USE OF CEREAL GRAINS BARLEY, FINGER MILLET AND SORGHUM (BFS) FLOURS IN THE PREPARATION OF BISCUITS

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ABSTRACT

Biscuits were prepared using 5 to 25 per cent level of BFS flours and were analyzed for their physicaland sensory characteristics. The results were analyzed statistically on the basis of which, biscuits containing 10 and 15 per cent level each of BFS flours were selected for standardization of various ingredients in the formulation. The variations were made in the levels of fat, leavening agents and sugar in order to improve the quality of biscuits. Based on the physical and sensory characteristics, products containing optimum levels of various ingredients and BFS flours were evaluated for their chemical characteristics. The salient findings of this study are as: Chemical analysis of raw BFS flours revealed that barley flour had moisture, protein, fat, ash, crude fibre and carbohydrate contents of 12.31, 10.66, 1.92, 1.20, 3.31 and 73.91 per cent, respectively. The corresponding values for finger millet flour and sorghum flour were 12.66, 6.81, 1.35, 1.96, 2.93, 77.22 and 11.37, 9.02, 2.30, 1.38, 1.30 and 75.93 per Cent, respectively. The calorific values of different test flours were 355.56 (barley), 348.27 (finger millet) and 360.50 (sorghum) Kcal/100g.

Key words: *Analyzed, sensory characteristics, standardization, protein, fat, ash, crude fibre.*

INTRODUCTION

Cereal grains truly represent humanity's double-edged sword, for without them we likely would not have had an agricultural 'revolution'. We surely would not be able to sustain the enormous present-day human population (? 6 billion), nor would there likely have been societal stratification which ultimately was responsible for the vast technological/industrial culture in which we live. The use of Cereal grains barley, finger millet and sorghum (BFS) flours in the preparation of biscuits. All of from an evolutionary perspective, humanity's adoption of agriculture, and hence cereal grain consumption, is a relatively recent phenomenon. Table 3 shows that this event occurred in most parts of the world between 5,500 and 10,000 years ago. Cereal grains represent a biologically novel food for mankind [341, 342], consequently there is considerable genetic discordance between this staple food, and the foods to which our species is genetically adapted.

Cereal grains lack a number of nutrients which are essential for human health and well-being; additionally they contain numerous vitamins and minerals with low biological availability.

Furthermore, the inability of humans to physiologically overcome cereal grain ant nutrients (phytates, alkylresorcinols, protease inhibitors, lectins, etc.) is indicative of the evolutionary novelty of this food for our species. This genetic maladaptation between human nutrient requirements and those nutrients found in cereal grains manifests itself as vitamin and mineral deficiencies and other nutritionally related disorders, particularly when cereal grains are consumed in excessive quantity. More disturbing is the ability of cereal grain proteins (protease inhibitors, lectins, opioids and storage peptides) to interact with and alter human physiology.

These interactions likely occur because of physiological similarities (resultant from phylogenetic commonalities) shared between humans and many herbivores which have traditionally preyed upon the gramineae family. The secondary compounds (anti-nutrients) occurring in cereal grains (gramineae family), were shaped by eons of selective pressure and were designed to prevent predation from traditional predators (insects, birds and ungulates) of this family of plants. Because primates and hominids evolved in the tropical forest, where in dicotyledonous plants prevailed, the human physiology has virtually no evolutionary experience with monocotyledonous cereal grains, and hence very little adaptive response to a food group which now represents the staple food for many of the world's peoples.

REVIEW OF LITERATURE

Cereal grains obviously can be included in moderate amounts in the diets of most people without any noticeable, deleterious health effects, and herein lies their strength. When combined with a variety of both animal- and plant based foods, they provide a cheap and plentiful caloric source, capable of sustaining and promoting human life. The ecologic, energetic efficiency wrought by the widespread cultivation and domestication of cereal grains allowed for the dramatic expansion of worldwide human populations, which in turn, ultimately led to humanity'senormous cultural and technological accomplishments. The downside of cereal grain consumption is their ability to disrupt health and well-being in virtually all people when consumed in excessive quantity. This information has only been empirically known since the discovery of vitamins, minerals and certain anti-nutrients in the early part of this century.

The realization that cereal grain peptides interact with and induce change in human physiology and therefore elicit disease and dysfunction is even newer and dates to the early1950s with the discovery of wheat gluten as the causative agent in celiac disease. In the past 10 years has come the evidence (admittedly incomplete) that certain cereal peptides may interact with the immune system to elicit a variety of autoimmune-related diseases. These two seemingly distinct entities (autoimmune disease and consumption of a staple food) are connected primarily through an evolutionary collision of dissimilar genes which bear identical products (molecular mimicry). Although, cereal grain consumption may appear to be historically remote, it is biologically recent; consequently the human immune, digestive and endocrine systems have not yet fully adapted to a food group which provides 56% of humanity's food energy and 50% of itsprotein.

Cereal grains are truly humanity's double-edged sword. For without them, our species would likely have never evolved the complex cultural and technological innovations which allowed our departure from the hunter-gatherer niche. However, because of the dissonance between human evolutionary nutritional requirements and the nutrient content of these domesticated grasses, many of the world's people suffer disease and dysfunction directly attributable to the consumption of these foods.

