ABSTRACT:

The impact of the dietary fiber on the maintenance of human health has attracted considerable scientific interest in the past three decades. Potential health benefits of dietary fiber include: reduced bowel transit time, prevention of constipation, reduction in risk of colorectal cancer, and the production of short chain fatty acids. Additionally, some foods high in dietary fiber may result in low glycemic indexes. The source of fiber used for fortification includes wheat bran, rice bran, coconut fiber, hazelnut, mulberry lees and many more. Bakery products like bread, cookies, biscuits, muffins etc offer an opportunity for fiber fortification. This has increased interest to add dietary fiber into food products. Baked food products are considered as excellent vehicle for fortification, value addition and feeding at mess scale. Because of this advantage, they are used as potential carriers of dietary fiber. Also, the consumer’s interest in high fiber-low calorie bakery products expanded scope for quality bakery products. The implication of dietary fiber in prevention of number of diseases has lead to the production of fiber fortified bakery products.

Keywords: Bakery products, dietary fiber, dough handling, texture, sensory properties

INTRODUCTION

Wheat (Triticum aestivum) is the world’s most important cereal crop in terms of production and consumption (Shewry & Tatham, 1994). It belongs to the family Gramineae and comprises of about 500 species and represents second most important cereal crop in the world (Dobraszczyk, 2005). It is major source of energy, protein, and dietary fiber in human nutrition. Among the three main parts: endosperm, germ and bran of the wheat grain, the majority of the health beneficial components are present in bran and germ (Lieu, 2007). Milling and baking are the most common techniques used in wheat grain processing for human food. In the milling process, the wheat grains may be fractionated into different types of flour. If the extraction rate is closed to 100% whole meal flour is obtained. With decreasing extraction rates in milling, more and more of the outer grain layers are removed, accompanied by loses in dietary fiber and associated bioactive compounds and the flour obtained is known as refined flour (Hegedus et al., 1985, Nilsson et al., 1997, Glits et al., 1999). Wheat is the most important crop for bakery production due to its supreme baking performance compared to other cereals (Dewettnick et al., 2008).

Bakery products are increasingly becoming popular due to their ready to eat convenience; cost competitiveness, availability of various products with different taste and textural profiles, advantages in nutrition and adequate shelf-life (Rao, 2004). The white flour and refined flour which is used for the production of Bakery items like cookies, biscuits, cakes, etc is deficient in several nutrients including some vitamins, mineral elements and especially dietary fiber (Awan et al., 1991). Dietary Fiber (FD), the edible part of plants or is resistant to digestion and absorption in the Human small intestines with complete or partial fermentation
in large intestines (Lee and Lin, 2008). DF can be categorized into insoluble DF (IDF) (cellulose, hemicelluloses, amyloids, lignin etc) and soluble DF (SDF) (beta-gglucan, gums etc). Total DF is the sum of IDF and SDF, (Stauffer, 1999). Sources of fiber can be neutral and unprocessed (e.g., bran), isolated (e.g., cellulose and various germs ), modified (e.g., carboxymethyl cellulose), or non-plant (e.g., Xylans and polydextrose (Gordon, 1989).

Whole wheat flour and wheat bran are two of the most important sources of DF. Wheat bran is rich in insoluble fiber and to some extent water soluble fiber as well. It comprises crude fiber (10%), pentosans (26.5%), cellulose (21.4%), starch (7.51%), total sugar (5.05%), sucrose (2.98%), and reducing sugars (4.42%), (Pomeranz, 1988). The effect of DF on promoting health and preventing diseases has been an issue of interest for many years and has become a subject of renewed research (Shahidi, 2000). Consumption of whole grain foods has been shown in epidemiological studies to reduce the risk of many chronic diseases, such as diabetes, cardiovascular diseases and certain cancers (Jacobs et al., 1998; Liu et al., 2000).

