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Production And Evaluation Of Muffins From Nymphaea Lotus And Wheat Flour

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ABSTRACT

Nymphaea lotus is an indigenous wild crop plant belonging to herbaceous aquatic plant widely distributed in the streams, rivers and ponds. The seeds contain mineral elements such as calcium, phosphorus, potassium, magnesiumand sodium which are good for human health. The main objective of the study was to develop nymphaea composite flour for the production of muffins.A survey was conducted at the Sumbrungu community, a suburb of Bolgatanga to explore the level of acceptability of the product and its sensory characteristics such as aroma, colour, taste and texture of the muffins. In all, 50 respondents were randomly selected to perform the sensory analysis on the products coded Sample A (20% nymphaea, 80% wheat), Sample B (50% nymphaea, 50% wheat) and Sample C (75% nymphaea, 25% wheat).Data gathered was edited, coded and analysed using Statistical Package for Social Sciences (SPSS) and Microsoft Excel and the results presented into tables and figures. It was concluded that muffins can be made using composite flour made of wheat and nymphaea lotus with substitution of wheat flour from 20% to 75%.

Key words: *Nymphaea lotus*, Muffins, Composite Flour, Product Development, Baking, Gunsi

INTRODUCTION

Nymphaea lotus is an herbaceous aquatic wild crop plant widely distributed in the streams, rivers and ponds (Fulckar, 2005). It is also known as water lily and is found scattered in ponds where it floats on top of water bodies. The plant has seeds that are consumed raw by the people of Bolgatanga, the Upper East region of Ghana. Its roots are also cooked and eaten fresh or dried. The seeds can be milled into powder and use as flour (Skinner, 2006). In various parts of the world, different parts of nymphaea lotus are used for food. Somepeople use the leaves whilst others use the seeds, stems or the rhizomes (Chawanje, 1998). In West Africa, the seeds are harvested, dried in the sun and used as a grain usually prepared by boiling in salted water before eaten. The food prepared from the seeds is called 'bado' a dish that looks like rice and is eaten with stew. The roots of nymphaea lotus are used as food by the nomadic tribes in the Malian Gourma in Mali (Nordeide et al., 1994). In Bolgatanga, the seeds are referred to as 'gunsi' in Grune dialect and can be milled into flour and use as substitute for wheat flour in the preparation of different kinds of cuisines.

Muffins are referred to as baked breads in small tins. The word is derived from an old German word Muffin which means small cake. Different recipes for muffins are common in the 19th century. The types of muffins are identified by the ingredients used in production. Muffins come in both savoury varieties such as corn or cheese muffins, blueberry muffins, banana muffins, apple muffins, pumpkin chip

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muffins, cappuccino muffins. Muffins are high in complex carbohydrates and vitamin B. They are good source of fibre if they contain bran, fruits and vegetables and are made with whole wheat flour. Many recipes are high in fat, often containing 5 to 8 grams of the fat per muffin.Muffins are used as breakfast food accompanied with a cup of tea because they are easy to prepare in a short period of time. They can be used as deserts as a snack.

2.0 NUTRITIVE VALUE AND HEALTH BENEFIT OF *NYMPHAEA LOTUS*

The nymphaea seed contains high content of carbohydrate and low yield of oil and other nutritional agents and so is recommended as food supplement to people living in both rural and urban areas(Musa et al., 2012). Given the nutritional composition of the nymphaea seeds, it can provide a well-balanced diet. The proximate composition of the seeds includes ash – 0.29c, moisture – 0.45, lipids – 0.29, proteins – 0.17, fibre – 0.50 and carbohydrates – 0.37 (Wasagu et al., 2014). There is also the presence of vitamin A, C, E. The study shows that nymphaea contain mineral elements including calcium, phosphorus, potassium, magnesium, and sodium.

In the assertion of Goenka (2015), nymphaea lotus contains a steroid known as Nymphayol responsible for healing the endocrine tissues which are damaged. It has the power of stimulating insulin secretion in beta cells. It has been revealed by researchers that the rhizome of nymphaea contains starch and can be used as a tasty food. Large proportion of nutrients like protein and tannin are present in the seeds. Extraction of the flower contains anti- oxidant which helps to remain the freshness of the body.

