popular but has low protein content. Whole grains were preferred in the present experiment as fiber present in outer bran part of the grain has many health benefits. According to epidemiological studies the consumption of whole grains products attributes to reduce the risk of oxidative stress related chronic diseases and age related disorders, such as cardiovascular diseases, carcinogenesis, type II diabetes and obesity.

Water and flour are the major components in bread that affect the bread texture and crumb properties. Bread is a staple food prepared by cooking dough of flour and water and possibly more ingredients. It may be leavened or unleavened and the leavening agents can be biological or chemical. For bread making fat, salt, yeast and baking soda are the common ingredients, contain other ingredients, such as, egg, milk, spice, sugar, fruit, nuts, vegetables, etc. Gram flour also known as garbanzo bean flour or basan, be made from is a pulse flour made from ground chickpeas known in a number of an Asian countries as gram. It is a staple ingredient in India, Pakistan, Nepal and Bangladeshi cuisines. Gram flour can be either raw or roasted gram beans. The roasted verities is more flavor full, while the raw variety has a slightly bitter taste. in the form of a paste with water or yogurt, it is also popular as facial oxfoliant in the Indian subcontinent when mix with an equal proportion of water, it can be used as an egg replacement in vegan cooking gram flour contains a high carbohydrates no gluten and a higher proportion of protein than other flours. It is important because of its excellent storage properties and nutritive value (Shashi *et al.*, 2007) [10]. Its dietary fiber and mineral content is markedly higher than wheat, rice, and fairly well balanced protein (Ravindran, 1991) [9]. Wheat (*Triticum aestivum*) is largely consumed in various forms like breads, biscuits, cookies, cakes, pasta, noodles and is the major source of dietary energy and protein for humans (Hussain *et al.*, 2004) [4]. A number of studies have shown their protective role against several nutrition-related diseases such as type-2 diabetes (Murtaugh *et al.*, 2003; Pereira *et al.*, 2002).

Materials and Methods

The raw materials (wheat flour and ragi, gram, barley, soya flour) will be procured from the local market Dehradun. The Ragi and barley were de-shelled and finely grounded followed by sieving to obtain fine flour. Different proportions of the flour C, S1, S2 and S3 accordingly composition of raw materials.

Preparation of composite flour

The whole wheat seeds and soya been were cleaned from dirt by sorting out contaminants such as sand and leaves and later washed and oven dried the soya bean were roasted and winnowed, both the dried whole wheat and soya beans was later milled using attrition mill and sieved into fine flour of uniform particle size, by passing then through a 2mm mesh sieve.

Bread making

The whole wheat flour was then mix with varying includes of 0, 10, 20, 30, and 40%. The composite flour was blended with other baking in gradients in mixer, kneaded for 12min into consistent dough and resulting dough was molded and placed pre- oiled baking boil. The dough was proofed for 45 to 60 min at 35^0C and 85% relative humidity and backed in a reel oven for 35 min at 270^0C.

Determination of pH

Measurement of pH indicates the acidity/alkalinity in the food sample. The glass electrode pH meter is widely used. Ten grams of the sample was weighed and 40 ml of distilled water was added to the sample. Transfer it to 100 ml volumetric flask and make up to 100 ml with distilled water. pH was determined by dipping the electrode into the solution and allows stabilizing. The pH reading was recorded.

Moisture Content

Moisture content (%) of the bread was determined gravimetrically by the standard procedures of AOAC. Five grams of sample (denoted as W) were taken in a pre-weighed in a petri plate (W_1) that was placed in a hot air oven (model NSW 144) maintained at 105°C until a constant weight for the sample was achieved. The sample was removed from the oven, cooled in a desiccator and weighed (W_2), and the moisture content (%) was calculated by the following formula

$$Moisture\ \% = \frac{W1-W2}{W} X100$$

Crude Protein

Crude protein was determined by Kjeldhal's method. A known amount (700 g) of sample was placed in Kjeldhal's digestion tube and added with 5 g K_2SO_4, 0.5 g. $CuSO_4$ and 25 ml concentrated sulphuric acid. The sample was digested for one hour followed by the addition of 20 ml of deionized water and allowing it to cool. After adding 25 ml NaOH (40%), the sample was then distilled and the ammonia liberated was collected in boric acid and titrated with 0.1N hydrochloric acid. a blank was prepared without any sample and treated in the same manner. Protein content in terms of percentage was calculated by the following formula

$$Crude\ protein\ \% = \frac{(sample\ titre - blank\ titre)x14x6.25}{sample\ weight} X100$$

