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Proximate Composition and Consumer Acceptability of Cookies Produced from Water Lily (*Nymphaea lotus*), Coconut (*Cocos nucifera*) and Wheat Flour (*Triticum aestivum*) Flour Composites

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Abstract The use of wheat flour as a primary ingredient in baked products in tropical countries imposes huge financial strain on local economies, in that governments spend high currency to import wheat into the country due to the fact that it cannot be cultivated locally. The aim of the study was to evaluate the proximate composition and consumer acceptability of biscuits produced from a blend of wheat, water lily and coconut flour. Five different biscuit products were prepared from a composite of wheat, water lily and dried coconut flesh flours using traditional rubbing in method with little modification. The proximate composition of the biscuits was determined using AOAC official methods. Sensory quality characteristics of the biscuits were evaluated by a panel of 50 untrained consumers under the 'hedonic scale' measure of 1-9 score points. The data was entered into Statistical Package for Social Scientist (SPSS) version 20. The Analysis of Variance (ANOVA) was carried out to establish effect of partial replacement of the wheat flour with the water lily and/ or dried coconut flesh at 95% confidence interval. The results of proximate composition of the various flour indicated increasing level of protein (g/100 g) , fat (g/100 g) and crude fibre (g/100 g) were 4.41 ± 0.22 to 16.73 ± 0.76, 6.47 ± 0.16 to 19.16 ± 0.16 and 12.54 ± 0.07 to 13.52 ± 0.04, respectively while there was decrease in levels of moisture (g/100 g), ash (g/100 g) and carbohydrate (g/100 g) as the proportion of the composite flour increased; 7.91 ± 0.03 to 10.30 ± 0.21, 0.90 ± 0.10to 4.28 ± 0.24 and 40.89 ± 1.22 to 61.99 ± 0.35, respectively. Sensory evaluation of the biscuits showed a significant difference ($p<0.05$) among the products. Biscuit sample XYZ (80% wheat, 12% water lily and 8% coconut) was preferred in terms of the overall acceptability.

Keywords: *biscuits, Nymphaea lotus, Triticum aestivum, Cocos nucifera, nutritional composition, consumer acceptability*

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1. Introduction

Biscuits are conventional wheat flour-based food products produced from dough with the use of heat by changing it into enticing products [1,2]. It forms part of the bakery products that are consumed extensively all over the world by people of all ages [3,4]. The main ingredients are wheat flour, fat, sugar and water and optional ingredients include milk, salt, flavouring agent, raising agent and additives [5]. A tropical country like Ghana spends huge foreign exchange to import wheat flour to meet their bakery demands, due to the inability of the climatic conditions in Ghana to support the commercial cultivation of wheat. It is therefore important that food product developers conduct research to identify alternative but economical sources of flour to augment the growing bakery industry.

Water lily *(Nymphaea lotus)* is an herbaceous aquatic wild crop plant widely distributed in streams, rivers and ponds, and its seeds are often eaten as vegetables [6] by the people of Upper East Region in Ghana. The seeds are locally referred to as 'gunsi' which has high moisture content. This seed has potential of being milled into flour and with the right optimizations can be used to partially replace wheat or millet flour in meal preparation, due to the relatively higher water binding capacity [7] and other favorable functional properties. Currently, "gunsi" is underutilized and records very high postharvest losses annually. Valorization of this crop can lead to extensive cultivation by local farmers which can serve as revenue generation and by extension improve their socio-economic status and livelihoods.

Coconut (*Cocos nucifera*), belongs to the family Arecaceae and the most effective species of the genus *Cocos.* It performs a critical role in the food regimen of human beings in Ghana, offering about 22% of the total calories [8]. Coconut chaff is made from coconut flesh residue, an end-product of downstream coconut milk and/ or oil extraction. This by product is often discarded though it can serve as a hub of crude fiber and thus assist in lowering of cholesterol as well as other health benefits when put back into the food chain by milling into flour [8].

Wheat (*Triticum aestivum*) is the third best main cereal crop next to rice and maize; having world production of 695 million metric tons every year [9]. Among the cereal flours, wheat is widely used in bread production aside its other uses. The exceptional cookies properties of wheat flour are because of its glutens. It produces consistent dough that retains gas and produces a light, bubbling baked product [10]. Wheat grain contains all necessary nutrients; 12% water, carbohydrates (60-80%), proteins (8-15%), fats (1.5-2%), minerals (1.5-2%), vitamins and 2.2% crude fibers.