In a study conducted by Wasagu et al. (2014), it was realized that nymphaea contains very essential minerals composition that are beneficial to the health of persons. They concluded with a recommendation that bakers should be introduced to the usage of water lily flour to reduce over dependence of wheat flour.

2.1 Wheat Flour

Wheat is the most essential stable food crop for more than one third of the world's population and contributes more calories and proteins to the diet people take than any other cereal crops (Shewry, et al., 2006). It is nutritious, easy to store and transport and can be processed into various types of food. Wheat is considered a good source of protein, minerals, B-group vitamins and dietary fiber. The nutritional composition of wheat includes protein, fat, carbohydrate, starch, sugar, thiamin, riboflavin, niacin and folate (Kumar, et al., 2011). Wheatcan be used for making porridge and milling into flour for the preparation of flour products.

2.2 Nutritional Value of Wheat

The nutritional importance of wheat flour cannot be underestimated, particularly in less developed countries where bread, noodles and other products provide a substantial proportion of the diet. It contains carbohydrate 68.5%, protein 12.6%, fat 2%, minerals 2.10% consisting of vitamin E, thiamine, riboflavin etc. Wheat is also a good source of traces minerals like selenium and magnesium, nutrients essential to good health (Topping, 2007).

Table 1: Nutritional composition of wheat flour

Element	Composition (%)
Protein	12.6
Fat	2.0
Carbohydrate	68.5
Starch	66.8
Total Sugar	1.7
Vitamin E	0.6
Thiamin	0.30
Riboflavin	0.07
Niacin	1.7
Folate	51

Source: (Kumar, et al., 2011)

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2.3 Composite Flour

When different flours are mixed together, it is known as composite flour. It is usually a mixture of flours from crops that are rich in starch. It includes yam and cassava with those crops that are rich in protein such as groundnuts and soya beans and cereals like rice, wheat and maize (Chandara, Singh, & Kumari, 2014). Nymphaea lotus contains good amount of starch and protein and other nutrients that are good for the body. Due to the amount of starch present in the seed, it makes is suitable to be mixed with wheat flour and used as a composite flour.

In this study, a composite flour of nymphaea and wheat were made and used in the production of muffins.

3.0 MATERIALS AND METHODS

3.1 Source of raw material

The nymphaea seeds wereobtained by harvesting from a pond in the Sumbrungu community. Other materials such as wheat flour, sugar, margarine, were obtained from the Bolgatanga market.

3.2 Processing of nymphaea flour

After harvesting the plant and removing the seeds, the nymphaea seeds were dehydrated by drying. The dried seeds were milled to obtain the nymphaea flour. Below is a simple diagram showing the process.

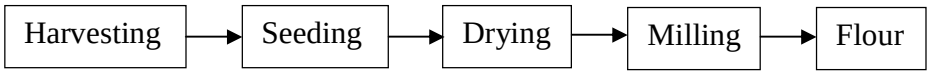

Figure 1: Flow chart of processing nymphaea lotus flour

3.3 Nymphaea Muffin recipe

Preheat oven to 375 degrees. Combine wheat flour, nymphaea flour, baking powder, and salt. In another bowl, the butter and sugar were creamed until light and fluffy. Eggs were added one at a time and beaten. Vanilla and milk were then added. On low speed, the flour was stirred into the egg mixture, stirring until just combined. Muffins pans were filled to 2/3 full. 1 tablespoon sugar was sprinkled over muffins and allowed to bake for 20 to 25 minutes. The muffins were allowed to cool in a tin for 5 minutes. Three samples of the muffins were developed using the measurement shown on Table 2.