*molecular weight of nitrogen; #nitrogen factor for plant foods

Crude Fat

Crude fat was determined by the use of solvent extraction technique using a soxlet unit. One gram of sample placed in an extraction thimble was covered with absorbent cotton and poured with 50 ml solvent (petroleum ether) in a round bottom flask. The soxlet assembly was set up and preferably greased at the joints. The sample was subjected to extraction with solvent for 4-5 hrs. At last the solvent was evaporated and recovered from the round bottom flask that was subsequently dried in an oven at 110^0 C for one hr, and finally after cooling, the crude fat was calculated according

$$Crude\ fat\ \% = \frac{Extracted\ fat\ in\ flask}{sample\ weight} X100$$

Crude Fiber

Crude fiber estimation involves the use of defatted sample (1 gm) in a flask digested by acid and alkali in succession. The acid and alkali digestion involved 150 ml of 1.25 % sulfuric acid and then with 1.25 % of 150 ml sodium hydroxide solution, respectively each for a period of 30 minutes. The sample was filtered and washed with boiling distilled water after each digestion process Finally the sample was placed in a good crucible and oven dried at 110^0 C for about an hour followed by cooling in a desiccator. The weight of the sample was recorded as W_1 and the carbonaceous components were burned in a muffle furnace at 500^0C (model NSW-101) for 2 hrs followed by cooling in a desiccator. The cooled crucible is re weighed (W2) and the crude fiber was expressed as percentage of sample, calculated according to the formula.

$$Crude\ fibre\ \% = \frac{W1 - W2}{sample\ weight} X100$$

Ash Content

The total inorganic matter regarded as the ash content was determined by incineration of sample at 600^0 C. One gram of sample was weighed into pre weighed porcelain crucible and incinerated in a muffle furnace (model NSW-101) at 600^0C until proper ashing of the sample. The crucible with ash was removed from muffle furnace, cooled in desiccator and weighed. Ash content was calculated by the following formula.

$$Ash\ (\%) = \frac{Ash\ weight}{sample\ weight} X100$$

The composition of different components observed in the bread varied widely sample to sample in the present study. This is probably due to initial composition of bread the degree of composition of wheat, ragi, gram, barley and soya flour added on the basis of sensory analysis.

Table 1: Composition of rich nutrient multigrain bread

S. No	Material	c	S1	S2	S3
1	Wheat flour	100	40.0	42.00	44.0
2	Gram flour	-	13.4	15.4	16.4
3	Barley	-	24.6	24.2	23
4	Raghi	-	20.0	16.4	14.6
5	Soya	-	2.0	2.0	2.o
	Total	100	100	100	100
Ingredient					
1	Yeast	3.3	3.3	3.3	3.3
2	Sugar	5	5	5	5
3	Salt	1.6	1.6	1.6	1.6
4	Water	66.6	66.6	66.6	66.6
5	Butter	5.5	5.5	5.5	5.5
6	Milk powder	2.0	2.0	2.0	2.0

The control sample was prepared 100% wheat flour and sample S_1 have a different ratio of wheat, gram, barley, ragi and soya flour (40.0: 13.4: 24.6: 20.0: and 2.0) and sample S_2 was prepared different composition (42.0: 15.4: 24.2: 16.4: and 2.0) wheat flour, gram flour, Barley, ragi and soya flour and S_3 (44.0: 16.4: 23.0: 14.6: and 2.0) wheat flour, gram flour, barley, ragi and soya Flour and ingredient used in bread sample on different % for each samples.

Table 2: Proximate analysis of multigrain high rich nutrient of Bread sample.

S. No.	Costituents	C	S1	S2	S3
1	Moisture	12.85	12.87	12.12	12.34
2	Protein	1.08	1.165	1.32	1.26
3	Fat	0.44	0.38	0.5	0.47
4	Fibre	0.82	1.12	1.26	1.239
5	Ash	0.93	0.85	1.02	1.07
6	Carbohydrate	96.57	97.64	97.35	97.21

C-control sample (100%) wheat flour
S1- (40.0:13.4:24.6:20.0:2.0) in % wheat flour, gram, barley ragi and soya flour
S2-(42.0:15.9:24.2:16.4:2.0) in % wheat flour, gram, barley, ragi and soya flour
S3- (44.0:16.4:23.0:14.6:2.0) in % wheat, Gram, barley, ragi and soya flours

Proximate Analysis

The compositional analysis of wheat, gram, barley, ragi and soya flour is presented table 1. The carbohydrate was calculated by the different method it was found that ragi flour contains a high amount of carbohydrate content (97.64) protein (1.32) fat (0.50) fiber (1.23) ash (1.22) and moisture (12.87) whereas the carbohydrate composition of wheat is less than the water ragi flour the protein values are higher for the wheat flour while have the fiber portions are dominated in water ragi flour providing functionality to the product.

