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Composite flours: A breakthrough in bakery industry

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Abstract
Changing pace in population growth vis-à-vis demand in food, living and dwelling styles of people as well as development and advancement in the field of science and technology has introduced a crave towards nutritious food. Also with the increased income and enhanced buying capacity of individual and families, people have shifted towards processed and baked foods which are healthier and acceptable and ready-to consume. Due to the varied Agro-climatic regions various types of food grow in different parts of the world. These food material including, both cereal, grain, legumes as well as fruits, vegetables form an essential part of the diets of the people of that region. As no food is complete in itself, thus scientists and food technologists have always suggested various alternatives to improve their diets. Use of mixed flours for one type of preparation or other is always been a part of human diet especially in India. However, scientifically the basic concept of composite technology was initiated by FAO (1964) aimed to encourage the incorporation of indigenous crops such as yam, maize and others in partial substitution of wheat flour which reduces or even eliminates the import of wheat that in turn helps to feed more mouths. Composite flours show a good potential for use as a functional agent in bakery products. Utilization of such flours not only improves the nutritional status but also helps those suffering from degenerative diseases associated with today's modern life style.

Keywords: composite flours, blending, bakery products, acceptability

Introduction
Eating habits of population has changed tremendously with people being more aware of their health and well being. Changing pace in population growth vis-à-vis demand in food, living and dwelling styles of people as well as development and advancement in the field of science and technology. Also with the increased income and enhanced buying capacity of individual and families, people have shifted towards processed and baked foods which are more healthier and acceptable. Thus the research and development towards the utilization of composite flours has been on rise in the last couple of decades, which is associated with a desire to find out a non-wheat bread making alternative (Mepba *et al.*, 2007) [16]. Quality of the final product determines the acceptability of incorporation of non-wheat flour ingredient.

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Advantages of composite flours
Incorporation of other cereal/ pulse flour or any fruit or vegetable product in base flour i.e., wheat has received many appreciations in respect of quality, acceptability and economically from the more health conscious generations. Food and Agriculture Organization in 1964 initiated the concept of composite technology with the aim of reducing the cost. The basic concept of the organization was to encourage the incorporation of indigenous crops such as yam, maize and others in partial substitution of wheat flour (Satin, 1988) [26] which will reduce or even eliminate the import of wheat that in turn will feed more mouths. Blending traditional wheat flour with other cereal flours which is inexpensive supports the baker economically as well as it becomes nutritionally rich also because wheat is nutritionally deficient in essential amino acids viz., lysine and threonine and pulse flours are good source of these amino acids (Dhingra and Jood, 2001) [2].

Noorfarahzilah *et al.* (2014) [20] suggested the use of composite flour as advantageous to the developing countries, if they have adequate technology and a lot of raw botanical sources. Also the development of these blends could lead to improved utilization of indigenous food crops. Use of composite flours in daily diet will not only improve the nutritional status of the general population but also helps those suffering from degenerative diseases, especially those associated with changing life styles and environment.

Incorporation of legume flours
Cereal and pulses have always been dominant in the diets of common people. Many of the cereal and pulses have been incorporated with wheat flour to make a number of bakery products as well as traditional Indian breads. These include corn, soybean, fababean, buckwheat, rice, barley, chickpea etc. Legume or pulse proteins have been successfully used in

the preparation of baked products which as a result is rich in protein and has an improved amino acid balance (Bojnansk *et al.*, 2012; Mohammed *et al.*, 2012) [1, 8]. Legume flours are rich in lysine whereas regular wheat flours are deficient in same, also legume flours completely lack sulphur containing amino acids whereas wheat flour is rich in the same (Eggum and Beame, 1983) [7]. Many researchers have reported the use of legumes as protein enriching agents in a variety of baked products, some of which include preparations from soybean and wheat flour (Ribotta *et al.*, 2005) [24], chick pea and wheat flour (Gomez *et al.*, 2008), germinated pea flour and wheat flour (Sadowska *et al.*, 2003) [25], use of lupin flours (Doxastakis *et al.*, 2002; Pollard *et al.*, 2002) [6, 23].

Use of soy flour as an ingredient in composite flour has been very popular especially in the preparation of bread (Dhingra and Jood, 2002; Basman and koksel, 2003) [3]. Incorporation or supplementation of reular wheat flour with up to 30 per cent soy flour has been found to improve the nutritional quality of baked products with in acceptable limits. The increase in the protein content of the bread could be due to the presence of significant quantity of nutritional protein in soy beans (Basman and Koksel., 2003).

Incorporation of treated legume flours

With the aim to improve the quality and acceptability of end product many of the legumes have been treated before being converted into flour and then incorporating legume flour in regular wheat flour for product preparation. These include heating, roasting, germination etc. Waagepeterson *et al.*, 2001, explained that protein and gluten composition has great impact on the preparation of dough viz., water absorption and mixing stability, CO_2 retention capability and bread volume. Also addition of germinated soy flour to wheat flour improves the overall bread quality and resulted a higher specific volume of bread (Dominguez *et al.*, 2008) [5]. Soy protein products are also known for their improved crust colour, crumb body, resilience and toasting characteristics in bread (Nilufer *et al.*, 2008) [19] while also extending its shelf life (Vittadini and Vodovotz, 2003) [30].