An adequate intake for dietary fiber is considered to be about 14 g/1000 kcal per day for adults (Wheeler & Pi-Sunyer, 2008). A diet rich in dietary fiber has been associated with prevention of constipation, diverticulosis, diseases, and cancer. Potential health benefits of dietary fiber have been well documented in relation to the bowel transit time (Feldheim and Wisker, 2000), prevention of constipation, and include reduction in risk of colorectal cancer (Bingham et al., 2003) and cardiovascular diseases (Bazzano et al., 2003), production of short-chain fatty acids (Wisker et al., 2000), promotion of colonic health, and stimulation of growth of beneficial gut micro-flora. Various sources of dietary fiber are often added to foods to lower the incidence of these disorders and to dilute calories.

Fewer calories, more fiber, less salt and fewer additives are the consumer demands for healthier diet (Meuser et al., 1994). Bakery products are considered good targets for fiber enrichment, as the decline of fiber consumption is partially due to refining of the flours. As baked food products are well liked by consumers all over the world and because of their high consumption, they can potentially be used as carriers of bioactive compounds and dietary fiber. Several studies have been carried out showing the potential enrichment of wheat-based cereal products with dietary fiber (Wang et al., 1989) hence the fibers are modified using enzymatic or physical treatments (Gould et al., 1989). The incorporation of such modified dietary fibers into baked products, such as cakes and cookies, has improved their texture, sensory properties and shelf life (Mark et al., 1988). The dietary fiber are of many forms like wheat bran, oat bran, rice bran, corn bran, whole grain rye, apple fiber, sugar beet fiber, carob fiber, psyllium husk fiber, flaxseed, soy hull, peanut hull, field pea hull and sunflower hull (Anil, 2002).

REVIEW OF LITERATURE:

Epidemiological studies have shown that diet high in fiber generally reflects a healthier life style (Kritchevsky, 2000). The diets high in fiber such as cereals, fruits and vegetables have positive effect on health since its consumption is related to a decreased incidence (Lambo et al., 2005). Both soluble and in-soluble dietary fibers are associated with several health benefits. Soluble fibers are known to be effective in reducing total blood cholesterol and promoting satiety and insoluble fibers help in treating constipation and reduce the risk of colon cancer and diverticular diseases (Lue et al., 1991). Total nutrition societies consider dietary fiber to be an essential part of a balanced diet for diseases prevention. The health
benefits associated with the consumption of dietary fiber result from combination of psychological changes. The psychological effects of dietary fiber fall into four categories:

1. Increasing faecal bulk and decreasing transit time
2. Binding bile acids
3. Degrading to short-chain fatty acids in large-intestines, and
4. Increasing viscosity and slowing digestion and absorption (Hughes, 1991)

Though declining, coronary health diseases (CHD) continues to be leading cause of death in United States. The metabolic effects of fiber can be attributed solely to soluble fiber and acts by several mechanisms, including interferences with micelle formation, interference with enzyme substrate interaction and thickening of unstirred water layer (Jenkins et al., 2000). In soluble fiber may assist in reducing cholesterol by reducing transit time and total time available for absorption. Because soluble dietary fiber is well hydrated, it can make the intestinal contents more viscous thereby rate of absorption. Factors involved include resistance to bulk diffusion due to increased viscosity of luminal contents and increased resistance of the unstirred water layer that lines the absorptive surface of enterocytes. Because the distal ileum is the absorptive site for bile acids, increasing viscosity as water is progressively removed from the luminal contents will hamper bile acid absorption and it forces the body to draw upon its cholesterol stores to synthesize more bile acids (Salvado et al., 2006). This effect together with physical binding of bile acids to the fiber causes increased faecal bile acid loss and is the principal mechanism by which fiber may reduce serum cholesterol.

Dietary fiber has ability to moderate after-meal rises in blood glucose and reduce insulin secretion and is thus beneficial for treating diabetics (Khan and Safdar, 2003). A long term study (Salmeron et al., 1997) of almost 90,000 women and in a similar study of about 45,000 men showed that subjects with higher intake of cereal fiber-based foods had about a 30% lower risk for developing non-insulin dependent diabetes mellitus compared to those with lower intake. Both soluble and insoluble dietary fiber contribute to improved glucose tolerance (Wolever, 1990). Soluble dietary fiber shows the release of glucose into the blood by increasing the viscosity of intestinal contents. Soluble dietary fiber also acts by adsorption to enzymes and substrates, which shows the rate of enzymatic digestion and by thickening the unstirred water layer, which shows the passage of glucose from the intestine into intestinal cells (Anderson, 1985). Insoluble dietary fiber shows carbohydrate digestion by interfering with enzyme access to carbohydrate substrates.

