



MILLET FLOUR FOR BAKED FOOD PRODUCTS

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Abstract

In developing countries cereal staples provide two-thirds of the total protein and calorie intake. Wheat flour, among all other cereal flours, has the special property of making visco elastic dough with water due to the presence of protein called gluten which interacts with water when kneaded and it produces an elastic structure upon absorbing water. There are mainly two limiting factors for using cereals for human consumption. First is that a gluten intolerance persons is allergic to gliadin part of wheat protein. Secondly, cereal proteins lack a number of essential amino acids, which may cause protein deficiency when consumed alone. Due to the changing life style of people and increasing number of working women, requirement for ready to cook (RTC), ready to serve (RTS) and convenient food has increased. Baked products are good substrate for carrying out and implementing fortification and value addition operations and can be used to feed at mass scale. In a diet, baked products are also one of the most important sources of dietary. A cookie made from wheat flour only may not be able to provide all the nutrition. Therefore, it is important to develop nutritionally enhanced product which can meet the nutritional requirement of human by utilizing underutilized crop also and at low cost.

Keywords: Food Enrichment, Gluten and Cookie.

Introduction

Millet flour promises flavorful and healthier baking goods along with nutrition. It is gluten-free and beside that, it gives mild flavor to both sweet and savory recipes. There are mainly two limiting factors for using cereals for human consumption. First is that a part of human population (Gluten intolerance persons) is allergic to gliadin (Vanisha *et al.*, 2011) part of wheat protein which causes Celiac disease (CD). It is caused by the presence of gluten proteins from cereals like wheat, rye and barley which cause inflammation of the small intestine. Its prevalence in any population over the world lies between 1:100-1:200 (Schuppan *et al.*, 2009) and people suffering from CD must stick to diet without gluten. Therefore, the commercialization of gluten-free food products has seen an annual growth of 28% in the last years (Glover, 2009). Secondly, cereal proteins lack a number of essential amino acids, which may cause protein deficiency when consumed alone (Harinder *et al.*, 1999).

As a result, attempts have been made to boost the consistency and quantity of the cereal protein by using different methods such as genetic modification and complementing cereal products with amino acids and protein concentrates from oilseeds or legumes (Harinder *et al.*, 1999). Supplementing staples such as non-wheat cereals or legumes, which are inexpensive, has yielded products of high nutritional value (Sheheta and Fryer, 1970). The use of different protein sources in the inclusion of baked products

has been documented by Marnett *et al.*, 1978; Kailasapathy *et al.*, 1985; Serna-Saldivar *et al.*, 1988 and Singh *et al.*, 1991.

Bakery product value addition

The demand of bakery products is witnessing an annual growth rate of 10.07%. The food industry is entrusted with the challenge of designing new food items with unique health characteristics. The importance of nutraceuticals in food industry is emerging rapidly. India being a developing country has a large population reliant on wheat as staple food and also 25% of wheat is consumed in the preparation of bakery products (Kamaljit *et al.*, 2010). Baked goods are known to be an outstanding medium for fortification, addition of value and at bulk level.

A cookie made from wheat flour only may not be able to provide all the nutrition. Therefore, it is important to develop nutritionally enhanced products which can meet the nutritional requirement of special segment by utilizing underutilized crops and at low cost. Development of good gluten network is a requirement for production of bakery products. Owing to poor functional and nutritional properties of substituted ingredients used in the recipe formulations, free bakery products without gluten are a challenge to food technologists and nutritionists (de la Barca, 2010). Therefore, research should be taken to look into the probability of using millets and nutritionally dense underutilized crops which are gluten free to use it as an ingredient along with wheat flour for making bakery products such as cookies, biscuits, bread etc.

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Bakery industry and product consumption

Bakery products can be classified as flour-based foods which are made in an oven that include products such as biscuits, bread, cakes, pies and pastries. Because of its low price, bakery products are utilized by a wide population. Also, bakery products have gained popularity as a result of changing eating habits of people and with rapid growth.

