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Alternativas para mejorar la calidad nutrimental de panes libres de gluten.

Alternatives to improve the nutritional quality of gluten-free breads.

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Abstract:

The incidence in patients with celiac disease creates a high demand for gluten-free products, however these are of very poor quality, so the food industry proposes several alternatives to improve their nutritional value, one of them is the use of gluten-free tubers. that provide nutrients; for example the taro. We have also sought to replace or reduce fat with some types of fibers, flours and gums. The following investigation compiles these proposals to expand the panorama on the importance of solving this problem.

Keywords:

Gluten free, nutritional value, reduce, fat.

Resumen:

La incidencia en pacientes con enfermedad celíaca crea una alta demanda de productos libres de gluten sin embargo estos son de muy mala calidad por lo que la industria alimentaria propone varias alternativas para mejorar su valor nutrimental, una de ellas es el uso de tubérculos libres de gluten que aporten nutrientes; por ejemplo, la malanga. También se ha buscado remplazar o reducir la grasa por algunos tipos de fibras, harinas y gomas. La siguiente investigación recopila esas propuestas para ampliar el panorama sobre la importancia de resolver este problema.

Palabras Clave:

Libre de gluten, valor nutrimental, reducir, grasa.

Introduction

Gluten free products

Gluten-free (GF) products have several nutritional deficiencies, some of them are; low dietary fiber, minerals (calcium, magnesium and iron), vitamins (B12, D and folate) and protein, as well as excess saturated fat and a high glycemic index [7].

"Using fat in the production of bread is expensive, and from a diet point of view, it counts as a high-calorie food" [2]. Several studies report the relationship of excessive fat consumption in foods with diseases such as; obesity, diabetes, colon cancer among others, and cardiovascular problems.

The most important factor in reducing caloric value is the reduction in fat content, the most concentrated energy source in the diet, which provides 9 kcal / g compared to 4 kcal / g for protein and carbohydrates. Since excess fat in the diet is associated with obesity, some cancers, a high level of cholesterol in the blood, and an increased risk of cardiovascular disease, attempts have been made to produce foods with the organoleptic and functional of fats without the high caloric content. High fat levels can be efficiently reduced by using ingredients that simulate and / or accentuate the functions of fats. Such ingredients are called fat substitutes and serve some or all of the functions of fats, with or without nutritional value [4].

Alternatives

The food industry proposes to replace fat with dietary fiber. Dietary fiber-based fat substitutes sufficiently mimic the techno-functional properties of fat [26].

Several studies have been published on reducing the fat content of cakes and muffins by adding different carbohydrates and fibers, such as inulin, β-glucan, oat bran and flaxseed meal, cocoa fiber, polydextrose, maltodextrin, and citrus pectin [6].

In baked goods, fat replacements retain moisture to improve texture. Carbohydrate-based substances, such as starch, inulin, pectin, and modified cellulose, are of increasing interest as fat substitutes due to their health benefits such as dietary fibers [30].

Recently it has been suggested that the addition of fat to bread could be replaced by replacing part of the bakery flour with ground flour from waxy wheat [22]. Various attempts at fat replacement in cake products have been reported in the last decade 5. Modification of the starch with octenylsuccinic anhydride (OSA) results in the

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creation of amphiphilic starch molecules, which possess hydrophobic characteristics without modification. This means that the starch can adsorb to the interface of the water and oil and therefore stabilize the emulsion. OSA starches have increased swelling volume, the ability to prevent amylopectin retrogradation. These properties can be useful in various bakery applications, to alter the texture [2].

Fat substitutes

Inulin

Inulin forms opaque gels in high concentrations when mixed with water. The way it traps water results in lubricating and flow properties similar to that of greases. These unique properties are the reason why inulin has been identified as a promising ingredient for structuring in reduced-fat or reduced-fat foods [14].

The effects of inulin as a fat substitute on the texture and sensory properties of muffins demonstrate that a substitution of up to 50% of fat with inulin is possible [26]. Adding inulin to bread generally resulted in smaller breads with a harder crumb and darker color [21].