MATERIAL AND METHOD

The present investigation entitled "Development of multigrain biscuits using wheat, barley, finger millet and sorghum" envisaged the use of barley, finger millet and sorghum (BFS) flours in the preparation of biscuits. Biscuits were prepared using 5 to 25 per cent level of BFS flours and were analyzed for their physical and sensory characteristics. The results were analyzed statistically on the basis of which, biscuits containing 10 and 15 per cent level each of BFS flours were selected for standardization of various ingredients in the formulation. The variations were made in the levels of fat, leavening agents and sugar in order to improve the quality of biscuits. Based on the physical and sensory characteristics, products containing optimum levels of various ingredients and BFS flours were evaluated for their chemical characteristics. The salient findingsof this study are as follows:

1. Chemical analysis of raw BFS flours revealed that barley flour had moisture, protein, fat, ash, crude fibre and carbohydrate contents of 12.31, 10.66, 1.92, 1.20, 3.31 and 73.91 per cent, respectively. The corresponding values for finger millet flour and sorghum flour were 12.66, 6.81, 1.35, 1.96, 2.93, 77.22 and 11.37, 9.02, 2.30, 1.38, 1.30 and 75.93 per cent, respectively. The calorific values of different test flours were 355.56 (barley), 348.27 (finger millet) and 360.50 (sorghum) Kcal/100g.

2. The calcium, phosphorus and iron contents of barley flour were 24.55, 171.84 and 1.05 mg/100 g, respectively. The corresponding values for finger millet and sorghum flour were 330.14, 258.52, 3.14 and 23.04, 179.91, 3.81 mg/100 g, respectively. Among the flours, finger millet flour exhibited maximum calcium and phosphorus contents, whereas sorghum flour exhibited the maximum iron content.

3. Substitution of wheat flour with BFS flour in the formulation (5 to 25 per cent each) increased the water absorption of blends and diameter of biscuits. The spread ratio and per cent spread factor increased up to 10 per cent level and thereafter showed a decreasing trend. The thickness of biscuits decreased at 5 per cent level and then increased up to 25 per cent level. The weight and hardness of biscuits showed a continuous decreasing trend.

4. The control sample had greater overall acceptability than the biscuits containing 5 to 25 per cent of each of BFS flour. The overall acceptability of biscuits containing each of BFS flours up to 5 per cent level was statistically similar to that of control biscuits. At higher levels, the

acceptability had however reduced. Further studies were therefore undertaken with 10 and 15 per cent levels of each of BFS flours in the formulation.

5. Optimization of fat level in the formulation showed that with the increase in level of fat (16 to 18 per cent), thickness of biscuits decreased whereas diameter, spread ratio, per cent spread factor, weight and hardness increased. On the basis of maximum overall acceptability scores, 17 per cent level of fat in the biscuits prepared from all types of blends was considered as optimum.

6. With the increase in level of leavening agents namely ammonium bicarbonate and baking powder from 0.5 to 0.6 and 0.3 to 0.6 per cent, respectively the diameter, spread ratio, per cent spread factor and weight of biscuits increased; however, thickness and hardness decreased. On the basis of maximum overall acceptability scores, a level of 0.5 and 0.3 per cent of ammonium bicarbonate and baking powder, respectively, was found to be optimum in the biscuits from all types of blends.

7. Increasing the sugar level (18 to 20 per cent) in the formulations reduced the thickness and hardness but increased the diameter, spread ratio, per cent spread factor and weight of biscuits. On the basis of sensory evaluation of biscuits, a level of 19 per cent was found to be optimum for biscuits prepared from all types of blends.

8. Standardization of ingredients in biscuits containing 10 per cent of each of BFS flours led to the increase in its acceptability characteristics similar to that of control. The overall acceptability scores increased from 4.2 to 4.65 in case of optimization of biscuits containing 10 per cent each of BFS flours and scores increased from 4.0 to 4.4 in case of biscuits containing 15 per cent each of BFS flours.

9. BFS flour fortified biscuits contained greater amount of protein, fat, ash, crude fibre, calcium, phosphorus and iron contents than the control. Protein content of biscuits containing BFS flours increased by 19.31 to 36.97 per cent over the control biscuits. The incorporation of BFS flour blend brought about an increase of 17.09 to 82.25 per cent in crude fibre content. The calcium and phosphorus content of BFS flour fortified biscuits witnessed an increase of 60 to 128.19 and 17.10 to 28.12 per cent, respectively over the control biscuits.

On the basis of above findings, it can be concluded that nutritionally rich biscuits can be prepared by substituting wheat flour with 5 and 10 per cent each of barley, finger millet and sorghum flours. After optimization, product containing 10 per cent of each of BFS flour was found to be most acceptable in terms of physico-sensory characteristics followed by that containing 15 per cent of each of BFS flour. Nutritionally, the biscuits prepared from blends were higher in protein, ash, fibre, calcium and phosphorus. This indicates that the under-utilized barley, finger millet and sorghum grains could be processed and used with advantage to produce value added products.

CONCLUSION

The results of the study suggested that grain millets combined with novel fibre − FOS can create acceptable health foods with enhanced textural quality. This data can help predict the performance of FOS as partial replacer of sucrose in improvement of nutritional quality of such baked products. The fibre, calcium and iron content of cookies can be improved without compromising on the quality and acceptability. One serving of cookies provided 5.2 g of total fibre, which met the FDA definition of 'High Fibre'. These cookies can be categorized as 'Good Source' of iron as they would suffice 12.8% DV of iron.Thus, the use of FOS in cookies was effective for technological and nutritional advantages of cookies and may have additional health benefits including prebiotic effect and enhanced mineral absorption. Increasing the availability ofhealth-promoting foods in our diet will help to ensure a healthier population.

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