In addition, flours from other legumes like lentil, pea and chickpea are an important source of proteins, carbohydrates, vitamins and minerals and are widely consumed in some traditional diets (Dodok *et al.*, 1993) [4]. Since protein has a major role in determining the quality of bread, supplementation of wheat flour with other legume flours certainly affects the rheological properties of fortified wheat flour and its products (Eliason, 1990). Addition of legume flours, especially lentils and chickpea has improved crumb acidity thus making the bread tastier and richer (Bojananska *et al.*, 2012) and this improvement in quality was related to richness of minerals in these legumes and their flours. Also, heat treatment applied to legumes improved their texture, palatability and nutritive value by way of gelatinization of starch, denaturation of protein increased nutrient availability and inactivation of heat labile toxic compounds and other enzyme inhibitors. Goni and Valentin – Gamazo, 2003 also reported that use of pulse flours in bread making increased mineral bioavailability and a lowering glycaemic response in healthy consumers.

Gluten

Gluten plays a key role in quality characteristics of bakery products. It influences its water absorption, cohesion, viscosity, extensibility, elasticity, resistance to deformation, tolerance to kneading, ability to gas retention and dough strengthening properties (Lazaridou *et al.*, 2007) [14]. Vital wheat gluten, a by-product of wheat starch extraction process has been found to improve the bread making properties of weak flours (Stenvert *et al.*, 1981; Wiepert and Lindhauer, 1999) which includes improving loaf volume, crumb grain, texture, softness as well as shelf life.

The flours which are substituted with modified starches, the basic starch content should not exceed 20 per cent and the amount of vital gluten should be 8 per cent of the weight of the starch substitutes (Miyazaki *et al.*, 2006) [17].

Rice Flour

Addition of rice flours has also been reported to improve the bread quality and consumer acceptability with increased nutritional value. Velluppillai *et al.* (2010) incorporated upto 35 per cent of malted rice flour in regular wheat flour and reported that malted rice flour incorporated functional benefits viz., increased gas production in the dough, improved crust colour, better crumb moisture retention and enhanced flavor development. However addition of regular untreated rice flours has its own disadvantages in the development of breads as rice flours are unable to retain gas that is produced during fermentation of dough which results in a product that is low in specific volume and does not at all resembles traditional wheat flour based bread (Gujral and Rosell. 2004) [12].

Maize Flour

Maize is a rich source of many vitamins and minerals including potassium, phosphorous, zinc, calcium, iron, thiamine, vitamin-B6 and folate (Watson, 1997) [33]. Addition of regular untreated maize flour upto 40 per cent and defatted maize germ flour up to 15 per cent produced bread without any negative effects on its quality attributes (Paucean and Man, 2013) [22].

Fruit and Vegetable flours

Taste and acceptability of new products have become secondary priorities to the consumers, who are more health conscious and vigilant. Also, availability of nutritive raw minerals has also attracted the attention of researchers and nutritionists towards its better utilization and incorporation in a food product which is a part of regular diet. In this direction, many nutritionists and food scientists have tried incorporating cocoyam, cassava, taro, mango, apple, pomace, kernel powder, potato flours etc. in bread and similar baked products. However, these flours were suitable upto a few per cent of replacement but substituting a higher amount reduces the quality of final product. This has been attributed to reduced flour strength and gas retention capacity due to reduced gluten content which corresponds to reduced bread volume and less sensory appeal (Giami *et al.*, 2004; Khalil *et al.*, 2000). However, certain pre-treatments may help to improve the quality and acceptability of food product.

Addition of pre-treated cassava root flours with citric acid gave desired quality characteristics in bread (Owuamanam,

2007) [21]. Further incorporation of cassava roots upto 30 per cent in wheat flour was suggested suitable in bread flour. According to Wang *et al.* (2010) [33] higher total fibers in non-wheat flour interacts relatively well with large amount of water through hydroxyl group existing in fiber structure. Therefore, addition of pumpkin and canola protein in regular wheat flour resulted in an increase in water absorption (Mansour *et al*., 1999) [15].

Similarly addition of 5 per cent pumpkin flour added to regular wheat flour for bread preparation improved the loaf volume and had a good overall acceptability (See *et al.*, 2007) [27]. Sharma (2000) incorporated apple pomace in powdered form to the bakery products and reported an acceptable incorporation upto 15 per cent in bread and biscuits. Even the regular household bread (*chapatti*) gave desirable results when compared. Treatment of apple pomace with KMS to control browning, improved the results for acceptability in bread and biscuits.

Conclusion

Composite flours show a good potential for use as a functional agent in bakery products. Utilization of such flours not only improves the nutritional status but also helps those suffering from degenerative diseases associated with today's modern life style. Still there is a need to find out the optimum levels of incorporation, functionality of ingredients and other related characteristics for better economic and nutritional benefits.

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