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Review Article

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Evaluation of Organoleptic and Phytochemical Properties of Bread Fortified With *Taraxacum Officinale* Leaf Powdery

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ABSTRACT

Food fortification is done to enhance some properties of food. Food fortification within acceptable limits is necessary in order not to compromise the general acceptability of the food product and its sensory properties. This study sought to evaluate the organoleptic and phytochemical properties of bread fortified with Taraxacum officinale leaf powder and to further determine the general acceptability. Literature reviewed included reports obtained by searches in Scientific databases such as ScienceDirect and PubMed. Dough fortification with dried Taraxacum officinale leaves presented various degrees of effects on the final bread product. In the literature, dough fortification with 5 % dandelion leaf powder resulted in comparable sensory properties and acceptability to unfortified bread. Literature on bread fortification with dandelion is limited. Thus, further study to understand the impact of the fortification on nutrient quality, physical properties of bread and on the sensory properties may be necessary.

Key words: *Taraxacum officinale*; Food fortification; Dough fortification

INTRODUCTION

Background to the Study

Bread is one of the oldest food products of antiquity which has led to the sustenance of human societies. Since the rise and fall of civilization, bread making/baking is still an important factor in every nation's economy. Wheat is a cash cereal that belongs to the family; Poaceae, Genus, Tritium; and Species, *Tritium aestivum*. Wheat is rich in gluten content, which gives bread a fine, tough, and elastic texture. Wheat flour comprises 72.51 g of carbohydrate, 12.2 g of dietary fiber, 13.70 g of protein, 1.87 g of fat, per 100 g and appreciable contents of vitamins and minerals. Wheat flour is high in gluten, which makes it superior to other types of flour such as maize, barley, leguminous or herb-based flour. Gluten is a protein that gives the dough its strength, rheology, and elasticity. It also traps carbon dioxide produced by yeast during the fermentation process and this causes the bread to rise. With the world population, climate, and quest for better and healthier food, and economy changing, it's necessary to use composite flour for baking. Composite flour can be defined as flour that contains two or more different flour mixed for baking. Also, with humanity's concern with the shelf life, the sensory properties, the quality, and the nutritional benefits of food commodities, it has become very eminent for scientists to find ways to improve these properties in foods. Fortification of bread with other components because of demands for natural and healthier food has become the trending field of research. Thus, whole grains, leaves, roots, and other seeds have become popular in the production of fortified bread. This is done to develop products that are generally acceptable to consumers. Dandelion is a rich source of vitamins and minerals and is particularly high in vitamins A and C and iron, carrying more iron and calcium than spinach [1]. The folk medicines of China, India, and Russia have recognized dandelion’s effect as a liver tonic. Traditional Chinese medicine combines dandelion with other herbs to treat hepatitis, they used it to enhance the immune response to upper respiratory tract infections, bronchitis, and pneumonia, and as a topical medicine compress to treat mastitis. Additionally, wheat is used in the treatment of anemia and inflammation, jaundice, toxicity, for purifying blood, managing fever, eye problems, gastrointestinal problems, osteoarthritis, eczema, cancer of the uterus and breast in women. Analysis of the contents of dandelion has revealed rich sources of β-carotene, which protects cells from oxidation and cellular damage. The leaves of dandelion also contain carbohydrates (e.g. inulin), carotenoids (e.g. lutein), fatty acids (e.g. myristic acid), minerals, sugars (e.g. glucose, fructose, and sucrose), choline, vitamins, mucilage, and pectin. Inulin, a complex carbohydrate which is a major component of dandelion leaves has many beneficial effects such as the elimination of pathogens in the gastrointestinal tract, and repression of obesity, cancer, and osteoporosis. This study aims to assess the organoleptic and phytochemical properties and the general acceptability of bread fortified with *Taraxacum officinale* leaf powder.

Justification

Taraxacum officinale is rich in phytochemicals, minerals and nutrients and can be used to improve the sensory characteristics, nutritive and phytochemical value and general acceptability of bread products. This study therefore seeks to assay the Phyto- nutritive and product acceptability of wheat bread fortified with *Taraxacum officinale* leaf powder.

