

The Acceptability and Nutritional Content of the Fiddlehead Fern as Extender to Bread Products in Mindanao, Philippines, 9000

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Abstract: Fiddlehead fern (commonly known as pako) is an indigenous edible vegetable that can be found in banks of swift streams and rivers which are widely distributed in the Philippines and mostly in Asian countries and even in the United States of America. In many instances, this fern vegetable is commonly used in the preparation of salads, soups and other vegetable dishes. It is highly good for mixing cooked egg, meat or seafood. These are considered the most important fern variety good for human consumption. Because of its high nutritive value, this study explored on the idea of making this vegetable fern as an extender to all baked products, particularly bread products. Food experts and dieticians alike have already known and accepted that bread becomes the secondary staple food in the Philippines and is also made as primary staple food by some countries such as Ireland, United Kingdom, New Zealand, USA, Australia, France, Saudi Arabia, Switzerland, Ukraine, Canada and Mexico. The current results on nutrient analyses performed by the Department of Science and Technology revealed that when fern vegetables were mixed to the dough and baked, it showed up with an excellent source of calcium (76 mg/100 g), iron (7 mg/100 g) and phosphorus (130 mg/100 g). The study then concluded that fern loaf bread is found to be most sellable both in private and public schools because of their good appearance, flavor, aroma, texture and taste. The use of fiddlehead fern as extender to bread has contributed to an increase in bulk or volume that apparently increases its yield per mixture. Moreover, these fern vegetables as extenders to bread products are highly considered nutritious due to its plentiful micro-nutrients to nourish and help protect the body against diseases arising from malnutrition.

Key words: Fiddlehead fern, nutritional content, extenders, bread products, body

INTRODUCTION

Ferns are plants that grow on the mountains and are usually used for landscapes and flower arrangements. Yet, unknown to most of us, there is this one kind of fern variety that Filipinos love to eat. This indigenous vegetable is commonly called “Pako or Fiddlehead Fern” with its scientific name, *Diplazium esculentum* (Retz and Swartz). These are usually grown from rhizomes as harvest crops (All About Diabetes, 2013). They can be found growing on banks of swift running streams, rivers, freshwater swamps or in the wild. They are also edible vegetable harvested crops that can be either blanched, boiled or stir fried and in some cases, pickled. Often compared to the flavor of over-cooked asparagus, the young fronds are generally cooked before consumption to avoid bitterness. Sometimes the fronds are dried and then reconstituted for cooking. Pako is an excellent source

of vitamins A and C and are rich in niacin, magnesium, iron, calcium, potassium and phosphorus (Bushway *et al.*, 1982; Delong *et al.*, 2011).

This study aimed to create and produce a unique innovation of bread where the fiddlehead fern or pako is an added ingredient used to increase its bulk and enhance the aesthetic and nutritive value of the fern bread. The product is not only very affordable but most importantly it is nutritious for people who have osteoporosis and similar bone structure condition, anemia and diabetes and blindness in children.

MATERIALS AND METHODS

Research design: The experimental method of research was used in conducting the study including the sampling scheme, sensory evaluation and chemical analyses of the nutrient contents found in bread with fern and bread without fern as well as its acceptability to the bread consumers (USDA, 2016).

Research setting: The study was conducted in Mindanao University of Science and Technology (MUST), Lapanan, Cagayan, de Oro City, Mindanao, Philippines. Experiments were performed inside the Culinary Arts laboratory of the said university.

The respondents: The respondents of the study were the actual number of bread consumers coming directly from the Mindanao University of Science and Technology and the local industries composed of teachers, students, bakers and chefs. The 65% were students, 21% teachers and another 21% from industries. The said respondents were served with samples which strictly adhered to the packaging principles of hygiene and sanitation (Foodipino, 2012).

Sampling procedure: Methods and techniques are the most important thing to consider in the preparation of new bread innovation. The techniques used in preparing the sample were the straight dough method and the sponge dough method of mixing (Gay, 2008).

