'Nutraceuts' Peels to Diet, a Novel Technology from Discarded Vegetable Peels

Madhu P. C.
Department of Biotechnology, MET'S School of Engineering, Mala-680732, Thrissur, Kerala.
Corresponding Authors: madhupc2014@gmail.com

Abstract

With ever increased food processing in the new millennia, production of Agro waste has been increased tremendously. These wastes are rich sources of essential bioactive compounds. In developing countries, the waste materials from Agro industries can help to obtain valuable compounds. Fresh fruits and vegetables are highly utilized commodities by health-conscious consumers and represent a prominent segment on the functional and nutritional food sector. However, food processing is causing significant loss of nutritional compounds and generation of waste is creating serious economic and environmental problems. Fruit and vegetables encompass husk, peel, pods, pomace, seeds and stem, which are usually discarded, despite being known to contain potentially beneficial compounds such as carotenoids dietary fiber, antioxidants enzymes and polyphenols. Here a challenge is made to manage industrial potato peel waste and orange peel waste and to utilize it in biscuits baking. Due to the high market competition and increased demand for healthy natural and functional products, thus we made an attempt to increase antioxidant and dietary fiber content, it may significantly be increased by incorporating potato and orange peel powder. Foods containing fiber can provide health benefits as well, such as helping to maintain a healthy weight and lowering the risk of diabetes, heart disease and some types of cancer. Hence, it may open a new channel in food industry for developing value added products from vegetable peels.

Introduction

The baking industry is one of the largest sectors of the food processing industry in India. Since they are readily available, convenient for eating right away, and have a long shelf life, baked goods are the most popular. The most popular snack food for both children and adults is biscuit. Additionally, their rising demand opens up more opportunities for their production, fortification, and other nutritional advancements. The main goals of fortification are to maintain the nutritional quality of products, to maintain adequate nutrient levels in order to treat or prevent specific nutritional deficiencies in the population, to increase the added nutritional value of a product from a business perspective, and to provide specific technological functions in food processing. Now a days to improve the nutritional quality of bakery products, whole natural foods and their byproducts are becoming part of the bakery products which improve their quality and nutritional bioavailability in a cost-effective way.

1. Dietary fiber

Dietary fiber (DF) is an essential component of a healthy diet and the health benefits associated with its regular consumption include regulating the intestinal tract and preventing diseases such as diabetes, hypertension, obesity, coronary heart disease and colon cancer. Due to this importance, over the last decades, the knowledge about DF has increased considerably both in the physiological and in the analytical domain. Fresh fruits and vegetables are an important part of the human diet as a significant source of water, vitamins and natural sugars and are also the main source of DF. Dietary fiber can include soluble dietary fiber (SDF) and insoluble dietary fiber (IDF). SDF refers to fibers that cannot be digested or absorbed by human bodies but are partly soluble in water. Examples of SDF are some gums, such as pectin, gum Arabic, guar gum, and glucan, including some biological polysaccharides and synthetic polysaccharides. IDF is a fiber that cannot be digested or absorbed by human bodies and is insoluble in water. IDF includes some components of the structure of cell walls, such as cellulose, hemicellulose, and lignin. The dietary fibers obtained from different sources differ in total dietary fiber content, SDF content, physicochemical properties, and physiological properties (Ajesh Kumar V, et al., 2022).

2. Structural aspects of dietary fiber

DF includes primarily polysaccharides, but also oligosaccharides and substances from plant cell walls associated with the NSP. The common characteristics are that these escape digestion in the small intestine and reaches the large intestine, where a proportion undergo fermentation; hence the intrinsic effect on metabolism and disease risk are likely to be mediated through their properties as they pass through the gastrointestinal tract. The majority of DF constituents are represented by carbohydrates: poly and oligosaccharides. Similar to oligosaccharides,

polysaccharide molecules are composed of glycosil units in linear or branched arrangements. The degree of polymerisation (DP) varies from less than 100 (only a few of them) to 10,000–15,000 (cellulose) with the majority of DF having a DP ranging between 200 and 3,000. Each type of polysaccharide is characterized by its monosaccharide unit and the nature of linkages between them. The physical properties of polysaccharides are dominated by their conformation (sometimes described as ordered or disordered 'random coil' chain geometry) and the way they interact with one another. The chemical structures and chain conformations of DFs dictate their physical characteristics, which may have profound effects on their physiological role as constituents of digest, and may induce both local and systemic responses. Some of the most important physical characteristics of DF include: hydration properties, solubility/dispensability in water, rheological properties, bulk due to non-digestibility, the ability to adsorb bile acids, ferment ability by gut micro flora and surface area characteristics (Rana et al., 2012)

Application of dietary fiber in functional foods

Fiber in foods can change their consistency, texture, rheological behavior and sensory characteristic of the end products, the emergence of novel sources of fibers, have been offering new opportunities in their use in food industry (Guillon and Champ 2000). Fiber can even be produced from sources that might otherwise be considered waste products. For example, wheat straw, soy hulls, oathulls, peanut and almond skins, corn stalks and cobs, spent brewer's grain and waste portions of fruits and vegetables processed in large quantities can be converted into fiber ingredients, which may be highly functional in certain food applications. Dietary fiber holds all the characteristics required to be considered as an important ingredient in the formulation of functional foods, due to its beneficial health effects (Dhingra, Devinder et al., 2012)

Therapeutic functions of dietary fiber The diets with a high content of fiber, such as those rich in cereals, fruits and vegetables have a positive effect on health since their consumption has been related to a decreased incidence of several types of diseases as due to its beneficial effects like increasing the volume of fecal bulk, decreasing the time of intestinal transit, cholesterol and glycaemic levels, trapping substances that can be dangerous for the human organism (mutagenic and carcinogenic agents), stimulating the proliferation of the intestinal flora etc. Some functions and benefits of dietary fiber on human health are summarized in Table 1. (Dhingra, Devinder et al., 2012).

