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Analysis of Branded Wheat Flour

Dr. Meena Mehta

Dr. B.M. Nanavati College of Home Science, 338 R.A. Kidwai Marg, Matunga (W) Mumbai 400 019 INDIA

ABSTRACT

For a common people food made from wheat is a staple food. It is consumed in different mode, irrespective of social and economic status of the population. The wheat flour and its derivatives like Maida and Rava are the common ingredients of many food preparations. Generally, wheat is purchased milled to flour before any food recipes are made from it. In the modern era direct wheat flour has become necessity and people choice is shifted from wheat to ready-made wheat flour. Many traders make wheat flour with different brands. With the help of food specialist wheat flour is enriched with respect to its mineral content. It has become necessary to investigate the over-all quality of wheat flour after enrichment of it with suitable chemical substances. Although nutritional facts with the content is available on the packed wheat flour but it is still mandatory to analyze the different brands of wheat flour. The analysis revealed that the protein, fat and mineral content of the enriched wheat flour is increased substantially. The enriched wheat flour is more nutritious than the pure wheat flour. The sensory analysis also revealed that the enriched wheat flour was more acceptable than the pure wheat flour.

KEYWORDS : Wheat flour, Quality, fortification

Introduction

Food is a fundamental right of human being. All human beings achievement, Social, Cultural and Economical is influenced by good and healthy food. However, in this modern era rough how we eat and how we prepare is governed by our traditional customs. Secondly, our lives are ruled by the clock. Thirdly, rising food cost erodes purchasing power of the population. Our body needs varieties of nutrients. When food is good we think of quality of food in terms of its nutritive value[1]. The paradigm has shifted from nutrient dense food to energy dense food.

Modern wheat is not wheat at all. Once agribusiness took over to develop a higher-yielding crop, wheat became hybridized to such an extent that it has been completely transformed from its pre-historical genetic configuration. All nutrient content of modern wheat depreciated more than 30% in its natural unrefined state compared to its ancestral genetic line[2]. Approximately 700 million tons of wheat is now cultivated worldwide making it the second most-produced grain after maize. It is grown on more land area than any other commercial crop and is considered a staple food for humans. There are many health benefits as well as risks are associated with the consumption of wheat flour. Wheat flour from industries are modified with nutritional benefits[3, 4]. There is a strong emphasis on the development of wheat products all over the world when there are many adverse and crippling effects such as neurological impairment, dementia, heart disease, cataracts, diabetes, arthritis and visceral fat accumulation are related to quality of wheat flour[1]. It is surprising that many professionals in public health still recommend wheat flour without proper assessment of the differently branded wheat flour. It is highly desirable to investigate nutritional status of wheat flour and comment on its beneficial as well as health risk on common population.

The majority of wheat is processed into 60% extraction, bleached white flour. 60% extraction is the standard for most wheat products. Unfortunately, the 40% that gets removed includes the bran and the germ of the wheat grain, its most nutrient-rich parts. In the process of making 60% extraction flour, over half of the vitamin B_1, B_2, B_3, E, folic acid, calcium, phosphorus, zinc, copper, iron, and fiber are lost. Any processed foods with wheat are akin to poison for the body since they cause more health risks than benefits. Nutrient absorption from processed wheat flour products is thus consequential with almost no nutritional value[5]. Some experts claimed that selection of 100% whole wheat products, the bran and the germ of the wheat will remain in meals, and the health benefits will be impressive.

Mandatory fortification of all flour, other than whole meal, with calcium carbonate and iron, niacin and thiamin is testament to long-standing policy agreement that roller-milled white flour was and remains nutritionally inadequate, at least in respect of these four nutrients[6]. Advances in knowledge and research since 1953 indicate that the underlying nutrient density of typical bread wheat flour might have declined, hence dietary contribution of white flour when fortified need to be investigated. Both nutritionally dense, flour which contains optimal levels of those vitamins and minerals with which it is naturally endowed, and digestible, that is free, as far as possible, of protein fractions that trigger gluten sensitivity[7]. This provides the challenge for researcher to investigate the quality of wheat flour with respect to change in physical and chemical composition of the wheat flour.

The main objective of this study is centered at analysis of different brands of wheat flour with respect to their major flour characteristics. Results based conclusion was drawn and commented on their health benefits in tune with the literature.