The idea of substituting wheat flour in cookies was introduced many years ago and graded levels of wheat attained some degree of success in bakery industry [11]. Indigenous non-wheat flours have been used in substituting percentages of wheat flour in biscuits making [12]. Though this has seen some success, consumer acceptability of these composite-flour cookies has not been resounding. The search for alternative flours for baking is indeed a call in the right direction and it is expedient the government invests into such laudable and productive research. The study therefore sought to evaluate the proximate composition and consumer acceptability of biscuits produced from a blend of wheat, water lily and coconut flour.

2. Materials and Methods

2.1. Experimental Site

The experiment was conducted at the Mycotoxin and Food Analysis laboratories, Department of Food Science and Technology, College of Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

2.2 Sample Preparation

2. 2.1. Coconut Flour Production

Dried coconut was cracked, washed and then subjected to grating. Through the grating process, coconut milk was extracted by putting the residue in a clean calico cloth and squeezed out. The residue was subjected to drying in a hot air oven at 60°C for 12h to constant mass. The coconut flakes were milled with a hammer mill and sieved. Finely textured coconut flour was then obtained and packaged in airtight container until it was used.

2.2.2. *Nymphaea lotus* Flour Production

Nymphaea lotus seeds were collected from the central market of Bolgatanga. The seeds were allowed to dry in hot air oven at 60°C for 12 h to a constant mass. Once dried, the *Nymphaea* seeds were placed inside a food processor blender and pulverized for 2 to 3 min until finely textured flour was attained. It was sifted, packaged and stored in air tight container until used.

2.4. Formulation of Composite Flour and Other Ingredients for Biscuits Production

Biscuits were prepared using the traditional rubbing- in method described by Chinma *et al.* [13] with minor modification. Five different samples of biscuits were produced and coded as ABC, RBD, XYZ, DIO and ERY. Sample ABC served as the control, containing 100% wheat flour. Samples RBD, XYZ, DIO and ERY consisted of wheat, coconuts and water lily flours in different proportions (Table 1).

Table 1. Formulation of Composite Flour and other Ingredients for biscuit Production

	SAMPLES				
INGREDIENTS	**ABC**	**RBD**	**XYZ**	**DIO**	**ERY**
Wheat flour (soft) (%)	100	90	80	70	60
Nymphaea flour (%)	0	6	12	18	25
Coconut flour (%)	0	4	8	12	15
Margarine (g)	40	40	40	40	40
Sugar (g)	40	40	40	40	40
Vanilla essence (ml)	3	3	3	3	3
Salt (g)	0.5	0.5	0.5	0.5	0.5
Baking powder (g)	1.5	1.5	1.5	1.5	1.5
Milk Powder (g)	2	2	2	2	2
Water (ml)	15	15	15	15	15
Egg	1	1	1	1	1

2.5. Chemical Analyses

Proximate composition was determined using the method of AACC No.44-16, No. 08-01 and No.30-10, respectively. Nitrogen content was determined by the Kjeldahl method and converted to protein content by multiplying by a factor of 6.25. All measurements were taken in triplicate.

2.5.1. Moisture

Two grams sample was weighed and transferred into a previously dried and weighed glass crucible and placed in a hot air oven to dry for 105°C for 5 h. Samples were cooled in a desiccator, weighed, and returned to the oven to dry to constant weight. Loss in weight was calculated as percentage moisture (5).

2.5.2. Ash

Two grams of sample were transferred into a pre-ignited and pre-weighed porcelain crucible and combusted in a muffle furnace at 600°C for 2 h. The crucibles containing ash were cooled and re-weighed. Loss in weight was calculated as percentage ash content (5).

2.5.3. Crude Fat

Two grams of sample were transferred into a 22 x 80 mm paper thimble and capped with glass wool, dropped into a thimble holder and attached to a mlpre-weighed 500 ml round bottom flask containing 200 ml hexane and assembled on a semi-continuous Soxhlet extractor. The contents of the thimble were refluxed for 16 h. The hexane was recovered on a steam water bath and the flask was heated for 30 min. in an oven at 103°C. The flask containing the fat was re-weighed after being cooled in a desiccator. Increase in weight was calculated as percentage crude fat (5).