Table 2: Ingredients and their measurements

INGREDIENTS	SAMPLE A	SAMPLE B	SAMPLE C
Wheat flour	80g	50g	25g
Nymphaea flour	20g	50g	75g
Baking powder	5g	5g	5g
Salt	5g	5g	5g
Butter	25g	25g	25g
Sugar	30g	30g	30g
Eggs	2	2	2
Vanilla	1 teaspoon	1 teaspoon	1 teaspoon
Milk	50ml	50ml	50ml

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Flow chart for making muffins

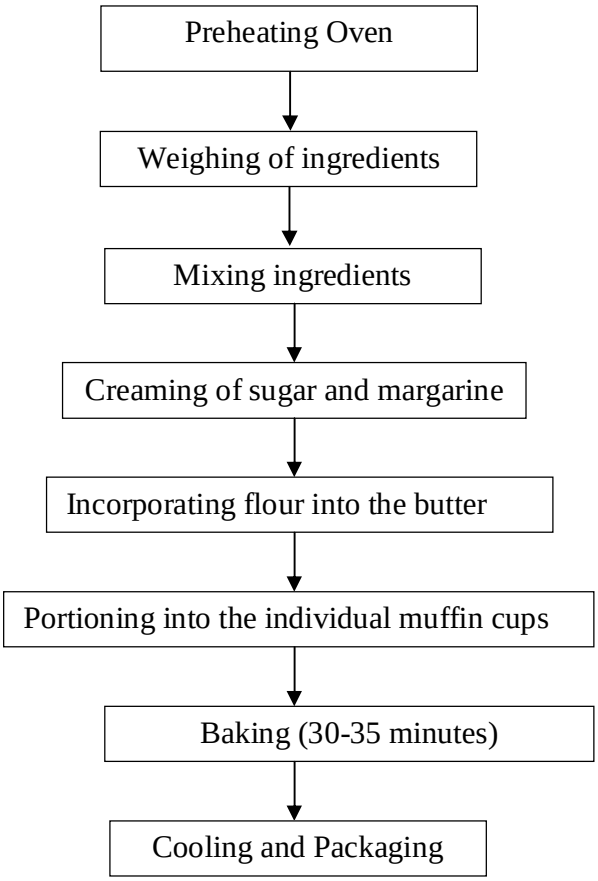

Figure 2: Flow chart of Muffins preparation

3.4 Validation of procedure

The product was developed on three (3) trial basis and professionals (caterers) and catering students were allowed to analyse the product at each process. Their suggestions were used to modify the process before the final product was produced.

3.5 Sensory Analysis

A survey was conducted at the Sumbrungucommunity a suburb of Bolgatanga to explore the level of acceptability of the product and its sensory characteristics such as aroma, colour, taste and texture of the muffins. In all, 50 respondents were randomly selected to perform the sensory analysis on the products coded Sample A (20% nymphaea, 80% wheat), Sample B (50% nymphaea, 50% wheat) and Sample C (75% nymphaea, 25% wheat) by completing the questions on the sensory ballot sheet. Respondents were given water to rinse their mouth before and after tasting each sample.

3.6 Data collection and analysis

Both primary and secondary data were gathered in the course of the study. Data gathered was edited, coded and analysed using Statistical Package for Social Sciences (SPSS) and Microsoft Excel and results presented into tables and figures.

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4 RESULTS AND DISCUSSIONS

Table 3: Gender of respondents

Gender	Frequency	Percent
Male	16	32
Female	34	68
Total	**50**	**100**

Source: **Field Work, 2019**

A total of 50 respondents were engaged in the study using a simple random sampling method. As a result, 34 females were engaged representing 68% of the total population engaged as against 32% for males. This shows that majority (68%) of the respondents were females

Table 4: Average scores obtained

	N	Minimum	Maximum	Mean	Std. Deviation
Colour A	50	2	5	4.44	0.73
Colour B	50	1	5	3.96	0.88
Colour C	50	1	5	4.56	0.70
Aroma A	50	2	5	4.52	0.71
Aroma B	50	2	5	4.06	0.74
Aroma C	50	1	5	4.38	0.88
Texture A	50	2	5	4.36	0.80
Texture B	50	1	5	4.04	0.90
Texture C	50	1	5	4.40	0.73
Taste A	50	2	5	4.42	0.78
Taste B	50	2	5	3.86	0.90
Taste C	49	1	5	4.06	1.20
Valid N (listwise)	49				

Source: **Field Work, 2019**

Sensory analysis by respondents

The respondents were asked to indicate their level of likeness of the nymphaea enriched muffins based on four sensory attributes including colour, flavour, texture and taste. The means/average scores obtained from the survey is presented on table 4above. The scale used for the ranking was from 1 (lowest

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ranking) to 5 (highest ranking) in order to identify which of the attributes attracted the respondents the most and whether those attributes could influence their demand of the product.