Evaluate the use of inulin as a fat substitute in corn bread. It was concluded that inulin could be used effectively and successfully as a substitute for 50% butter or fat, which will dramatically reduce calorie and fat content [12].

Chia

Chia contains high levels of protein and fiber. Due to its high fiber content, in the presence of water, it forms a gel that has emulsifying characteristics. Various studies have shown that this compound can be used as a substitute for fats in baked goods [10].

When the chia seed is immersed in water, a clear mucilaginous gel called chia mucilage (CM) is exuded. This gel is essentially composed of soluble fiber and corresponds to approximately 6% of chia seed. It can act as a fat substitute because it has the ability to hydrate, develop viscosity and maintain freshness, particularly in bakery products [9].

Flax seeds

Flaxseeds contain approximately 28% fiber, of which one third is soluble [8]. Soluble fiber is associated with the ability to lower cholesterol and regulate blood sugar levels. The rest of the dietary fiber is insoluble [33]. Insoluble fiber promotes increased stool volume and reduces intestinal transit time, thus helping to prevent constipation and may provide protection against colon cancer [6].

Oilseeds

Peanut, the world's third largest oilseed after soybeans and cotton, is grown primarily for human consumption, but has various uses as a whole seed or as a basic ingredient in the manufacture of peanut butter / butter, oil and others. Similar products the oil is easily digestible and the consumption of peanuts has been associated with the prevention of cardiovascular diseases and prevents the development of type II diabetes. Low-fat peanut meal can be implemented in bread development [1].

Most used flours

The most common cereal flours used for the production of gluten-free bread are rice, sorghum and corn. Flours from Andean crops and tubers such as potatoes and cassava have also been used. In general, breads formulated with gluten-free raw materials include a high incorporation of water; in the literature, the addition of water varies between 65% and 110% [29].

Products used to improve the dietary fiber (DF) and β-glucan content of foods traditionally come from cereals such as wheat, oats, and barley. Recently, edible mushrooms have been gradually used as sources of DF in world markets due to their nutritional qualities [23].

Food products that contain resistant starch (RS) have lower glycemic index (GI) values, this leads to a controlled food formulation in the release of glucose, benefiting those who are overweight and have diabetes. The amount of resistant starch (RS) in food is related to the type and amount of starch (crystal and granular structure, amylose: amylopectin ratio, amylose chain length and amylopectin linearization), together with the conditions of food processing, cooking and storage [31].

Rice

Rice is considered a suitable substitute for wheat, as it is available worldwide and is less allergenic. Therefore, various efforts have been made to produce gluten-free rice bread. The addition of gums such as hydroxypropyl methylcellulose (HPMC) produce a gluten-like macromolecular network, which improves the rheological properties of rice dough and increases the volume of bread [36].

Starch is an important component of sorghum grain, however, its digestibility seems to be lower than that of other cereals, such as corn; a characteristic attributed mainly to the interaction between sorghum starch and protein matrix [37].

It is important to note that there are regional products that meet these criteria and that could become an interesting alternative to stimulate their production and consumption, such as GF gluten-free cheese bread, which is made by mixing mainly cheese, sour cassava starch, flour corn, and milk or water. These are combined into a dough and formed into small portions, which are then baked. This GF product has a fluffy texture and low density, and increases its hardness rapidly, reducing its shelf life in terms of freshness [18].

The properties of starch and the interactions with other components, particularly with water, are of great interest to the food industry. When the starch is heated in the presence of a sufficient amount of water, the loss of molecular order in the structure of the starch and the leaching of amylose result in the conversion of an aqueous suspension of starch granules into a viscous paste and gelatinization [16].

Role of fat in baked goods

The fat helps the incorporation of air bubbles in the dough during mixing, helps to ferment the product, softens the crumb, imparts moisture and improves the sensation in the mouth [26]. They have a great influence on the volume and quality of bread after firing [10]. As well as lubrication during mixing phase [9].

In biscuits, the fat not only provides flavor, but also facilitates the incorporation of air into the dough, which

contributes to its increase in volume and interferes with the continuity of the gluten structure, favoring the formation of a softer paste [6].