Hypothesis

Taraxacum officinale leaf powder fortified bread products would have high acceptability and increased phytochemical quality.

Problem Statement

Bread products tend to have low phytochemical content and this study seeks to enhance its phytochemical property and determine the acceptability of the product.

Main Objective

To investigate the effect of partial substitution of wheat bread dough with *Taraxacum officinale* leaf powder on the phytochemical quality and sensory properties of wheat bread.

Specific Objectives

- To determine the acceptability of wheat bread products fortified with 5% (w/w) and 10% (w/w) *Taraxacum officinale* leaf.
- To determine the phytochemical quality and quantity of wheat bread products fortified with 5% (w/w) and 10% (w/w) *Taraxacum officinale* leaf powder.

LITERATURE REVIEW

Bread and Its Importance

Bread is a widely consumed staple product and necessary in human nutrition. Bread is produced by baking the dough after the processes of Scaling, mixing, primary fermentation, folding, dividing, rounding, resting, shaping, proofing, baking, cooling and storage.The quality of bread depends on the nutritional value of the raw materials used and the effect of the processing. Wheat flour is used in most bread because of its nutrient components and high availability, but different problems are associated with this flour, such as allergies and loss of nutrient components due to milling and refining Rosentrater. One-third of the world's population consume bread regularly showed that bread is a good source of carbohydrate and provides energy for the body showed that bread has high fiber content, which contributes to reduce the risk of cardiovascular diseases, type II diabetes, and Obesity. The appreciable amounts of other nutrients present in bread add to the growing list of its importance. Reports show that healthier loaves of bread have low glycemic index. Ingredients used for the production and baking of bread

include wheat flour, baker's yeast, Fat, Sugar, Salt, leavening agent, and water. Mixing of the ingredients in varying degrees and formats leads to different sensory characteristics of bread products.

Taraxacum Officinale

Dandelion *Taraxacum officinale* is a member of the Asteraceae (Compositae) family that is native to Europe and widely distributed in the warmer temperate zones of the Northern Hemisphere. Dandelion is regarded as a nontoxic herb that can be exploited for its choleretic, diuretic, antirheumatic, and anti- inflammatory properties. Dandelion is an entirely edible plant, and its leaves, roots, and flowers are incorporated into different food products. Analysis of the nutrient and chemical content of 55 g of green dandelion leaves according to the USDA (United States Department of Agriculture) reveals appreciable amounts of proteins (1.5 g), fat (0.4 g), fibre (1.9 g), carbohydrates (5.1 g) and high amounts of vitamins and minerals and other constituents (45.7 g) with a balanced combination of trace elements making dandelion an interesting source of micronutrients. Comparison of the nutritional composition of dandelion with that of lettuce and spinach, i.e., vegetables with similar culinary uses, shows a higher content of dietary fiber and proteins and a greater variety of amino acids and most vitamins and minerals of dandelion. Dandelion consists of 1.5 % lipids (on dry weight) and has higher proportions of unsaturated fatty acids (oleic, palmitoleic, linoleic, and linolenic acids) than either lettuce or spinach. According to the USDA (United States Department of Agriculture) National nutrient database, Dandelion is known to provide the following percentages of the Required daily allowance of nutrients: 9 % of dietary fiber, 19 % of vitamin B-6 (pyridoxine), 20 % of Riboflavin, 58 % of vitamin C, 338 % of vitamin A, 649% of vitamin K, 39 % of iron, 19 % of calcium, 2 % energy, 7 % carbohydrates, 5 % protein, and 3 % total fat. Dandelion is also one of the richest green-vegetable sources of b- carotene. Young leaves are often consumed fresh as salads, either alone or in combination with other plants such as lettuce, shallot tops, or chives. They may also be boiled and drained, sprinkled with pepper and salt, and moistened with soup or butter. Additionally, dried leaves are employed in many digestive or dietary drinks such as the traditional dandelion wine and soft drinks of the Chinese. As shown bydandelion contains an array of phytochemicals distributed along the plant and endowed with potentially healthful properties. Dandelion is bitter because of the content of sesquiterpene lactones, mostly of the eudesmanolide and germacranolide types, and are unique to this plant. Major sesquiterpene lactones – generally occurring as glycosides include taraxacolides, dihydro-lactucin, ixerin, taraxinic acids, and ganglioside. Although the most biologically relevant components of dandelion are the sesquiterpene lactones (suggested to exert anti-inflammatory and anticancer effects), the plant also contains several phenylpropanoids (shown to exert inflammation-modulating effects), terpenoids, polysaccharides (shown to play a role in immune regulation and to exert platelet anti-aggregation activity, hepatoprotective effects, and antitumoral activity), and inulin. Several studies show that dandelion is also a rich source of vitamins, choline, inositol, lecithin, minerals, and oligo- elements (calcium, sodium, magnesium, iron, silicon, copper, phosphorus, zinc, manganese). Moreover, dandelion contains a high level of potassium (2.10 mg /kg plant tissue). Dandelion is devoid of toxins and alkaloids and thus, shows low toxicity. Studies with rabbits treated orally with dried dandelion plant (3 to 6 g /kg body), and mice treated with dandelion ethanoic extracts, showed no significant or visible signs of toxicity [2]. Notably, the