Colour is the visual perceptual property corresponding in humans to the categories called red, blue, yellow, etc. It refers to the appearance of the muffins produced. In muffin production, the appearance is very important. Properly baked muffins should be pale yellowish-browned. The average rankings calculated indicates that most of the respondents liked the colour of sample C containing more of the wheat flour more than sample A and B with the highest mean score of 4.56 (Table 4).

Flavour sometimes called aroma refers to a quality that can be perceived by the nasal senses. It is usually a pleasant odour. The aroma of food products usually attracts consumers the most as compared to colour. Usually people are attracted by the aroma when they first see food. The mean scores indicated that the aroma of sample A (4.52) containing more of the nymphaea flour was preferred the most as followed by sample C and B respectively (Table 4).

On the other hand, texture of the biscuit refers to its look and feel. Muffins usually have rough texture and look foamy. The mean scores obtained indicated that the texture of sample C was highly ranked by most of the respondents followed by Sample A and B. However the range of the means score obtained was above 4 for all the samples suggesting that they were all liked for their texture. This in essence suggests that the products were well prepared and the procedure could be adopted when producing nymphaea enriched muffins.

Again, respondents expressed the likeness based on taste. Taste is the sensation of flavour perceived in the mouth and throat; how sweet the muffins taste when it's put in the mouth. Sample A obtained the highest means score of 4.42 as against 4.06 and 3.86 for sample C and B respectively. It can be said that the scores obtained by Sample A containing more wheat flour may be due to the familiarity of the respondents with the wheat flour products

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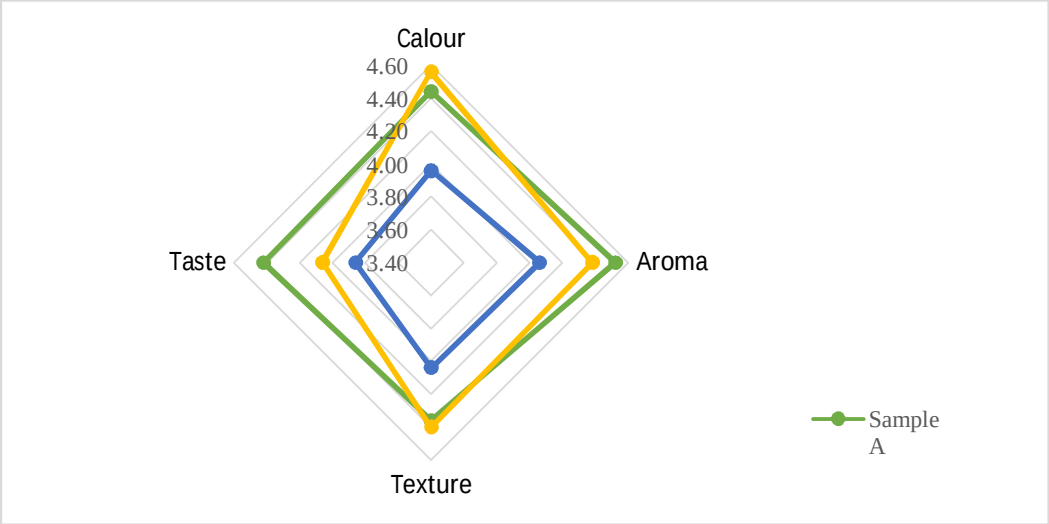

Figure 3: Web diagram showing sensory mean scores obtained

The web diagram for mean sensory scores of the developed muffins showed that the muffins produced using more of the nymphaea flour and less of wheat flour (Sample C) had the highest score in colour and texture (figure 3). It can also be seen that sample A containing more wheat flour and less nymphaea flour also had the highest mean scores in aroma and taste. The muffins containing equal proportions of wheat flour and nymphaea was the lowest ranked among the three samples in all the four sensory attributes examined during the study.