Table 1. Shows functions and health benefits of dietary fibers

Funtions	Benefits
Adds bulk to the diet, making feel full faster	May reduce appetite
Attracts water and turns to gel during digestion, trapping carbohydrates and slowing absorption of glucose	Lowers variance in blood sugar levels
Lowers total and LDL cholesterol	Reduces risk of heart disease
Regulates blood pressure	May reduce onset risk or symptoms of metabolic syndrome and diabetes
Speeds the passage of foods through the digestive system	Facilitates regularity
Adds bulk to stool	Alleviates constipation
Balances intestinal pH and stimulates intestinal fermentation production of short-chain fatty acids	May reduce risk of colorectal cancers

Antioxidant

Antioxidants are substances that may protect your cells against free radicals, which may play a role in heart disease, cancer and other diseases. Free radicals are molecules produced when your body breaks down food or when you're exposed to tobacco smoke or radiation. Antioxidants, such as vitamins C and E and carotenoids, may help protect cells from damage caused by free radicals. Other naturally occurring antioxidants include flavonoids, tannins, phenols and lignans. Plant-based foods are the best sources. These include fruits, vegetables, whole grains, nuts, seeds, herbs, spices, and even cocoa.

Antioxidant defense system

Antioxidants act as radical scavenger, hydrogen donor, electron donor, peroxide decomposer, singlet oxygen quencher, enzyme inhibitor, synergist, and metal-chelating agents. Both enzymatic and non-enzymatic antioxidants exist in the intracellular and extracellular environment to detoxify reactive oxygen species (ROS).

Mechanism of action of antioxidant

Two principal mechanisms of action have been proposed for antioxidants. The first is a chain- breaking mechanism by which the primary antioxidant donates an electron to the free radical present in the systems. The second mechanism involves removal of ROS/reactive nitrogen species initiators (secondary antioxidants) by quenching chain-initiating catalyst. Antioxidants may exert their effect on biological systems by different mechanisms including electron

donation, metal ion chelation, co-antioxidants, or by gene expression regulation (V. Lobo et al., 2010).

Objectives

1. Improvement of dietary fiber content in biscuits with the incorporation of potato peel powder and orange peel powder.
2. Development of antioxidant rich biscuits with the incorporation of orange peel powder without compromising the sensory acceptance.

Methodology

Collection of Raw Materials

Potato peels and orange peels were collected from hotels from different cities near the Institute. Considering the nature of their work, restaurants are bound to generate considerable amount of food waste. This certainly becomes a major concern to the relevant authorities such as management and government. A large amount of peel waste is generated in restaurants which forms part of this waste and has led to a big nutritional and economic loss and environmental problems. Thus, discarded peels can be utilized to produce value-added product.

Peel Powder Production

Steps:

1. Potato peels and orange peels were washed in distilled water.
2. They were weighed.
3. Peels were laid on aluminum foil.
4. They were then placed in hot air oven at 50° C for 24 hrs.
5. Dried peels were crushed into powder using mechanical blender.
6. The peel powder was stored in a refrigerator.

Preparation of Biscuits

Ingredients

1. Ragi flour, 2. Baking powder, 3. Butter, 4. Stevia powder, 5. Milk, 6. PPP, 7. OPP

Procedure

1. Preheat your oven at 180°C
2. Mix the ingredients in a bowl. Do it until the mixture is light and fluffy.
3. Grease your cooking tray with butter and place the biscuits on top.
4. Bake the biscuits at 160°C for 20 minutes.

Fig 1 a). Potato Peel and b). Orange Peel

Fig 2 a) Potato Peel Powder (PPP) and b) orange peel powder (OPP)

Result and Discussion

With an ever-increased demand of fiber enriched food sources, we extend out study to developed a fiber enriched biscuits (Fig. by improving the quality and requirement of dietary fiber food sources.

Fig 3. biscuits made with vegetable peel powder

Measurement of Sensory Evaluation

Sensory score of biscuits showed that with regard to taste, aroma and overall acceptability, the sensory characteristics of biscuit type 3 were found to be the best. The taste is the primary factor which determines the acceptability of any product, which has the highest impact as far as market success of product is concerned. Biscuit containing 100% ragi flour were

rated the poorest in taste. Biscuit containing 20% potato and orange peel powder has the highest mean score. The mean scores for appearance of the biscuits didn't show considerable change. As increase in peel powder, mean score for texture was also increasing while that of aroma was decreasing Table 2.

Table 2 Organoleptic study of the products

Biscuits	Appearance	Aroma	Texture	Taste	Overall acceptability
Control	7.8	9	7.3	6	6.6
Type 1	7.9	8.5	7.3	6.5	7.09
Type 2	7.9	8.4	7.2	6.3	7.3
Type 3	7.5	8.9	7.8	7.5	8.2

Conclusion

In conclusion, with increased food processing in the new millennia, production of agro-industrial waste has increased tremendously. Development of sustainable solution for managing fruit and vegetable waste has become extremely important in present scenario. Hence, the utilization of the fruit as well as vegetable waste especially peels in developing value-added products will be an eco-friendly and sustainable way to create novel business opportunities. Foods containing fiber can provide health benefits as well, such as helping to maintain a healthy weight and lowering the risk of diabetes, heart disease and some types of cancer. Hence, it may open a new channel in food industry for developing value added products from vegetable peels.

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