2.5.4. Protein

To two grams of sample in a kjedahl flask was added 25 ml concentrated H_2SO_4 and digested till the colour of the solution turned clear. The solution was transferred into a volumetric flask and the volume made up to the 100 ml mark with distilled water. Ten milliliters of the solution were distilled and titrated against 0.1 M HCl against a blank. Titre values of duplicate samples were recorded and percentage nitrogen calculated using the formula (1)

$$\%\,Nitrogen = \frac{(S_t - S_b)100\times 0.1\times 0.014\times 100}{Sample\ weight\times 10} \quad (1)$$

where S_t = titre of sample; S_b = titre of blank; Percentage nitrogen (%N) was converted to percent crude protein by multiplying by a factor of 6.25 (% Protein = % N x 6.25).

2.5.5. Crude Fibre

A defatted sample of about 2.0 g was transferred into a 750 ml Erlenmeyer flask containing 200 ml of boiling 1.25% H_2SO_4 and refluxed for about 45 min. The mixture was screened with cheese cloth and residue washed with large volumes of boiling water till filtrate was longer acidic. The residue was emptied into a flask containing 200 ml boiling 1.25% NaOH and refluxed for about 45 min. The mixture was screened with cheese cloth and residue washed with large volumes of boiling water till filtrate was longer alkali. The residue was transferred to a previously weighed porcelain crucible (M1) and dried for 1 h at 100°C and re-weighed after cooling in a desiccator (M2). The crucible was ignited in the muffle furnace at 600°C for 30 min and re-weighed after cooling in a desiccator (M3). The increase in weight was calculated as percentage crude fibre (5).

2.5.6. Available Carbohydrate

The available carbohydrate content present was calculated by difference [(100- 5m)], where m = proximate of moisture, fat, ash, fibre and protein (5).

2.6. Sensory Analysis of Biscuits

Sensory quality characteristics of the biscuits were evaluated by a panel of 50 untrained consumers' using a 9-point Hedonic scale where 9 = like extremely; 8 = like very much; 7 = like moderately; 6 = like slightly; 5 = neither like nor dislike; 4 = dislike slightly; 3 = dislike moderately; 2 = dislike very much; 1 = dislike extremely. Biscuits samples made from each flour combination were presented in coded white disposable plastic container. Sachet water was provided to rinse the mouth between evaluations. The biscuits were evaluated for their colour, appearance, flavour, texture, taste and overall acceptability.

2.7. Statistical Analysis

Data was analyzed using analysis of variance (ANOVA). Tukey Test was used to determine significant differences among the various samples in duplicate. Data were analyzed using the software, Statistical Package for Social Science (SPSS) version 20.00 (SPSS inc., Chicago), IL, USA at the 0.05 level of significance.

3. Results and Discussions

3.1. Proximate Composition

Table 2 shows the results of the proximate analysis of the various biscuit samples produced. The moisture contents for the biscuits ranged from 4.39 % ± 0.37 to 8.53 % ± 0.11. Statistical analysis of the samples showed significant difference ($p<0.05$) among the samples. The biscuit sample ABC had the highest moisture content of 8.53 %± 0.11 while sample ERY recorded the lowest moisture content of 4.39% ± 0.37It was also observed that the moisture content of the biscuit also decreased with increasing composite flour addition (ABC > RBD > XYZ > DIO > ERY). This is due to the dry nature of both the coconut and nymphaea flours. The relatively lower moisture content recorded in the current study for all samples could help prolong the shelf life of the biscuit. The moisture content of the control samples ABC, RBD and XYZ were similar to that produced by Ndife et al. [14] from whole wheat flour and full fat soya bean flour. The biscuit samples ERY and DIO had the lowest moisture content and this suggests they will relatively have a longer shelf-life since lower moisture content of baked products is critical for prolonging the shelf life [15]. The other biscuit samples may however have a shorter shelf-life since high moisture content has been associated with short shelf life of baked products, as they encourage microbial proliferation that lead to spoilage [16,17].