Methods and Materials

Analysis of Flour

The study was conducted on proximate analysis of branded and loose wheat flour. Five popular brands namely Pillsbury, Annapurna, Shakti Bhog Atta, Surya and loose wheat flour were investigated for their physical and chemical characteristics. The chemical parameters like Moisture content, Ash value, Gluten content and Acidity were estimated by methods recommended by PFA[8, 9]

The routine analysis of flour include the determination of added chalk, SO_2, oil, protein, acidity, iron, thiamine and nicotinic acid, an examination for improvers, bleaching agents and a microscopic examination were carried out. In addition, analysis of the gluten, physical tests on the dough produced, determination of the particle size, maltose, color and grade figures were also examined.

Moisture Content of Wheat Flour: Sample was weighed and placed into dish. Transfer the dish in an oven maintained at 105°C and dries for 2hrs .Cool and weighed. Calculate the moisture content from the weight loss of the sample

Determination of Ash in Wheat Flour: Flour was weighed into well-dried porcelain, and then was heated onto a Bunsen burner until 350-400°C Transfer to oven and heat for 2 hrs. After cooling ash was weighed and total ash was calculated as a % ash of wheat flour.

Determination of Crude Gluten in Flour: Weigh wheat flour sample and add about 25mL of water, and mixed into dough with a spatula. Knead the dough gently under water for 10-15min, to wash away the soluble matter and starch. Then rolled dough into a ball and weigh the moist gluten and expressed as percentage of flour. Record the color. Then it was dried at 100°C to constant weigh and report as the gluten as % of flour.

Acidity of Wheat Flour: Weighed sample of flour was shaken with CO_2-free water in a conical flask. Then it was placed in a water bath at 40°C for 1hr with flask. Filter and titrate with 0.05N NaOH solution by

using phenolphthalein as an indicator. The acidity of the water extract is calculated as lactic acid.

Gluten Quality: The washing-out process can be done mechanically. A quantitative test consists of weighing the gluten either wet or after being dried. The measurement of gluten quality has been based on four general principles, namely; expansion by heat, recovery from compression, gluten extension and gluten relaxation of gluten. Although there is agreement that many properties of dough are due to the gluten component of flour.

Mineral: The sample was analyzed for their mineral content like Fe, Ca, Zn by Atomic Absorption Spectroscopy method.

All the experiments were examined for the reproducibility and the results of above experiments are summarized and tabulated for the discussion.

Results and discussion

Wheat flour quality and methods in wheat flour quality determination is important[10]. However, the choosing appropriate raw material according to quality of wheat/flour/semolina is very important to produce products such as bread, biscuit etc. Physical Tests for wheat flour includes color, gluten washing, density, granulation and particle size. The germ and bran are removed from the kernel when white flour is milled, even though they contain nearly all the fiber and B vitamins; they are removed because they also negate the elastic properties of the gluten, which is so vital to the texture and crumb of the bread. Samples of all the four branded as well as loose wheat flour were collected from the Mumbai local market and physical tests were carried out. The results are tabulated in the table 1.

Color tests, are used to judge the flour grade. The photo electric method is used to assess flour color. Common flour standards and modified color would help focus on the real potential health properties of bread and encourage positive dietary change, aided by transparency[11, 12]. Flour color might be unacceptable to health. There could be shelf-life issues with flours in which the nutritious, germ is present. White flour became adopted in many cultures because it was recognized as being healthier than dark flours. The unknown factor for its benefit at that time was that mold and fungus in the grains, which may led to several diseases, were eliminated in the processing that resulted in white flour. A meaningful level of nutrient retention would probably result in creamy-colored flour with an extraction rate. The amount of the whole grain retained is 80 %. Golden Flour would enlist the technical process of millers to preserve the natural vitality of grain rather than destroy it.

The market survey revealed that branded flour had acceptable flavor and adds to the aesthetic value of the flour.