phytochemical composition of dandelion depends on the season in which it is gathered, the time of harvesting, as well as other ecological factors, and it varies greatly among the flowers, leaves, and roots of the plant.

Enrichment of Food Products with Dandelion

According to bread supplemented with 5% dandelion leaves showed no significant changes in all sensory characteristics, as compared to un-supplemented bread. On the contrary, increase in the content of dandelion to 7.5 %, 10 %, and 20 % decreased all sensory characteristics. Unfortified and fortified bread samples with dandelion leaves were evaluated according to colour, odour, taste, texture and general appearance. Fortification led to increase in the content of protein, ash and fibre whereas there was a decrease in fat and carbohydrate content. Analysis on fortified bread also showed increase in water content as compared to unfortified bread. Increase in water content could be attributed to the ability of fortificant to retain water due to increasing fiber content of fortified bread. The relatively high moisture contents of the fortified bread compared to the 100 % wheat bread indicates that the bread samples fortified with high proportions (10 %) of dandelion will be softer than un-fortified dandelion bread (100 % wheat bread). However, the unfortified bread would have longer shelf life compared to the fortified bread due to its relatively low moisture content. Statistical difference in colour between unfortified bread and fortified bread reported was due to reduction in lightness and increase in darkening caused by colour of fortificant and reactions between introduced sugars and proteins from the fortificant. The increment in the protein content of the fortified bread could be due to the high protein content of dandelion leaves used as fortificant. The relatively low fat content of the dandelion fortified bread indicates that the bread will be less palatable than the un-fortified bread, since fat increases food palatability further reported that increasing levels of fortification led to significant changes between fortified and unfortified bread. Furthermore, according to the report by enrichment of cookies with dandelion in proportions of 2 %, 4 %, 6 % and 8 % resulted in various changes in sensory and physical properties and general acceptability of the fortified products. The pH of cookie dough was highest in the control group at 6.60, and tended to decrease from 6.58 to 6.52 as the concentration of dandelion powder increased ($P< 0.05$), there was no significant difference between the control group and the 2 % addition group, the 2 % and 4 % addition group, the 4 % and 6 % addition group, and the 6 % and 8 % addition group($P>0.05$). However, it is known that the pH of the dough affects the aroma, appearance, and colour of the cookies, but due to little change in the pH, the effect of the powder on the pH of the dough in the concentration range of dandelion powder used was negligible. Further reports by indicated that the moisture content of the control group (unfortified cookies) was the highest at 16.95 %, and as the concentration of dandelion powder fortification increased, moisture content showed a tendency to decrease significantly in the range of 16.34 ~ 16.69 % ($P<0.05$), However there was no significant difference between the control group and the 2 % and 4 % addition group, the 2-6 % addition group, and the 6-8 % addition group ($P>0.05$). It was reported that the decrease in the moisture content of the dough was due to the replacement of a portion of wheat flour having a moisture content of 11.00 % with a dandelion powder having a moisture content of 7.35 %. In the determination of the antioxidant activity, it was found that the electron donating ability for DPPH was the lowest in the control group at 6.27 %, and as the amount of dandelion powder increased, electron donating ability increased significantly from 16.50 % to 45.93 % (<0.05). In the same work, sensory evaluation showed that there was no significant difference between the 2 % and 4 % addition groups in all sensory characteristics evaluated (Colour, Flavour, Softness, Taste and