The ash content ranged from 1.84 % ± 0.28 to 2.28 ± 0.12 with sample ERY having the highest ash content while ABC had the lowest ash content. From the results, there was no significant ($p>0.05$) difference between the ash contents for the biscuit samples. The ash content of all samples except ERY (60% Wheat flour, 25% *Nymphaea* flour, 15% Coconut flour) were lower than what was recorded by Abayomi et al. [18]. The ash content of any food material represents the inorganic elements obtained after the combustion of the organic materials in the food and these inorganic materials are composed of mineral element (Calcium, Magnesium, Iron, Phosphorus) which are important for building rigid structures and regulatory functioning of the body. The presence of the high ash content in the biscuit as compared to the flour could be due to the addition of other ingredients during the biscuit preparations. Minerals in food are used by the body for building strong bones to transmit impulses, make hormones and maintain a normal heartbeat [19], the relatively high ash content of the biscuits can serve as a source of mineralization of the body when consumed.

The crude protein content of the biscuit ranged from 9.04 to 9.74% and sample ERY (60% Wheat flour, 25%

Nymphaea flour, 15% Coconut flour) having the highest (9.74%). The crude protein content of the five formulations was significant different from each other. In this study replacement of wheat flour by coconut and nymphaea flours increased the protein content of biscuits essentially. incorporation of composite flour into wheat flour has the potential to upgrade the protein content of biscuits, which can be used to lessen the challenges of protein energy malnutrition which is often recorded in developing countries. Sample ABC (100% wheat flour) had the least crude protein content (9.04%). This could be attributed to the elevated proportion of protein content of the composite flour as reported in literature by Edem et al. [20] and Ndie et al. [21]. Abayomi et al. (2013) reported a much higher protein content (17.65-21.65%) for their biscuits produced from sweet potato flour and soybean flour. The protein content of the biscuits increased as the percentage of composite flour increased (Table 2). Protein in food is very essential as is responsible for body building and repair of worn out tissues. Proteins are important food components, especially for children since they are needed as building blocks for the body, necessary for growth and for the repair of damaged tissues [22]. People who consume these products will therefore benefit immensely.

Sample ERY (60% wheat flour, 25% nymphaea flour and 15% coconut flour) had the highest fat content of 35.70% followed by sample DIO (70% wheat flour and nymphaea flour18% 12% coconut flour) which had a fat content of 35.14% and sample ABC (100% wheat flour) had the least fat content (28.21%). This could be attributed to the high percentage of oil in coconut and nymphaea flour. The fat content for the five sample formulations were significantly different ($p < 0.05$) from each other. There was significant increase in the fat content as the level of coconut and *Nymphaea* flours increased. Ndie *et al.* [21] had reported a level of 47.7% in African walnut as a substitute to wheat flour in cookies preparation. This finding is also similar to that of Hagenmaier [23] whose work was in coconut flour and wheat flour cookies. The fat content of all samples was higher than that of a biscuit (5.25%) with 70% sweet potato flour and 30% soybean flour produced by Abayomi et al. [18]. These differences could be attributed to the different ingredients (wheat flour, Nymphaea flour, coconut flour) used for the biscuits in this study. Fat is very important in food as it helps in the absorption of vitamins and it also fills fat cells and insulates the body to keep it warm. Therefore, the biscuit samples could be the source of the fat the body needs to perform it functions as stated earlier by Hagenmaier [23].

The crude fibre content ranged from 1.87 ± 0.03 to 2.85 ± 0.07 for the five biscuit varieties. Biscuit sample ERY (60% Wheat flour, 25% Nymphaea flour, 15% Coconut flour) recorded the highest amount (2.85) of crude fibre. The least was recorded by sample ABC (Wheat flour). The study reported significant ($p<0.05$) differences in the crude fibre of all samples. Increasing the content of the Nymphaea flour and Coconut flour in the preparation of the product resulted in the corresponding increase in the fibre in the biscuit samples content. Coconut is known to have higher content of fibre. This implies that the biscuit contains the appropriate amount of fibre which is of good value to the consumer. This trend is similar to the work of Soronja-simovic et al. [24] that showed an increase in crude fiber of chestnut cookies. The crude fibre content of all samples were however lower than those produced by Srivastava et al. [25] which ranged from (12.54-13.52%) and Ndife et al. [14] which ranged from and 3.29-5.73%. Fibre in food facilitates easy digestion in the colon and reduces constipation [17].