Problems with gluten protein

Bread has been considered for centuries as one of the 32 most popular staple food products. Gluten is the main structure-forming protein in flour and is responsible for the good baking properties of wheat dough. The protein fractions in gluten are glutenin and gliadin 15. Gliadin (soluble in alcohol) and glutenin (insoluble in alcohol). Gliadin is responsible for the viscosity of the dough, while glutenin is responsible for the strength and elasticity of the dough [35].

Celiac disease (CD), or gluten-sensitive enteropathy, is an autoimmune disease characterized by chronic inflammation and atrophy of the mucosa of the small intestine caused by exposure to gluten in the diet that affects genetically predisposed individuals [28].

In patients with CD, the consumption of foods containing gluten leads to damage to the small intestine with the consequent reduction in the absorption of nutrients. To date, the remedy for celiac and other gluten-related illnesses is to exclude gluten from the diet [13].

Currently between 1 and 2% of the world population suffers from celiac disease (CD). In Mexico it is estimated that at least 800,000 people suffer from celiac disease, this indicates that there is a prevalence of 0.5 and 0.7% of the population [7].

The wide prevalence of celiac disease causes an increasing demand for gluten-free foods 36. Commercial breads (GF) are mainly starch and, therefore, lack fiber, vitamins and nutrients, causing an imbalance in the diet of celiac patients [24].

The taro

The taro (*Colocasia esculenta*) also known as malanga, is cultivated in several countries in Africa, Asia and America. It is an edible tuber belonging to the family of *Araceaes.* Its shape is round ovoid with starchy pulp and dark brown skin [20]. Some physiological and phenological features suggest that local varieties of (*Colocasia esculenta*) can adapt to limited water conditions for cultivation [19]. Malanga starch can be used in the food industry as an ingredient in snacks, sauces, creams, noodles, pasta, meat products, among others [34].

Its value lies in its high content of starch (30-85% dry base), proteins (1.4-7%), in addition to being a good source of fiber (0.6-0.8%), vitamin A, C, calcium and phosphorous [27].

In Mexico the cultivation of taro is carried out in the states of Veracruz, Oaxaca and Puebla, the total production of taro in the state of Veracruz was 16,552 tons for 2015 according to the Agri-Food and Fisheries Information Service [20].

The high fiber content in taro can help treat constipation and therefore reduces the incidence of colon cancer, diabetes, heart disease and some other digestive diseases [17]. On the other hand, the high percentage of minerals and vitamins (Fe, Zn, vitamin C and β-carotene) represent 25% of what is recommended daily [2].

Taro flour contains nutritional components that can enhance the nutritional value of gluten-free foods. The protein content in taro flour (8.28%) is higher compared to other flours commonly used in gluten-free products such as; corn flour (5.50%), rice (7.33%), cassava (1.4%) or sweet potato (6.3%) [3].

It is traditionally used as a medicinal plant and provides bioactive compounds with important biological properties. It provides carbohydrates, proteins, thiamine, riboflavin, niacin, oxalic acid, calcium oxalate, minerals, lipids, unsaturated fatty acids and anthocyanins. It has a higher nutritional value compared to potatoes, sweet potatoes, cassava, and rice. In addition, it is easy to digest and has non-allergenic properties, it is anti-hypertensive, antidiabetic, antioxidant, hepatoprotective, anti-inflammatory, antimicrobial, helminthic, proliferative and lipid-lowering [25]. Superior nutritional value compared to potatoes, sweet potatoes, cassava and rice.

Contains digestible starch, good quality protein, ascorbic acid, thiamine, riboflavin, niacin and high amino acid scores, contains 70 to 80% starch with small granules ranging from 1 to 5 µ, significantly smaller than that of corn and wheat. Contains 34.04% and 34.26% amylose (and invariably about 66% amylopectin). Starches that contain a higher percentage of amylopectin have higher viscosity and paste stability. This means that the starch will produce a thicker paste, which will be less likely to decompose during cooking [11,15].

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