Moisture, ash, and protein tests are the most widely used on wheat flour. Miller and Johnson (1954) stated that moisture is related to quality of wheat and flour in at least three ways: (1) flour yield varies inversely with moisture content (2) composition percentage are inversely related to percentages of moisture present (3) deterioration of grain during storage may depend on the moisture relationships in the wheat kernel[13]. The moisture contents for all the branded wheat flour sample was between 8.00% and 10.20% All brands of wheat flour are suitable with respect to moisture content according to TS 4500 because it should not be over limit 14.5%. The variation in moisture content can be attributed to climate conditions, wetland temperature of warehouse and rain harvest.

The ash test is significant to determine flour grade. Since the ash content of bran is about 20 times that of endosperm. The ash test indicates how thoroughly bran and germ were separated from the kernel endosperm. There is considerable variation in the amount of mineral matter in wheat flour, depending on the class of wheat and the area it was grown. Therefore, the ash test is applied to wheat flour. The ash content changes between 0.75 and 2.05. The percentage ash is directly proportional to amount of bran present in the wheat flour. The total ash value was in the range prescribed by the PFA and Agmark specifications. However, acid insoluble ash was little higher than the specified value. The presence of 1.5% of sandy matter in the flour was responsible for the same.

The alcoholic acidity of the wheat flour sample is in the range of 0.17% to 0.57%. The normal recommended acidity should be around 0.1%. Loose wheat flour has higher acidity compared to other samples, while Pilsbury brand wheat flour has only 0.17% of acidity which is close to recommended value. Because inorganic matter diffuses quickly into wheat flour, it increases the overall acidity[14]. The higher value of acidity was attributed to the chemicals used to increase the shelf life of the flour. Long storage period under normal conditions are responsible for the reasonable changes in the chemical and physical characteristics of the flour.

Gluten content is important quality of wheat flour. Gluten amount is determined for different brands of wheat flour. Higher content of gluten is good quality of flour, because it affects swelling of bread during fermentation of yeast in it[15]. Gluten retains the evolved CO_2 gas during fermentation process. Gluten analysis of wheat flour sample reveals that gluten content was 4.72% for Pilsbury brand while it is maximum for the loose wheat flour sample. Dry gluten results of samples, flour are suitable, according TS 4500 and it should not be less than 9%.

Wheat flour quality can be judge on the basis of the amino acid composition of wheat gluten. It is difficult to show essential differences in the amino acid content of flours milled from different varieties and types of wheat.

It is established fact that wheat flour is fortified to increase its nutritional level with respect to its mineral content. Especially element like iron, Calcium, Magnesium and trace minerals like Copper and Zinc[15]. Different brands of wheat flour contain different amount these mineral in order to popularize their brand. These minerals are vital and necessary as the healthy nutrient from staple food. A word of caution is that excess use of these mineral may have toxic effect on human health. Hence it is necessary to use optimum amount of these minerals for fortification of wheat flour. All the samples were processed and total ash was dissolved in hydrochloric acid and diluted to known standard volume. An appropriate aliquot was used for the estimation of minerals by Atomic Absorption Spectroscopy. The results are tabulated in Table 2

Consumption of iron ameliorates iron deficiency, the most prevalent nutritional deficiency in the world, affecting approximately 3 billion persons. The consumption of wheat flour is greater than that of any other cereal grain[16]. Fortification of wheat flour is an effective, simple, and inexpensive strategy for supplying folic acid, iron, and other vitamins and minerals to large segments of the world population. In foods, the stability of vitamins is more precarious than that of minerals because vitamins are sensitive to heat, oxidizing and reducing agents, light, and other kinds of physical and chemical stress. Minerals are more resistant to manufacturing processes than vitamins. Copper, iron and zinc are affected by moisture and may react with other food components such as proteins and carbohydrates. Various forms of iron are used in fortification, among the most popular ones being ferrous sulphate because of their relatively high bioavailability[16]. Other potential iron sources include ferric orthophosphate, sodium iron phosphate, ferrous fumarate, and iron-EDTA. The stability of different forms of iron depends on various factors including the nature of the food it is added to, particle size, and exposure to heat and air. Elemental iron, as reduced iron or electrolytic iron, is used to fortify ready – to – eat breakfast cereals and has been found to have excellent stability during processing and storage.