overall acceptance) except the taste, but the taste was significantly evaluated higher than other samples ($P<0.05$). However, considering the functional benefits and sensory quality of the dandelion powder, the optimum addition amount of the white dandelion powder was judged to be 2 %.

Composite Bread

Composite flour is defined by as a mixture of different vegetable flours rich in starch, protein, and other nutrients with or without wheat flour. When composite flour is baked into bread, it is called composite bread. Dough fortification is the process of introducing fortificant into the dough to achieve sensorial property or nutritional adjustment or enhancement found that fortification of bread dough with soy leads to a reduction in final bread quality. Bread product whose dough was fortified with soy became drier, less tender reducing or curtailing overall acceptability. Bread also had a decrease in crumb firmness. These effects seen were due to a decrease in gas retention in the dough due to fortificant interrupting the cross-linking gluten proteins.

different proportions of maize to wheat composite flour revealed no significant difference ($p> 0.05$) in the proximate analysis evaluated. The physical analysis showed a decrease in loaf height (2.50-3.95 cm), volume (291.0 - 415.0 cm3) and specific volume (1.72-2.42 cm3/g) as the proportion of the maize was increased. However, the loaf's length was not affected. Also, the functional property analysis revealed an increase in viscosity, water absorption, and swelling capacity as the proportion of maize was increased. The general acceptability of the product was quite appreciable. Finally, the sensory analysis showed a significant difference ($p< 0.05$) in the texture and taste. The research concluded that substitution of part of wheat flour with maize flour has the potential of reducing blood glucose levels and can be used to manage diabetes evaluated the functional properties of maize-soy bean flour blends for sour maize bread production. Furthermore showed that gluten content in fortified wheat bread reduced per the increasing amount of fortification. They also found a reduction in the volume of bread and texture of products depending on powder or flour used for substitution indicated an increase in protein content especially lysine (essential amino acid containing Sulphur) which is not present in wheat flour when legumes were added as composite flours for bread baking. This was further corroborated by using germinated chickpea flour, by using germinated pea flour, and by using lupin. Supplementation of wheat flour with barely and cornflour on balady bread quality revealed an increase in protein, fat, fiber, ash, and minerals. It also showed higher rheological parameters of dough. The sensory analysis showed a significant change in taste [3].

Sensory Analysis

Sensory Analysis as defined by is the measure, analysis, and interpretation of products through the senses of smell, touch, taste, and sight. In an experiment conducted by the panel chosen analyzed samples (Fortified bread and 100% wheat bread) and scored 1 – 9 (Dislike extremely – Like extremely) based on their preference on a hedonic scale. The means were estimated and analyzed. From the analysis, it was noticed that the texture and taste of 100% wheat bread was significantly different ($p<0.05$) from the other samples. The general assessment of the panels showed that the whole meal bread was acceptable in terms of colour, texture, and aroma the whole wheat bread was rated higher than the fortified bread.Research carried out by also analyzed the sensory properties of fortified bread containing legumes, lentil, and chickpea in an amount of 10 %, 20 %, 30 %, 40 %, and 50 %

which was baked into bread. The addition of the lentil and chickpea influenced the color, texture, flavor, and crumb taste considerably. The 20 % of chickpea bread was considered the best in terms of total acceptability and comparison to whole wheat bread. The 10 % lentil bread was equally good as the wheat bread. But the bread containing 40 % and 50 % lentil or chickpea had unacceptable sensory points. In research conducted by the scores for unfortified bread were not significantly different from the mean scores of bread fortified with 5 % moringa leaf powder at $p<5$ significant level. But at increased levels of fortification above 5%, the analysis determined a significant difference between the scores of the fortified and unfortified bread, thereby showing a possible change in sensory characteristics