The carbohydrate content ranged from 43.91 ± 0.57 to 52.09 ± 0.12 for the biscuit varieties. Sample XYZ (80% Wheat flour, 12% Nymphaea flour, 8% Coconut flour) had the highest (52.09%) and the lowest was recorded by DIO (70% Wheat flour, 18% Nymphaea flour, 12% Coconut flour) with a content of 43.91%.The study reported significant ($p<0.05$) differences in the carbohydrate of all samples. The carbohydrate content of all samples was lower than that reported (ranges 64.52-70.32%) by Abayomi et al. (18). They were however similar to those reported (49.3-59.5%) by Owiredu et al. [26] except samples DIO (70% Wheat flour, 18% Nymphaea flour, 12% Coconut flour) and ERY (60% Wheat flour, 25% Nymphaea flour, 15% Coconut flour) which recorded 43.91% and 47.24%, respectively. The high carbohydrate content of the sample XYZ suggests a high energy content of the biscuits and high-energy foods tend to have a protective effect in the optimal utilization of other nutrients [22]. This means the biscuit will serve as a good source of energy for children and all its consumers. Similar trend was observed by Iwe, et al., [27]. Carbohydrates are sources of essential energy for the body and are good source of vitamins and minerals.

Table 2. Proximate composition of biscuit

Sample	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Fibre (%)	Carbohydrate (%)
ABC	8.53 ± 0.11^{a}	1.84 ± 0.28^{a}	9.04 ± 0.13^{ab}	28.21 ± 0.49^{a}	1.87 ± 0.03^{a}	50.48 ± 1.03^{c}
RBD	8.24 ± 0.18^{ab}	1.87 ± 0.50^{a}	9.25 ± 0.35^{ab}	27.37 ± 0.59^{a}	1.90 ± 0.00^{a}	51.40 ± 0.92^{c}
XYZ	7.47 ± 0.08^{bc}	2.04 ± 0.47^{a}	9.36 ± 0.44^{b}	26.31 ± 0.08^{a}	2.21 ± 0.01^{b}	52.09 ± 0.12^{c}
DIO	6.91 ± 0.07^{c}	2.16 ± 0.14^{a}	9.47 ± 0.28^{ab}	35.14 ± 0.71^{b}	2.56 ± 0.07^{c}	43.91 ± 0.57^{a}
ERY	4.39 ± 0.37^{d}	2.28 ± 0.12^{a}	9.74 ± 0.00^{a}	35.70 ± 0.18^{b}	2.85 ± 0.07^{d}	47.24 ± 0.36^{b}

Values represent means and standard deviation replicate readings for various parameters. Values in the same column with different superscripts are significantly different ($p>0.05$).Keys: ABC = 100% (Wheat flour), RBD = 90, 6, 4, XYZ = 80, 12, 8 (Wheat flour, Nymphaea flour, Coconut flour), DIO = 70, 18, 12 (Wheat flour, Nymphaea flour, Coconut flour), ERY = 60, 25, 15 (Wheat flour, Nymphaea flour, Coconut flour), *Carbohydrate.

Table 3. Sensory attributes of biscuit

Sample	Colour	Taste	Aftertaste	Hardness	Overall
ABC	7.63 ± 0.95^{bc}	7.77 ± 1.13^{a}	7.62 ± 1.17^{ab}	7.79 ± 0.98^{ab}	7.83 ± 0.73^{b}
RBD	7.85 ± 0.70^{b}	8.04 ± 0.97^{a}	7.83 ± 1.00^{ab}	7.48 ± 1.21^{bc}	8.10 ± 0.80^{b}
XYZ	8.61 ± 0.72^{a}	8.15 ± 0.72^{a}	7.96 ± 0.82^{a}	8.12 ± 1.18^{a}	8.58 ± 0.67^{a}
DIO	7.35 ± 1.00^{b}	7.67 ± 0.76^{a}	7.42 ± 0.82^{b}	7.02 ± 1.06^{cd}	7.67 ± 0.88^{b}
ERY	6.56 ± 0.80^{d}	6.81 ± 1.02^{b}	6.73 ± 1.07^{c}	6.50 ± 1.26^{d}	6.88 ± 0.92^{c}