The market for processed food products is continuously rising in emerging societies around the world, including India, for different reasons like changing socio-economic environment, higher per capita income, fast moving life, higher living standards the technological, industrial and economic advancement. The bakery industry is among one of the country's largest processed food industries which has been growing steadily in the recent past. Most of the bakery sectors are committed to bread and biscuits, accounting for about 82% of overall bakery products. 3.0 million tones is the estimated annual production of bakery products. The organized and unorganized sectors together account for an estimated production of around 11 million tons of biscuits in the country (www.biscuitfederation.org). Biscuits enjoy a wide popularity among both the rural and urban population among all the age groups (Agrawal, 1990).

As per a study published on www.fnbnews.com, the consumption per capita of baked goods in advanced countries lies between 10 and 50 kg per annum which is far ahead when compared to that of India, it is just one to two kilograms a year. In both urban and rural areas, the rate of growth of bakery products has been excellent. The sector has made fast strides and has also demonstrated future growth opportunities. Britannia, Parle, Cremica, ITC and Cadbury's are the large players organized companies in the market. On other side, the breads and cakes market have multiple regional and local players and is much more fragmented. Britannia is the only national brand in the entire bakery market. However, in recent years, foreign players such as United Biscuits, Unibic have also gained recognition in particular product segments. The sector is expecting that any more foreign brands will enter the Indian industry.

In the last 3-4 years, the bakery industry has expanded further. This arose principally on two points, as further clarified. The first is the increased access to quality chocolate ingredients, toppings, fillings, etc. Second, several new players have emerged due to better education which encourages them not to prepare products of low quality but to develop products of international standard. A steady growth in the number of players. The industry, however, is much decentralized with very few coordinated participants in the region. Owing to this fractured and unconnected view, each city is also diversified with its own bakery culture and eating habits. The bakery sector has the potential to be designated as a sunrise industry.

A variety of bakers have recently arrived to manufacture three-dimensional and thematic cakes. Besides the standard method, bakers are also experimenting for many other ingredients such as rice treats and shape them into cake designs. Wooden-planks are often used for support by some bakers. One more innovation, called sugar crystal sculptures, is often being used where it is used as per the theme of the cake. Though India is one of the leading producers of cookies, per unit cookies consumption is unlikely to be as low as 8 Kg per year as in the developing countries of 15 Kg per year (Shukla *et al.*, 2000). Cookies are very common among bakery items and are ubiquitous in the Indian market, but not in traditional Indian cuisine. Cookies are available in various sizes and shapes and have excellent organoleptic properties in particular unit packages.

National nutrition fact sheet

Utkarsh Shah published an article in 2011 claimed that over 47% of India's children are malnourished, that's second highest in the world, according to World Bank (1998). Malnutrition and under nutrition have adverse effects on every nation's economic development and also impair the country's overall efficiency. Furthermore, due to malnutrition; the age group 0-6 years of age raises morbidity and mortality, which contributes to an increased burden on health and disease in the nation. 17.5% of the Indian population is under 6 years of age according to the census in India (2001). The United Nations figures suggest that more than 2.1 million children die every year before they reach 5 years of age, often due to pathogenic yet preventable diseases such as malaria, pneumonia, typhoid and measles. United Nations estimations also state a daily mark of 1000 deaths in the same age group because of diarrheal diseases. In India, anemia was estimated at 65-75% (WHO 2004). Anemia is a worldwide public health threat with significant human health repercussions; it is more prominent in pregnant women and infants. The World Health Organization (WHO) estimated that 40-60% of pregnant women suffer from it in developing nations. Around half of anemic people suffer from iron deficient anemia because of deficient body iron stores in the body. Folate deficient anemia is the major cause for the major proportion of the remaining anemia among other causes.