MATERIALS AND METHODS

The review was conducted by analysis of work reported by several authors and extrapolation of the findings on work that was to be conducted. The articles for the review were obtained from Google Scholar database, ScienceDirect database, Mendeley database, PubMed, African journal of food, agriculture, nutrition and development online database, African Journal of Food Science (AJFS) and the American journal of plant sciences database (AJPS). The search for articles in the databases was done using the following keywords, 'Bread dough fortification', '*Taraxacum Officinale* fortification', 'Dandelion fortification of food', 'Bread fortification with dandelion', '*Taraxacum officinale'*, 'fortification of dough with dandelion' and 'Dandelion fortified wheat flour'. Articles were selected according to the preferred reporting items for systematic reviews and Meta-analysis guidelines. The selected articles contained the search keywords in part or whole within the article title, abstract, or full text. Articles that were retrieved were manually reviewed to identify and exclude research that did not fit the search keywords or criteria as described and duplicate works.

DISCUSSION

The literature reviewed provided an indication of the feasibility of the fortification of bread products with *Taraxacum offi*cinale. According to the experiment by Arafa et al., (2010), bread fortifications done with 7.5 %, 10 %, and 20 % showed significant changes in the product obtained as compared to the control (unfortified bread). Only fortification at 5 % (w/w) presented no significant changes in the physical characteristics (colour, odour, taste, texture and general appearance) between the control and fortified bread. This is important because it shows that fortification done at 10 % may not be acceptable to the consumer. Effects of 5 % fortification on the physical properties of bread maybe necessary to investigate in further studies.However, further reports by showed that to produce softer fortified bread products, higher concentrations of fortificant (10 %) may be needed as water content increased with increasing fortificant. Nevertheless, lower moisture content of 5 % compared to 10 % fortification also indicated the lower tendency for microbial spoilage. Furthermore, increasing fortification led to darkening of fortified bread. This would not be convenient for consumers when 10 % fortification is done due to envisaged significant difference as compared to 5 % fortified bread and unfortified bread. Increment of protein and fat content of fortified bread could have good implications on the palatability and nutritional value of bread translating into high acceptability.

Literature reviewed did not report on the effect of baking on the phytochemical quality and quantity of fortified bread products. This is evidenced in research work by where only the nutritional quality of fortified bread was analysed. Determination of the effect of the phytochemical quality and quantity is necessary to develop acceptable bread products since phytochemicals present may cause flavour, taste, or textural changes which may enhance or deteriorate sensory properties and general acceptability of the bread product [4].

CONCLUSION AND RECOMMENDATION

The reviewed literature provide necessary information on the amount of fortification needed to develop fortified bread products that show little changes in the sensory properties and general acceptance of fortified bread products. Further studies to be conducted must consider determination of the relevant characteristic physical effect of fortification on bread and the effect of fortification on the phytochemical quality and quantity of the fortified bread as compared to the unfortified bread. Also, studies must be done on the least possible degree of fortification that presents the least change in the properties of fortified bread against unfortified bread. Future studies need to consider the effects of fortifying bread with dandelion powders on dough parameters such as rheology and the implications for the processing of dough and the baking quality, such as loaf volume, crumb structure and crust hardness Dandelion addition to food products may present some challenges such as the introduction of anti-nutritive factors which may impact the nutritive quality of food products. The effect of fortification on the nutritive properties of bread must, therefore, be experimented to evaluate the bioavailability of nutrients in fortified bread. Furthermore, the effect of the baking process on the quantity and quality of bread products must be experimented.

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