Values represent means and standard deviation replicate readings for various parameters. Values in the same column with different superscripts are significantly different (p>0.05). Keys: ABC = 100% (Wheat flour), RBD = 90, 6, 4 (Wheat flour, Nymphaea flour, Coconut flour), XYZ = 80, 12, 8 (Wheat flour, Nymphaea flour, Coconut flour), DIO = 70, 18, 12 (Wheat flour, Nymphaea flour, Coconut flour), ERY = 60, 25, 15 (Wheat flour, Nymphaea flour, Coconut flour).

3.2. Consumer Acceptability of Biscuit Samples

The results of the sensory evaluation as presented in Table 3 shows that, panelists rated the colour of the various biscuits from 6.56 to 8.61. They were thus rated as like slightly to like very much. Colour is the foremost and most important sensory attribute that influences consumer preference and acceptance for any product especially in food products. From the hedonic scale, product XYZ, was rated like extremely whiles the rest was rated like very much. The results for sample XYZ was significantly different from the other samples (Table 3). Colour generally refers to the appearance of the product. It is one the sensory attributes consumers explore in purchasing new products due to it aesthetic appeal. These findings are similar to reported study by Zoulias et al. [28] who concluded that colour is a vital quality trait of biscuit. Colour is produced through a process of visual perception in the eyes resulting from the stimulation of the retina by light (wavelengths between 380 and 760 nm). Hefnawy et al. [29] reported that adding chickpea flour to wheat flour in toasted bread improved color acceptance as judged by their panelist. Aleem et al. [30] were of the view that the colour traits of biscuit became darker with the expansion in concentration of defatted composite flour, the grainy appearance of the biscuit from incorporated formulation was increasingly acceptable. Sample ERY recorded the least score for colour and can be attributed to the levels of substitution in the composite flour and heating moreover changes the colour of the biscuit surface; namely, the browning process. This is because wheat flour contributes to the development of desirable colour in baked products.

The taste of the various biscuit products ranged from 6.81 to 8.15. The products were thus rated as being like slightly to like very much. Product XYZ (Wheat flour 80%, N*ymphaea* flour 12%, Coconut flour 8%) liked very much by the taste panel when compared to the other samples. There were significant (p<0.05) differences in taste among the various samples. This could be as a result of variation among the ingredients used in the preparation of the biscuits. Hossain et al. [31] showed that combining coconut flour at distinctive extents in cake detailing improves upon the cake quality especially within the range of its supplement and tangible properties such as taste, smell and texture. However, concurring to Sujirtha and Mahendran [32], upon substitution of wheat flour with coconut flour at high amount (50%) within the generation of biscuits, there was diminishing within the score for taste. Similar results were observed by Kefalas et.al [33] in their studies. Taste is a chemical sense stimulated by the taste receptors upon interaction with taste stimuli on the tongue. Based on the results, it can be concluded that fortification of wheat flour affected the taste of the biscuit.

The hardness of the biscuit samples was rated as like slightly to like very much. In the current study, panelists rated the hardness of the various biscuits products from 6.50 to 8.12, with product XYZ (Wheat flour 80%, N*ymphaea* flour 12%, Coconut flour 8%) rated as the best followed by RBD (Wheat flour 90%, *Nymphaea* flour 6%, Coconut flour 4%), ABC (Wheat flour 100%), DIO (Wheat flour 70, *Nymphaea* flour 18%, Coconut flour 12%) and ERY (Wheat flour 60%, *Nymphaea* flour 25%, Coconut flour 15%). From the hedonic scale, product XYZ (80% Wheat flour, 12% N*ymphaea* flour, 8% Coconut flour) was rated liked extremely while the rest was rated liked very much. Product XYZ was significant different (p<0.05) from the rest of the products. Similarly, the findings further revealed that product ABC (100% Wheat flour) has the least variation among the ingredients used in the preparation of the biscuits and ERY has wider variability. Aleem et al. [30] stated a straight decline in total weight, breadth, spread proportion and hardness of biscuit as the degree of defatted soy flour combination increased. Different kinds of flour generally influence their dietary values and physical characteristics, such as hardness and spread proportion as well as colour parameters. These findings are similar to that of Yadav et al., [34] and Aleem et al. [30] who concluded that biscuit thickness was accounted for to increase with the increase of incorporation of composite flours.