In India, the root cause of the malnutrition is assumed to be non-availability of food and micro-nutrient deficiency. The World Bank Report on India in 2009 has suggested boosting expenditure in this sector to provide micronutrients to the nutritionally marginalized section of the population. The research noted that a shortage of micronutrients would lead to an annual loss of US\$2.5 billion if they are left unattended at this point in time. The level of under-nutrition in India is substantially different in urban and rural areas. According to a report, 50% of rural children and 38% of urban children are undernourished (World Bank, 2009). In addition to this regional divide, there is also a gender divide that means that

females are more likely to develop under-nutrition than males, mainly because of biased attitude towards a female child. Similarly, social retrograde segments rather than other parts of the population are influenced by diet. Malnutrition contributes to a variety of issues in the body including epithelial, mucosal, immunoglobulin, division of the lymphocytes. It may also serve to undermine the immune system and lead to higher infections (Chandra and Kumari, 1994). Noticeable impact on life style patterns has happened due to accelerated change in population pattern along with changing economic scenario. India is burdened with rising incidences of both obesity as well as malnutrition. It may happen that obese and overweight children also be suffering from micronutrient deficiencies because of faulty dietary habits (www.pediatriconcall.com/pediatric-journal). The issue of malnutrition and micro-nutrient deficiency should be given urgent attention, since it is correlated to intellectual development of a child, labor productivity and ultimately the economic growth of the entire nation (World Bank, 2009).

Nutritive value & health benefits of millet in bakery product

Health & wellness concern is acting as a driving force in bakery industry similar to other food industries, with companies working on developing healthier product choices. Manufacturers are interested in development of bakery products with better ingredients. Enrichment of wheat flour with millet flour can be taken up as research to achieve a low cost and healthy product. Millets have been used for producing a number of traditional foods across India since age-old time. However, use of millets in human food is decreasing fast due to numerous reasons. To improve the nutritional value of diets, there is a need to resuscitate these health promoting foods (Palanisamy *et al.*, 2011). Rai *et al.*, 2011 prepared cookies by a combining millet flours, concluded that cookies with pearl millet and sorghum flour combination had higher fat, protein, ash and calorific values as compared to control cookies. The overall acceptability scores were found the highest for cookies manufactured from a combination of millet flour with others. When compared to control cookies, these cookies had improved nutritive value.

Enrichment of non-wheat flour to wheat flour for making cookie involves technological difficulties and impairment of baking quality. Therefore, studies can be planned to enrich wheat flour with millet flour and see the possible impact of such flour on the baking, nutritional properties and physico-chemical properties of cookies. India has a conventional food culture; still cookies are popular because of their excellent shelf-life, simplicity and ease of use and transport, and comparatively lower prices for the many customers. Cookies are essential components of one's diet due to their acceptance, and their availability in Indian markets. The cookies are one of the strongest matrices for holding nutrients to satisfy the needs of typical consumers' dietary demands.

Market trends towards their consumption and utilization has reduced so it is important to incorporate such crops into regular modern human diet. Utilization of non conventional millet flour through cookie is an important step and utilization of these in bread has been introduced in the production in market in the form of multigrain bread. In the past there have been efforts for the enrichment of cookies by soyabean, pigeon pea flour, pea flour, acha, using oats, rye (Ranhotra and Gelroth, 1986; Damaris, 2007; Jeeyup, 2010; Ayo *et al.*, 2010, Kamaljit *et al.*, 2010). As cookies are liked by all age groups of people from children, adults, pregnant women, lactating mother, heart patient, elderly people so biscuits can be selected as an ideal product for enrichment for improving the nutritional quality for the target group. On the basis of these needs we can develop products and dissemination can be done by government and non-government agencies to the target population.

Challenges and future perspectives

With the increasing demand of value-added products day by day, there will be a very great challenge in front of industries and researchers to fulfill the requirements of health-conscious customers. In recent years, biscuit segment has experienced strong growth. Companies are trying to maximize the share of value-added items while concentrating on day-to-day operating efficiencies. For cakes, the challenge will be to raise cakes consumption. This challenge also represents a valuable opportunity for this unique section. The bakery industry faces big problems in the quality of flour and supply chain. Bakery producers have to struggle with the consistency of flour and other ingredients. In this sector, as the purchasing power has risen among the population, the opportunities are massive.