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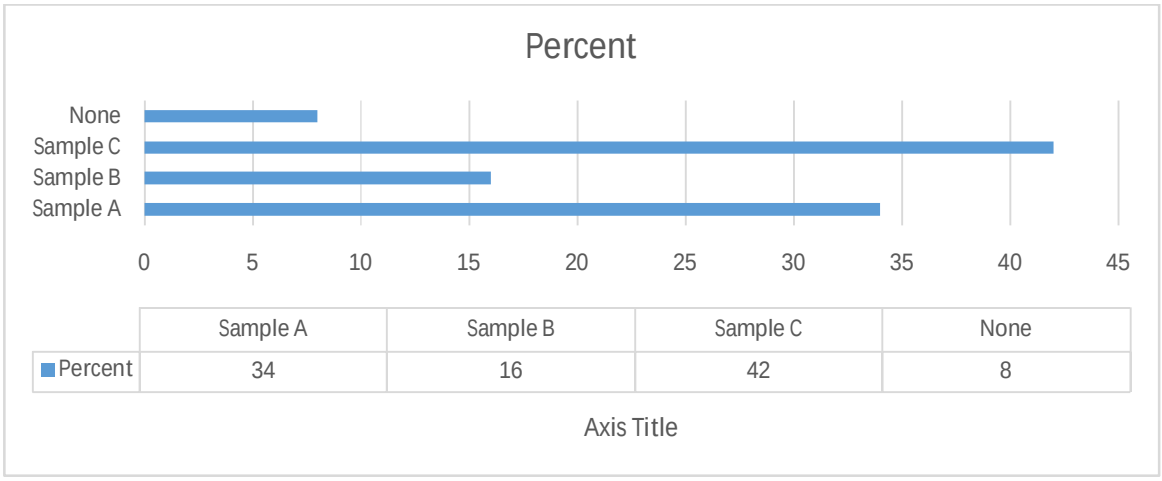
Table 1: Overall Ranking

	Colour	Aroma	Texture	Taste	Overall Score average	*Rank*
Sample A	4.44	4.52	4.36	4.42	**4.44**	***1st***
Sample B	3.96	4.06	4.04	3.86	**3.98**	***3rd***
Sample C	4.56	4.38	4.40	4.06	**4.35**	***2nd***

Source: field work 2019

The overall ranking of the muffins samples was carried out by summing all the average ranks obtained by the sample in all four sensory features and calculated an overall score average. Sample A obtained the highest means score, followed by Sample C and Sample B respectfully. The following table gives more detail.



Source: field work 2019

Figure 4: Most preferred muffin samples

From the survey conduct to test the sensory attributes of the muffins samples, it was realized that sample C was the most preferred. Respondents indicated that they would prefer to buy sample C which was made of 75% of nymphaea and 25% wheat. Some of the reasons stated where that it had unique taste and flavour from the usual wheat products. Also some respondents stated that the nutritional composition of combining wheat and nymphaea would benefit their health and therefore they would prefer that. Incorporating nymphaea flour and other flour into bread, and possibly other baked food products will result in creating opportunity for food producers to provide more healthy dietary fibre enriched products (Olubunmi, 2015). Others were of the view that it will reduce importation of wheat flour.

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Table 6: Objectives and Findings

Specific objectives	Outcome
1. To prepare flour using nymphaea seeds	- Nymphaea was successfully processed into flour through milling.
2. To make muffins using nymphaea flour	- Three (3) tasty samples of muffins were developed using the nymphaea flour produced.
3. To develop a standard recipe for the production muffins using nymphaea flour	- A recipe was successful developed and validated by using it to prepare the muffins on different occasions until it was perfected and used for the final production.
4. To conduct sensory analysis on nymphaea enriched muffins	- Sample A was liked for its colour and taste, Sample B for its aroma and Sample C for its Texture.
5. To evaluate the acceptability and possible demand for nymphaea enriched muffins	- The level of likes showed that all three sampled were good.

5.1 Conclusion

In conclusion, it is evident from the experiment that muffins can be made using a composite flour made of wheat and nymphaea flour with substitution of wheat flour from 20% to 75%.Muffins made with nymphaea flour substitutions were found to be nutritionally superior due to the nutritional composition of nymphaea including higher protein, fat and fibre content. All the samples attracted high scores during the sensory analysis conducted. The scores obtained during the sensory analysis suggested that there is overall acceptability of the three products judging from ranking of the samples on the five sensory attributes as shown of table 4. Respondents admit that the muffins were well baked and have sweet taste.

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