Moisture Content

The moisture content of multigrain bread was the highest and was significantly ($P < 0.01$) different from wheat flour. The moisture content of multigrain bread was lower than 12.12% and 12.34% recorded for ragi flour and wheat flours as well as

12.85% for wheat flour as reported by. The moisture content in this study for multigrain flour was higher than the (12.125%) for ragi flours in Nigeria. The moisture content of wheat flour was within the acceptable limit of not more than 10% for long term storage of flour. Moisture content of foods is influenced by type, variety and storage condition. The low moisture content of wheat flour would enhance its storage stability by avoiding mould growth and other biochemical reactions reported moisture content of (7.75%) for wheat flour which was quite higher than the moisture content in the wheat flour in this research. This assertion explains why they have longer shelf life and also confirms their used in both noodles and bakery products. According to, high quality noodles should have an adequate shelf life without any microbiological deterioration and therefore the low moisture content of the wheat flours will in the end extend the shelf life of the.

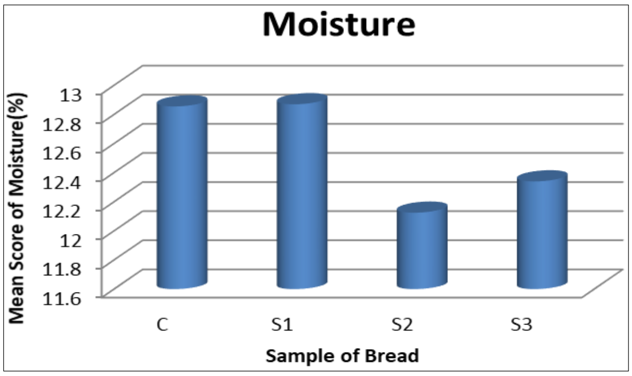

Fig 1: Change in moisture content of different composition of multigrain bread.

Crude Protein Content

The crude protein content of the flour samples ranged between 10.23% and 24.53%. The protein content of wheat flour reported in this study was found to be lower than the 14.70% and 12.86% for wheat flours. The crude protein content differences can be attributed to the geographical location. Since soils with high nitrogen levels can influence protein levels. The protein content of the flours in this study suggests that they may be useful in food formulation systems especially with the wheat ragi barley. The protein content of ragi (5.82-12.8%) was found to be between the range of 1.14-12.14 % for some and also close to 21.63- 25.28% for four advanced lines multigrain bread. The crude protein content and quality of wheat flours can be improved by blending wheat flours with ragi, barley and soya flours and used as composite flours.

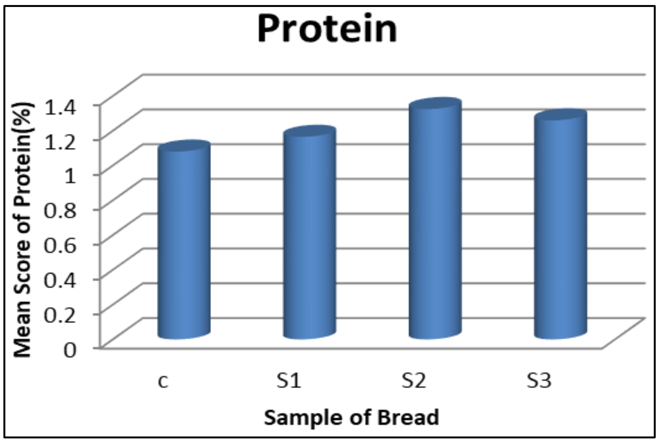

Fig 2: Change in protein content of different composition of multigrain Bread.

Crude Fat Content

Mix flour had higher (0.50%) fat content than sample C and S_1 (.40%). Had .32% and .41% fat content wheat flour, gram flour, ragi flour and soya flours respectively. The fat content of wheat flour from this study was found to be lower than1.5% reported for wheat flour. The differences in fat content may be due to location and varietal differences. Diets with high fat content contribute significantly to the energy requirement for humans. High fat content of soft wheat flour in this study would make it a better source of fat than the raghi flour. High fat flours are also good for flavor enhancers and useful in improving palatability of foods in which it is incorporated.