References

- Agarwal SR (1990). Prospects for small scale biscuit industry in the nineties. *Indian Food Ind.*, **9(3)**: 19-21.
- Ayo JA, Ikuomola DS, Esan YO, Onuoha OG, Ayo VA and Ekele V (2010). Effect of added defatted beniseed on the quality of acha based biscuits. *Continental J. Food Science and Technology*, **4**: 7-13.
- Chandra RK and Kumari S (1994). Nutrition and immunity: an overview. *J. Nutr.*, **124**: 1433S-1435S.
- Damaris Achieng Odeny (2007). The potential of pigeonpea (*Cajanus cajan* (L.) Millsp.) in Africa. *Natural Resources Forum*, **31**: 297-305.
- de la Barca AMC, Rojas-Martínez ME, Islas-Rubio AR *et al* (2010). Gluten-Free Breads and Cookies of Raw and Popped Amaranth Flours with Attractive Technological and Nutritional Qualities. *Plant Foods Hum Nutr.*, **65**: 241-246.
- https://www.who.int/whr/2004/en/report04_en.pdf?ua=1
- Jeeyup (Jay) Han, Jeenifer AM Janz and Mindy Gerlat (2010). Development of gluten free cracker snacks using pulse flours and fractions. *Food Research International*, **43**: 627-633.

- Kailasapathy K, Perera PAG and MacNeil JH (1985). Improved nutritional value in wheat bread by fortification with full-fat winged bean flour. *J Food Sci.*, **50**: 1693-1696.
- Kamaljit K, Baljeet S and Amarjeet K (2010). Preparation of bakery products by incorporating pea flour as a functional ingredient. *American Journal of Food Technology*, **5(2)**: 130-135.
- Marnett LF, Tenney RJ and Berry VD (1978). Methods for producing soy - fortified breads. *Cereal Sci. Today*, **18**: 38-43.
- NIN (2003). Nutritive value of Indian Foods, Ed Gopalan and Deosthale, National Institute of Nutrition, Hyderabad.
- Palanisamy Bruntha Devi, Rajendran Vijayabharathi, Sathyaseelan Sathyabama, Nagappa Gurusiddappa Malleshi and Venkatesan Brindha Priyadarisini (2011). Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: A Review. *J. Food Sci. Technol.*, Nov 2011.
- Rai S, Kaur A and Singh B (2014). Quality characteristics of gluten free cookies prepared from different flour combinations. *J Food Sci Technol.*, **51**: 785-789.
- Ranhotra GS and Gelroth JA (1986). Stability of Enrichment Vitamins in Bread and Cookies. *Cereal Chem.*, **63(5)**: 401-403.
- Schuppan D, Junker Y and Barisani D (2009). Celiac disease: from pathogenesis to novel therapies. *Gastroenterology*, **137**: 1912-1933.
- Serna-Saldivar SO, Lopez-Ahumada G, Ortega-Ramirez R and Abril-Dominguez R (1988). Effect of sodium stearoyl-2-lactylate on the rheological and baking properties of wheat bread with defatted soybean and sesame meal. *J. Food Sci.*, **53**: 212-214.
- Sheheta NA and Fryer BA (1970). Effect on protein quality of supplementing wheat flour with chickpea flour. *Cereal Chem.*, **47**: 663-670.
- Shukla FC and Shilpa M (2000). Bakery industry in India. Present quality control and future scenario-A Review. *Bev. Food World*, **27**: 11-15.
- Singh N, Harinder K, Sekhon KS and Kaur B (1991). Studies on the improvement of functional and baking properties of wheat-chickpea flour blends. *J. Food Process Preservation*, **15**: 391-402.
- Utkarsh Shah (2011). Impact Assessment of Nutritional Supplement Program in Urban Settings: A study of under nutrition in Slum Community of Mumbai. *Journal of Social and Development Sciences*, **1(1)**: 24-35.
- Vanisha S Nambiar, Dhaduk JJ, Neha Sareen, Tosha Shahu and Rujuta Desai (2011). Potential Functional Implications of Millet (*Pennisetum glaucum*) in Health and Disease. *Journal of Applied Pharmaceutical Science*, **1(10)**: 62-67.
- World Bank (2009). Undernourished Children: A Call for Reform and Action, India Malnutrition Report (retrieved from <http://web.worldbank.org> on 23rd January, 2011).