

Review On: Progress In Wheat Bread Improvement: Emphasis on Ingredient Functionality

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Received date: April 07, 2021; Accepted date: April 19, 2021; Published date: April 30, 2021

Citation: Gashaw Abebaw, Solomon Duguma, (2021). Review On: Progress in Wheat Bread Improvement: Emphasis on Ingredient Functionality. J. Nutrition and Food Processing, 4(3); DOI: 10.31579/2637-8914/048

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Abstract

Bread is one of the oldest functional foods which its health effects have been investigated in many studies. The current communication presents a review of the in recent years on the topic and looks at possible future trends in the improved nutritional and health qualities which have been applied in the bakery industry, directing it further to the formulation design and production of functional pieces of bread. The results show that many beneficial ingredients such as dietary fibers, phenolic antioxidants, marine ingredients, and n-3 fatty acids can be used in the bread industry to increase its functionality and result in healthy products, low in calories, cholesterol, and celiac disease. Moreover, the use of psyllium seed, amaranth seed, chestnut flour, and prebiotics in gluten-free bread (GFB) baking may be the promising frontier to improve the overall appearance, quality, sensory properties, and shelf-life of gluten-free bread. To improve the quality of life of these patients from a dietary standpoint, food-processing researchers have been seeking to develop high-quality gluten-free bread. As the quality of wheat pieces of bread depends largely on the viscoelastic properties of gluten, various ingredients have been employed to simulate its effects, such as hydrocolloids, transglutaminase, and proteases.

Keywords: functional bread; nutritional fibers; antioxidants; gluten-free bread; dietary fibers; phenolic antioxidants; marine ingredients; n-3 fatty acids; wheat; starch gelatinization; egg protein coagulation; marine foods

Introduction

Functional foods can be used not only to solve consumer starvation and provide health needs by having the necessary nutrients but also can prevent nutrient shortages related to diseases [1]. Meanwhile, functional bakery products are becoming increasingly popular and are normally consumed with adjuncts in households, industrial canteens, restaurants, etc. Dietary fibers as a group of compounds contain a mixture of oligosaccharides and polysaccharides such as resistant gums, inulin, and hemicelluloses which may be associated with lignin and other non-carbohydrate components. The functionality increases of pieces of bread by replacing dietary fiber with a percentage of flour can lead to the breaking of a gluten-starch matrix, limiting the gas cells and the increase of dough plasticity [2]. Recent studies on the production of mixtures of flour-hydrated fiber have shown that they could be a suitable viscoelastic profile for formulated bread doughs and final bread could have acceptable sensory properties and favorable shelf life [3]. Addition of natural antioxidants to bread Phenolic components are found frequently in food products such as fruits, vegetables, and grains. Natural antioxidants are phenolic compounds that have different biological activities including anti-allergic, anti-viral, anti-inflammatory, anti-mutation, and anti-cancer properties. The functionality of their main ingredients (wheat flour, sugar, egg, and fat or oil) differs between cake types. The processes during cake making are not fully understood. During baking, the cake structure sets as a result of starch gelatinization and egg protein coagulation. Whether egg

white and egg yolk proteins on the one hand and the same proteins and wheat gluten proteins on the other form (a) mixed protein network(s) is unclear. Sugar controls oven rise, structure fixation, and collapse. Fat enhances aeration for leavening and improves tenderness and mouthfeel. We here discuss the basics of ingredient functionality during batter-type cake making. The supplementation with a combination of ingredients from different sources has been applied in research to enhance nutritive value and health-promoting components of cereal-based foods. For example, replacement of 22.5 up to 45% of wheat flour by teff, green pea, and buckwheat flours blend provided multigrain bread with superior nutritional composition, higher amounts of total bioaccessible phenolics, higher radical scavenging activity, and higher dietary fiber content. In another study, 20% of wheat flour was replaced by a blend of oat bran concentrate, whole oat flour, and finely ground chia seeds in the preparation of cookies.

Functional and nutritional values of these products can be improved by alternative dietary fibers and protein sources of cereals, tubers, corn gluten, corn germ, and rice bran. The functionality increases of loaves of bread by replacing dietary fiber with a percentage of flour can lead to the breaking of a gluten-starch matrix, limiting the gas cells and the increase of dough plasticity. Recent studies on the production of mixtures of flour-hydrated fiber have shown that they could be a suitable viscoelastic profile for formulated bread doughs and final bread could have acceptable sensory properties and favorable shelf life.