The results of wheat flour analysis indicate that branded flour has higher content of iron. All the branded flour has the iron content centered at 18mg/Kg except for non fortified loose wheat flour. Different brands use different chemical iron salts to have better bioavailability of fortified iron. According to the FDA[17], a Kg of enriched flour must have the nutrients iron 20 mg/Kg,

The Calcium and Magnesium content in the branded wheat flour was in the range of 25mh/Kg and 75mg/Kg respectively. The FDA[17, 18] has recommended fortification of Calcium up to 19.6mg/Kg while Magnesium is restricted to 75mg/Kg. Calcium and Magnesium is added in the form of Chalk $CaCO_3$ and light Magcarb $MgCO_3.Mg(OH)_2$. These minerals are important as a nutrient and useful in strengthening the human bone. However excess amount of fortification has adverse ef-

fect on the health.

There are many trace minerals essential for the enzymatic reaction during metabolism. The major minerals are copper and zinc which has vital role to play during absorption of nutrients[19]. The copper is useful as an electron transfer moity while zinc is important in hormonal activities. The FDA has recommended trace mineral level should be 1.5mg/Kg of Copper and 1.8mg/Kg. of Zinc. The analytical experiments on wheat flour samples indicate the maximum amount of Copper up to 1.6mg/Kg in Shakti Bhog Atta variety. The excess amount of copper can lead to Wilson's diseases. Similarly, the amount of Zinc is in the range of 1.75mg/Kg which is in good agreement with FDA[17] recommendation.

Wheat-flour fortification is increased from 18% in 2004 to 35% in 2013. Programs should continue to expand coverage of wheat-flour fortification as a strategy to increase iron consumption. Successful wheat-flour fortification worldwide requires adoption and enforcement of legislation for mandatory fortification at the national level, at industrial level and public-sector commitment for such legislation. Mandatory fortification places the same requirements on all flour producers and is more likely to succeed if the milling industry is well organized and supports fortification. The development and implementation of consumer education and communication strategies that include evidence of the health benefits of fortification require commitment from the public sector and is strengthened by the support of civic organizations. Through public, private, and civic collaboration, advocates and public health agencies are promoting wheat-flour fortification to increase worldwide consumption of vitamins and minerals.

Summary and Conclusion:

Amongst the all the five branded wheat flour sample, Shakti Bhog Atta and Pilsbury brand has most appropriate composition and balanced amount of mineral content. Some of the mandatory fortificants, notably iron, are poorly assimilated, undermining the credibility and logic of the current regulations. Certain population groups may be deficient in micronutrients, magnesium, zinc and selenium, which are not considered in current fortification policy. A much better approach would be to address the nutritional inadequacy of refined white flour. Furthermore, some people depend disproportionately on white flour products and under consume foods that are naturally richer in micronutrients. It cannot be assumed that they would be able to replace the nutrients currently added to white flour. The processing method influences bioavailability. The baking industry could promote its basic products transparently with an honest guarantee of minimum nutritional quality, subject to the caveat about the role of fermentation time in bioavailability, a far cry from the present scam of iron fortification.

Dr. Davis states that replacing wheat with healthy foods like vegetables, nuts, healthy oils, meats, eggs, cheese, avocados, and olives, then there is no nutrient deficiency that develops with elimination of wheat. People with celiac disease experience deficiencies of multiple vitamins and minerals after they eliminate all wheat and gluten from the diet.

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Table 1 Physical parameters of the wheat flour

Name of Sample	Ash	Moisture Content	Acidity	Gluten %	
				Wet	Dry
Pisbury	2.05	8.00	0.17	25.57	4.72
Annapurna	1.93	9.45	0.27	20.60	4.74
Surya	1.45	8.75	0.28	19.85	6.58
Shakti Bhog Atta	1.85	8.50	0.26	27.05	6.85
Loose Wheat flour	0.75	10.20	0.57	8.67	9.97

Table 2 Mineral content of branded wheat flour

Sample/ Mineral	Iron (mg)/ Kg	Calcium (mg)/ Kg	Magnesium (mg)/Kg	Copper (mg)/Kg	Zinc (mg)/ Kg
Pisbury	15.2	22.2	80.3	1.7	1.98
Annapurna	15.6	24.9	77.8	1.5	1.75
Surya	14.8	28.2	73.9	1.2	1.70
Shakti Bhog Atta	15.2	26.7	72.1	1.8	2.00
Loose Wheat flour	4.9	16.3	20.6	0.5	1.10

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