Colon Cancer is most common cancer related death in the U.S. after lung cancer. Colon cancer is positively correlated with high fat and high protein diets, but negatively correlated with high complex carbohydrate and high dietary fiber intake (NRC, 1989). Dietary fiber appears to play a contributing role in reducing colon cancer risk. The mechanism proposed for beneficial involvement of dietary fiber in colon cancer prevention include increasing faecal bulk and thereby decreasing the concentration of carcinogens, co-carcinogens, and promoters and decreasing transit time to minimize exposure of intestinal cells to those compounds (Reddy, 1987). Bile acids are potential carcinogens, and the binding and inactivating of bile acids by dietary fiber is also hypothesized to reduce colon cancer risk (Hill, 1991).

Insoluble dietary fiber plays an important role in promoting normal bowel movement by acting like a sponge in the distal colon, therefore increasing stool bulk. Though such action stool movement through the colon is promoted, thus reducing transit time.
consumption of dietary fiber will help increase water content and plasticity of stools, thus promoting regularity. Since the stool holds more water as a result of fiber intake, it is important to increase fluid consumption to a recommended 2 Liter per day in order to further the action of fiber on stool movement (James et al., 2003). A diet low in fiber is a cause of diverticulosis of the sigmoid colon (Mimura et al., 2002). The mechanism for the development of diverticulosis is that the normal propulsion of faecal contents is made more difficult due to greater water absorption due to slower gut transit. Thus, smaller, firmer stools are produced, leading to high intraluminal pressure (Mimura et al., 2002) which in turn, result in excessive segmentation and production of diverticula (Kay, 1982).

**Results and Discussion:**

The objective of this study was to investigate the influence of selected types of fibre on the processing parameters of dough prepared from wheat fine flour of medium quality and to evaluate the quality of bakery products. Coconut Flour, Wheat flour, wheat bran, rice bran, oat bran, Barley bran, Hazelnut Testa, Oat flour, Cellulose Pea, Cocoa, coffee, orange, and wheat fiber were purchased from local market. The proximate composition of the flour samples is given in Table 1. Moisture and ash content were determined following the ICC methods No 110/1 and 104/1, respectively (ICC, 1996). Kjeldahl method was used to characterize the protein content. Fat and starch were given by Weibull-Stoldt and Ewers methods, respectively.

<table>
<thead>
<tr>
<th>Fiber Type</th>
<th>Level of Substitution</th>
<th>Water absorpt ion</th>
<th>Arrival Time (min)</th>
<th>Dough Dev. Time (min)</th>
<th>Dough stability (min)</th>
<th>Mixing Tolerance Index (BU)</th>
<th>Degree Of softening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut Flour</td>
<td>0%</td>
<td>61.0%</td>
<td>4</td>
<td>5</td>
<td>5.5</td>
<td>18</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>61.0%</td>
<td>5</td>
<td>6.0</td>
<td>6.0</td>
<td>19</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>60.5%</td>
<td>5</td>
<td>6.5</td>
<td>&gt;10</td>
<td>19</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>58.0%</td>
<td>&gt;10</td>
<td>&gt;10</td>
<td>ND</td>
<td>ND</td>
<td>-</td>
</tr>
<tr>
<td>Wheat Bran (Raw, Roasted, steamed and roasted and microwave treated bran)</td>
<td>0%</td>
<td>62.7</td>
<td>-</td>
<td>6.5</td>
<td>6.0</td>
<td>73</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>30%RB</td>
<td>69.0</td>
<td>-</td>
<td>3.7</td>
<td>3.1</td>
<td>53</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>30%RSB</td>
<td>69.2</td>
<td>-</td>
<td>3.2</td>
<td>3.3</td>
<td>52</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>30%STRB</td>
<td>67.3</td>
<td>-</td>
<td>2.5</td>
<td>2.7</td>
<td>52</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>30%MTB</td>
<td>67.9</td>
<td>2.2</td>
<td>2.9</td>
<td>2.9</td>
<td>53</td>
<td>-</td>
</tr>
<tr>
<td>Fiber Type</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>Control (5% fine dry)</td>
<td>Control (5% hydrated)</td>
<td>Control (5% coarse, dry)</td>
</tr>
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<td>--------------------------</td>
</tr>
<tr>
<td>Wheat Bran</td>
<td>63.5</td>
<td>66.0</td>
<td>68.0</td>
<td>70.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>61.0</td>
<td>61.5</td>
<td>62.0</td>
<td>63.0</td>
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<td>-</td>
<td>-</td>
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<td>Oat Bran</td>
<td>62.0</td>
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<td>63.0</td>
<td>64.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Barley Bran</td>
<td>63.3</td>
<td>67.5</td>
<td>72.5</td>
<td>76.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hazelnut Testa</td>
<td>63.60</td>
<td>65.55</td>
<td>66.01</td>
<td>65.50</td>
<td>65.84</td>
<td>68.30</td>
<td>68.76</td>
</tr>
</tbody>
</table>