Consumers rated the aftertaste of the various biscuits products from 7.42 to 7.96, with product XYZ (80% Wheat flour, 12% N*ymphaea* flour, 8% Coconut flour) rated as the best followed by RBD (90% Wheat flour, 6% *Nymphaea* flour, 4% Coconut flour), ABC (100%Wheat flour), DIO (70% Wheat flour, 18% *Nymphaea* flour, Coconut flour 12%) and ERY (60%Wheat flour, 25% *Nymphaea* flour, 15% Coconut flour). From the hedonic scale, product XYZ (80% Wheat flour, 12% N*ymphaea* flour, 8% Coconut flour) was rated liked extremely while the rest was rated like very much. The aftertaste of the samples significantly (p<0.05) differed from each other.

Product XYZ (80% Wheat flour, 12% N*ymphaea* flour, 8% Coconut flour) was significant different from the rest of the products. Similarly, the findings further revealed that product ABC has the least variation among the ingredients used in the preparation of the biscuits and XYZ has wider variability. The findings of the current studies agree with Sujirtha and Mahendran [32] because majority of the consumers opted for product XYZ since it contained 80% of wheat flour, 12% nymphaea and 8% coconut but also agree with Bawalan [8] who said partial substitutions of wheat flour with flour from coconuts and Nymphaea lotus composite have the potential of reducing wheat imports and also adding value to otherwise low value crops which often does not give returns to growers. Aftertaste refers to the taste remaining in the mouth after eating the products. In this study, the remarks made by the panelists after tasting the products were rated as presented in Table 2. Biscuits can barely be respected as a healthy snack in most cases, they contain high levels of quickly digested carbohydrate, high fat, for the most part, low levels of fiber and a considerable amount of protein [35]. A possible solution of high cost of wheat importation is to use coconut and nymphaea flour for preparing biscuits since they are highly enjoyed by Ghanaians.

In this study the taste panelist rated the overall acceptability of the various biscuit products from 6.88 to 8.58. Sample XYZ (80% wheat, 12% Nymphaea flour, 8% Coconut flour) rated as 8.58 and the least rate was sample ERY (60% wheat, 25% Nymphaea flour, 15% Coconut flour). Statistical analysis showed significant ($p<0.05$) differences among the products. Findings further revealed that product ABC has the least variation among the ingredients used in the preparation of the biscuits and sample ERY (60%Wheat flour, 25% *Nymphaea* flour, 15% Coconut flour) has wider variability. Consumers choose foods based on the quality which is the degree of excellence and include taste, appearance and nutritional content which have significant and make for acceptance [36]. Hallab et.al [37] studied the nutritive value and organoleptic properties of white Arabic bread supplemented with soybean and chickpea. They demonstrated that over all acceptability scores decreased with increased chickpea flour fortification level in the final product. The surface, flavour and appearance of biscuits are major qualities that influence biscuit acceptability [38]. In addition, numerous studies have examined the properties of gluten-free biscuits utilizing distinctive sorts of rice flours, such as white rice flour with buckwheat flour [38]. These results are similar to Alice and Rosli [39] and Islam et al., [40].

4. Conclusion

The study showed that blending coconut and *Nymphaea* flours with wheat flour had a significant effect on the proximate composition on the biscuits. The results on proximate has shown that supplementing wheat flour with coconut and *nymphaea* flour resulted in considerable improvement in the protein, fat and fibre content but reduced the moisture, ash and carbohydrate contents. The results also indicate that biscuit sample from 80% wheat, 12% *nymphaea* and 8% coconut flour was preferred most to that of the rest of biscuit samples produced. This preference decreases with increasing content of the composite flour. In addition, biscuit sample XYZ (80% Wheat flour, 12% *Nymphaea* flour, 8% Coconut flour) could be recommended as the ideal formulation of preparing a healthy traditional wheat-coconut-*nymphaea* blend biscuit for the consumption of local populace.

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