In the first sample, 360 g of fiddlehead fern was mixed to 650 g of flour using straight dough method. In the second sample 360 g of ferns was mixed to the same weight of flour mixture using the sponge dough method. Two techniques of mixing to different bread products were evaluated by 6 teachers, 2 students and 2 bakers. After sampling it was found out that the sponge dough method of mixing was better for the 360 g of fern mixed with 650 g of flour mixture in terms of nutrient contents analysis and acceptability of the fern bread. The new fern bread products was topped with streusel to enhance its appearance, color, aroma and taste making it more appetizing and acceptable to the palate (Grant, 2016).

In preparing the fern bread products, fern vegetables were washed using hot water to remove dirt. This was followed by sorting to check for blemishes, foreign materials, insects and for grading size purposes (Vagelas *et al.*, 2011; Tongco *et al.*, 2014). Next, the ingredients were carefully weighed using appropriate weighing scale: heavy duty scale for weighing large quantities of materials and small sensitive scales for weighing small amounts of ingredients such as baking powder, baking soda and spices. Faulty scales and careless scaling are largely responsible for faulty baked products. In addition, one ingredient must not be weight on top of another. Very small errors in amounts of ingredients can materially alter the characteristics of a baked product. Other procedures included chopping or slicing, mixing dry ingredients with liquid ingredients for

even distribution of extenders and other leavening agents and preparing toppings and fillings to enhance the appearance, color, aroma and flavour, texture and taste of the fern bread.

Sensory evaluation: The sensory evaluation of the fiddlehead fern bread was conducted at Mindanao University of Science and Technology. The 65% of the student respondents formed two lines in an open area of the campus and fiddlehead fern bread samples were distributed to each line. Samples of packaged fiddlehead fern bread were given to the 21% of teacher respondents from the technology and livelihood education and the Food Innovation Center (FIC) and to the remaining 21% of bakers and chef panelist from the industries, culinary arts and non-culinary arts students (Livestrong, 2015).

The master sheet was used to identify the code number of bread products sampling. Hedonic test was used to evaluate the degree of liking in terms of its appearance, color, aroma and flavor, texture and taste.

Data analysis procedure: Two types of bread sample were analyzed: the fiddlehead fern bread and the bread without fiddlehead fern. The first sample of bread was coded as Cheesy Fern Loaf Bread and the second sample was coded as Cheesy Loaf Bread which had no fiddlehead fern vegetable as extender. Both iron and calcium used the method 999.1 OMA, AOAC 18th Edition. Lastly, determination of the two bread samples were analyzed for phosphorus using the method 999.1 OMA, AOAC method 18th Edition as parameters and methods of two bread samples (Lyimo *et al.*, 1991).

RESULTS AND DISCUSSION

Problem #1: What are the nutrient contents found in bread with fiddlehead fern and bread without fiddlehead in terms of calcium, iron and phosphorus?

Table 1 reveals that the nutrient contents of calcium, iron and phosphorus are higher in bread without fiddlehead fern than in bread with fiddlehead fern.

Problem #2: Is there a significant difference between bread with fiddlehead fern and bread without fiddlehead fern in terms of its nutrient content such as calcium, iron and phosphorus?

Table 2 shows the distribution of statistics according to bread with fiddlehead fern and bread without fiddlehead fern. The null hypothesis: there is no significant difference in nutritional content when grouped according to with fiddlehead fern and without fiddlehead fern bread is accepted (Martha Steward, 1996).

Table 1: Nutrient content of the two types of bread

Samples	Calcium (Ca) (mg/100 g)	Iron (Fe) (mg/100 g)	Phosphorus (P) (mg/100 g)
Without fiddlehead fern	81	8	137
With fiddlehead fern	76	7	130

Table 2: Nutritional content when grouped according to fiddlehead fern and without fiddlehead fern bread

Indicators	With fiddle head (mg/100 g)		t-value	p-value
	head (mg/100 g)	Without fiddle head (mg/100 g)		
Calcium	76	81	0.08	0.46854
Iron	7	8		
Phosphorus	130	137		

Table 3: Fiddlehead fern bread (acceptability appearance)

Indicator/Scale	Bread consumer	Percentage
Like extremely	48	45
Like very much	40	37
Like moderately	19	18
Total	107	100

Total mean = 8.27; Descriptive equivalent = like very much

The result indicates that there is no significant difference in the calcium, iron and phosphorus contents when grouped according to bread without fiddlehead fern and bread with fiddlehead fern. Similarly as to milligrams per 100 variations are evident due to some external factors like the cooking time for bread with fiddlehead fern took longer than the bread without fiddlehead fern because of the increase in bulk or volume of the mixture. The increase of bulk in the mixture is due to the additional fern ingredient, consequently resulting to a longer period of baking time. Equally important also is the source or origin of fresh Pako, by which its nutrient composition is dependent on the soil richness.