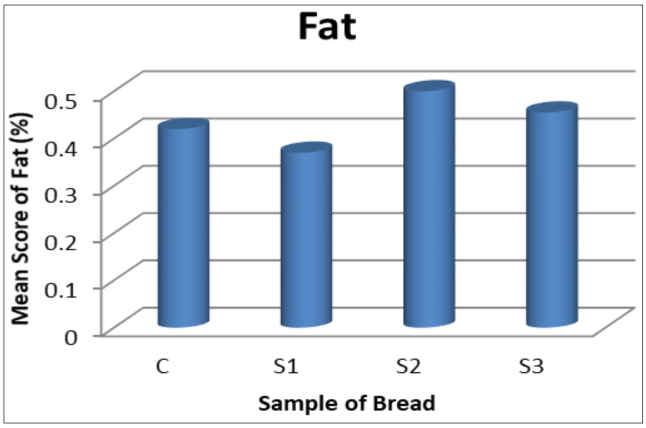

Fig 3: Change in fat content of different composition of multigrain bread

Ash Content

The ash content of the multigrain flours ranged between .93 to 1% (Graph 4.4). The ash content for bread sample in this study was lower than the .82% for sample S_1 wheat flour 24.0 % for gram flour as well as gram flour, Barley flour, ragi flour and soya flour 13.4%, 4.58%, 24.6%, 6.20% and 2.0%. The ash content (0.68% and 1.02) was close highest value multigrain flour reported for these studies. Ash content is an indication of mineral content of a food. This therefore suggests that ragi flour could be important sources of minerals than wheat flours. Ash content in wheat flours can be improved if ragi is incorporated.

Fig 4: Change in ash content of different composition of multigrain bread.

Crude Fiber Content

Reported 1.23% for brown rice flour and 0.85% refined wheat flour. The crude fiber content of 0.51% recorded for wheat in this research was quite close to the 0.85 % reported by ragi flour had the highest crude fiber content (3.21%). reported crude fiber content of 8.19% for pigeon pea, 9.58% cowpea, 4.61% mung bean and 6.83% for peas flour. These were all higher than the crude fiber obtained for the two flours in this research. Crude fiber helps in the prevention of heart diseases, colon cancer, diabetes etc. Wheat flour would not be a better source of fiber content since it had significantly lower crude fiber content. Therefore, it will be useful if cowpea is added to it and used in food formulation to help relieve constipation.

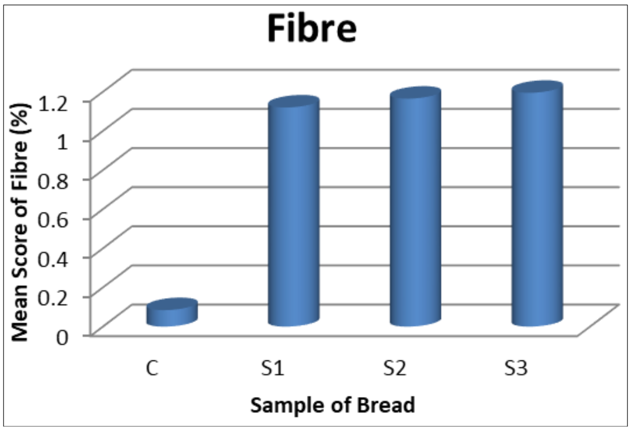

Fig 5: Change in fiber content of different composition of multigrain Bread.

Carbohydrate Content

The carbohydrate content of the multigrain bread varied from 97.1% to 97.6%. Sample $S_1$the highest carbohydrate content (97.60%). The carbohydrate content of the multigrain and ragi flours was comparable to 57.17% for cowpea, 74.22% for wheat; reported by. Carbohydrate content of 50.95% to 53.98% reported for Nhyira, varieties was within the ranges recorded in this research recorded lower range (97.1 to 97.2%) carbohydrate content for sample S_2 and S_3. It can be observed that the flours used for these studies had higher carbohydrate content. The high carbohydrate content of multigrain bread suggests that it could be used in managing protein-energy malnutrition since there is enough quantity of carbohydrate to derive energy from in order to spare protein so that protein can be used for its primary function of building the body and repairing worn out tissues rather than as a source of energy. Carbohydrates are good sources of energy and that a high concentration of it is desirable in breakfast meals and weaning formulas. In this regard therefore, the high carbohydrates content of the multigrain bread would make it a good source of energy in breakfast formulations.

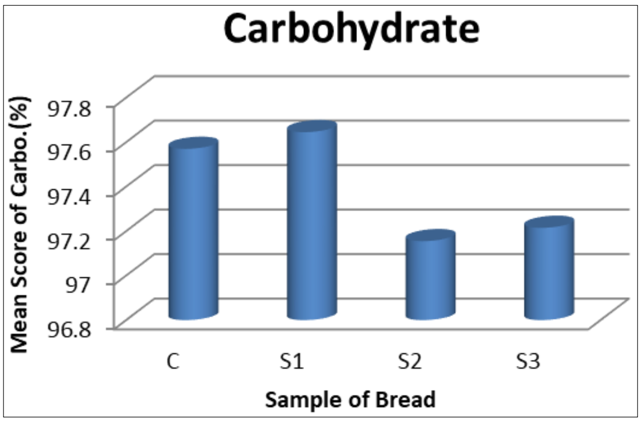

Fig 6: change in carbohydrate content of different composition of multigrain Bread

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