1.1. Dietary fibers to produce functional bread

Dietary fibers as a group of compounds contain a mixture of oligosaccharides and polysaccharides such as resistant gums, inulin, and hemicelluloses which may be associated with lignin and other non-carbohydrate components [4]. Shows some of the various sources of dietary fibers for the production of functional pieces of bread with their practical applications. Increase of water and oil holding capacities, modification of textural properties, reduction of syneresis (separation of liquid from a gel caused by contraction), prevention of lipid oxidation, emulsification and/or gel formation, stabilization of high-fat food and emulsions, slowing down the retrogradation of starch, and improving shelf-life are some functional properties of dietary fibers,

1.2. Addition of green tea extract to bread

Tea and its products contain polyphenols, mainly catechins which are considered natural antioxidants. In recent years, the health effects of tea especially green tea have attracted much attention. Green tea contains several biologically active compounds including epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG) [5].

1.3. Rye bread and improvement of intestine function

Rye is often consumed as a whole grain product and is a good source of dietary fiber, vitamins, minerals, and different biologically active compounds.

✓ Gluten-free bread

Celiac disease is a genetic disease that sick persons who have a long intolerance to wheat gliadin components; rye prolamins, barley hordein, and oat avenin, and nearly 1 % of the world's population are involved [6].

1.4. Marine foods as novel healthy food ingredients in bread

Marine foods are excellent sources of many healthy food ingredients and biological components as fish oils, bioactive peptides, and microalgae. These foods contain omega-3 fatty acids, chitin and chitosan, algal ingredients, antioxidants, minerals, and vitamins like calcium, carotenoids, and bioactive compounds. Bread is an excellent product in which the incorporation of marine functional ingredients especially omega-3 fatty acids is attempted [7].

1.5. Effect of flaxseed and quinoa flours on bread functionality

Flaxseed (*Linum usitatissimum L.*) or linseed is a dark brown seed that is used in the food industry as a supplement in bread preparation or/and other bakery products. This seed is a healthy ingredient with appropriate levels of polyunsaturated fatty acids (PUFAs). PUFA has an important role in the prevention and regulation of cardiovascular diseases and cancer types. Quinoa is a pseudo-cereal with high-quality protein and without gluten. This cereal is used as an alternative ingredient in oil production due to high levels of fatty acid and having good oxidative stability [8]. It is currently used as a substitute for wheat flour in gluten-free bread.

1.6. Marine foods as novel healthy food ingredients in bread

Marine foods are excellent sources of many healthy food ingredients and biological components as fish oils, bioactive peptides, and microalgae. These foods contain omega-3 fatty acids, chitin and chitosan, algal ingredients, antioxidants, minerals, and vitamins like calcium, carotenoids, and bioactive compounds. Bread is an excellent product in which the incorporation of marine functional ingredients especially omega-3 fatty acids is attempted [9].

1.7. Production of gluten-free bread with psyllium

Psyllium (*Plantago ovata* Forsk) seed shell contains functional hydrocolloids which is a rich source of natural soluble fibers, almost eight times higher than soluble fiber found in oat bran. Also, psyllium hydrocolloid as an emulsifier or thickener has considerable benefits including reduction of cholesterol, reduced risk of cardiovascular diseases and diabetes, laxative properties, treating colds, coughs, and other respiratory problems [10]. The shell of psyllium seed can be a valuable source of minerals to balance other minerals in foods.

1.8. Soybeans flours

Soybean flour is more commonly used in bakery products because of its functional properties. It has high protein (38–40 %), fat (18–20 %), and lysine (5–6 %) contents, which have great potentials in overcoming protein-calorie malnutrition. Found that soy flour (full fat and defatted) and barley flour could be added to bread flour up to levels of 10 and 15 %, respectively, separately and in combinations without any significant changes in organoleptic characteristics. Moreover, the pieces of bread containing barley and defatted soy flours (up to 15 % level) were considered as most acceptable, organoleptically and nutritionally as they contained an appreciable amount of protein, total lysine, dietary fiber, β -glucan, and minerals.

1.9. Effect of prebiotics on quality of gluten-free bread

Prebiotics are defined as non-digestible food ingredients that beneficially affect the host by stimulating the growth and/or activity of one or a limited number of bacteria such as probiotic bacteria in the colon, thus increasing host health.

Conclusion

In this review, different types of nutritional ingredients for the production of functional bread are investigated. The results showed that the addition of functional ingredients including fiber-rich compounds and phenolic antioxidants to slices of bread not only had physiological effects on the blood cholesterol levels and preventing cardiovascular diseases, cancers and inflammation, but also had a positive effect on the sensory properties of slices of bread. The functional compounds such as the shell of psyllium seeds and prebiotics are consumed in GFB and have a good effect on their quality, safety, and acceptability. Also, recent studies have shown that marine foods, flaxseeds, and quinoa seeds can

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DOI: [10.31579/2637-8914/048](https://doi.org/10.31579/2637-8914/048)

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