Table 1: Farinographic Properties of Wheat dough blended with fiber

Water absorption of flour and the other farinograph parameters (Arrival time, Dough, Dough stability, Mixing Tolerance and degree of softening) were determined when examining all the mixtures of flours and additions of fiber experimentally according to CSN ISO 5530-1:1995. The volume of water was modified so that the maximal consistency of dough could be 74 BU.
FUTURE PERSPECTIVES

Bread contains a plenty of important nutritional components which exert a positive influence on the human health. Nevertheless, the consumption of bread has been decreasing over the last decades, which is mostly caused by factors such as change of eating habits and larger choice of replacements like breakfast cereals and fast food. Therefore, the addition of fiber into bread and wheat products is still more important. The products with wheat fiber, in comparison with conventional products with wheat bran, contain mainly cellulose and hemicelluloses, little lignin, but they do not contain any identified gluten or phytic acid (Soukoulis et al. 2009; Chen et al. 2011), pesticide or residues of heavy metals. The advantage is also a possibility of shortening the length of fibers to 20 µm thanks to the special grinding process. The fibers stay suspended in the substance for a longer time and can be repeatedly stirred very well in the case of sedimentation (Bodner & Sieg 2009). Apple fiber does not contain either gluten or phytic acid. It has a relatively high content of soluble dietary fiber with thickening attributes (Bilgiçli et al. 2007). Dietary fibre is widely recognized to have a beneficial role in overall health, but only at adequate levels and therefore new technologies and new products with its higher content are developed.

SUMMARY AND CONCLUSION

Dietary fiber is well recognized as one of the important dietary substances needed for good health. Today the yummy group of fat, starch and sugar are suspect where as a fiber rich diet is promoted with gusto. The importance of dietary fiber has lead to the development of large and potential market for fiber rich products and ingredients. Bakery products have the great scope as carriers of dietary fiber as they are very popular and consumed by people of all age groups. The production of bakery products with high content of fiber is an important objective through a healthy nourishing process. The adequate consumption of dietary fiber leads to improvements in gastrointestinal health, and reduction in susceptibility to disease such as diverticular diseases, health diseases, cancer and diabetes. Increased consumption of dietary fiber has also been associated with increased satiety and weight loss. In addition to the health benefits of dietary fiber, it is also important constituents due to its functional properties. It is used in formation of foods, resulting in texture modification and enhancement of food stability during production and storage. Flours from different raw materials were tested in order to investigate their ability to mimic wheat flour dough behaviour. Among tested alternative cereals (rice, corn), Wheat Bran (Raw, Roasted, steamed and roasted and microwave treated bran, rice Cellulose Pea, Cocoa, coffee, orange, and wheat fiber and wheat flours expressed the most similar protein (water absorptions, stabilities and degrees of softening) characteristics as wheat flour. Since profile of wheat flour was located between rice and Barley Bran profiles, it can be concluded that blends of rice and buckwheat flours would give the optimal rheological profile.

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