In cooking principle it is a common knowledge that vegetables should not be overcooked because it will result to the decrease/loss of nutrients. Therefore, in this study, the increased period of baking time may be attributed to the decrease of micro-nutrients found in Pako being mixed to the bread.

Problem #3: What is the acceptability level of bread with fiddlehead fern in terms of appearance, color, aroma and flavor, texture and taste?

Table 3 shows that the appearance of the fiddlehead fern bread is highly acceptable to the bread consumers as shown in the rating of like extremely 45%. It can be seen that the round fiddlehead fern bread that weighed 30 g per weight of dough and loaf size with a weight of 250 combined with a crunchy appearance on the outside and soft and airy in the inside made the new bread products appetizing to eat. This proves that the fiddlehead fern bread was visually acceptable to the bread consumers.

Table 4 shows that in terms of color, the bread consumers found the color of the fiddlehead fern bread

Table 4: Fiddlehead fern bread

Indicator/Scale	Bread consumer	Percentage
Like extremely	44	41
Like very much	41	38
Like moderately	18	17
Like slightly	4	4
Total	107	100

Total mean = 8.17 ; Descriptive equivalent = like very much

Table 5: Fiddlehead fern bread (acceptability aroma and flavor)

Indicator/Scale	Bread consumer	Percentage
Like extremely	51	48
Like very much	41	38
Like moderately	9	8
Like slightly	6	6
Total	107	100

Total mean = 8.28; Descriptive equivalent = like very much

Table 6: Fiddlehead fern bread (acceptability texture)

Indicator/Scale	Bread consumer	Percentage
Like extremely	73	68
Like very much	23	21
Like moderately	8	7
Like slightly	3	4
Total	107	100

Total mean = 8.53; Descriptive equivalent = like extremely

Table 7: Fiddlehead fern bread (acceptability taste)

Indicator/Scale	Bread consumer	Percentage
Like extremely	70	65
Like very much	27	25
Like moderately	7	7
Like slightly	3	3
Total	107	100

Total mean = 8.53; Descriptive equivalent = like extremely

highly acceptable as indicated in the rating of 41% described as like extremely. The color of the fern bread products turned whitish green due to the presence of fiddlehead fern mixed with in the processing stage (Fig. 1).

Table 5 presents the acceptability level of fiddlehead fern bread in terms of aroma and flavour. The data reveal that the bread consumers like extremely (48%) the natural aroma and flavour of the fresh bread. The addition of cheesy toppings further enhanced its smell and aroma.

Table 6 shows the fiddlehead fern bread acceptability texture component. It can be gathered from the data that 68% of the bread consumers found the fern bread products highly acceptable. The texture of the bread was soft and airy inside that complements with the crunchy streusel top exterior.

Table 7 describes the acceptability of fiddlehead fern bread based on its taste component. Bread consumers found fiddlehead fern bread highly acceptable as indicated in the rating of 65% described as like extremely (Conopio, 2014).

The taste component in considered essential in making eating a pleasurable experience that one likes to



Fig. 1: The appearance of fiddlehead fern bread

repeat several times. Through palate sensation, fiddlehead fern bread was extremely liked by the bread consumer.

CONCLUSION

The acceptability of the fiddlehead fern bread in terms of appearance, color, aroma and flavour, texture and taste was extremely accepted by the bread consumers. The nutrient contents present in the new bread fern products were calcium, iron and phosphorus which are essential to the body. A large percentage of calcium supports teeth, bone and skeletal structure of the body. Iron is needed in the production of red blood cell or hemoglobin to prevent anemia and other similar blood disorders. Phosphorus helps filter out the waste in the kidneys and plays an essential role in how the body stores and uses energy.

Both bread products with fiddlehead fern and without fiddlehead fern could strongly supplement the Recommended Daily Allowance (RDA) of an individual because of the presence of calcium, iron and phosphorus. Through proper menu planning, these nutrients could be properly distributed in the daily meals and snacks preparations.

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