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Quality Assessment of Noodles Produced from Wheat (*Triticum aestivum*), Orange Fleshed Sweet Potato (*Ipomea batatas*) and Sesame (*Sesamum indicum*) Blends

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Abstract: *Noodles, a staple food was produced from blends of orange fleshed sweet potato (OFSP) (Ipomea batatas) and Sesame (Sesamum indicum) as a composite flour and substituting with Wheat flour (Triticum aestivum) at different proportions of 100:0:0 (Wheat), 90:5:5 (Wheat, OFSP, Sesame), 80:10:10 (Wheat, OFSP, Sesame) and 80:15:5 (Wheat, OFSP, Sesame). These formulated blends were used to produce noodles and the noodles were subjected to proximate analysis and sensory evaluation. Results from the proximate analysis revealed that fat, fiber and ash were higher in the formulated blends than the control while Carbohydrate and Protein decreased with increase in OFSP. Moisture content of the control was higher and significantly different ($p<0.05$) from other samples. The result of the Sensory evaluation based on a nine-point hedonic scale showed that apart from the control which was the most acceptable, noodles supplemented with OFSP up to 15% and Sesame 5% were acceptable by the panelists.*

Keywords: *Noodles, Orange Fleshed Sweet Potato (OFSP), Physicochemical properties, Quality assessment, Sesame.*

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I. Introduction

Noodles is a staple food made from unleavened dough which is stretched, extruded or rolled flat and cut into one of a variety of shapes. A single noodle can be made, eaten, or extruded from a serving of noodles but it is far more common, to serve at once. Noodles are usually cooked in boiling water sometimes with cooking oil or salt added and are often served with an accompanying sauce or in a soup [1]. Extrusion in food processing technology is a process which combines several unit operations including mixing, cooking, kneading, shearing, shaping and forming, it is done by forcing a set of mixed ingredients through an opening in a perforated plate or die with a design specific to the food and it is then cut to a specified size by blades [2].

Wheat (*Triticum aestivum*) is the most common cereal available all over the world. It is a staple crop, one of the most wholesome food items and it ensures a diet rich in nutrients. Wheat provides an immense energy source in all parts of the grain kernel including the bran, germ and endosperm and the nutrient value of wheat is retained even after processing it into flour. Wheat is rich in catalytic elements, mineral salts, calcium, magnesium, sulphur, silicon, manganese, zinc, vitamin B, iodide and vitamin E and this is why it is often used as a foundation of nourishment [3]. Wheat can be easily integrated into pastas, cakes, bread, muffins and pancakes, or simply sprinkled over a favourite cereal or yoghurt [4].

In developing countries consumption of vitamin A in the diet is next to nothing as most people depend or eat mainly energy giving foods. Lack of vitamin A in the body leads to night blindness. Vitamin A is critical for the development of good vision as it is an essential component of rhodopsin, a pigment in photoreceptor cells in the eye. Eating orange fleshed sweet potato reduces the prevalence of vitamin A deficiency. Vitamin A is also necessary for normal organ formation and maintenance. Orange fleshed sweet potato varieties contain more than 50 fold of carotene which is converted to vitamin A after ingestion [5].

Sesame (*sesamum indicum*) is one of the oldest oil seed crops. It is an excellent source of copper and a very good source of manganese, calcium, magnesium, vitamin B, zinc, selenium and dietary fiber. It contains two unique substances sesamin and sesamolin. Both of these belong to a group of beneficial fibres called Lignans, and also protect the liver from oxidative damage [6]. Sesame has one of the highest oil contents of any

seed. With a rich nutty flavor, it is a common ingredient in Cuisines across the world [7; 8]. Sometimes sold with its seed coat removal (decorticated this variety is often present on top of baked goods in many countries [9].

The increasing consumption of noodles has led to concerned efforts to explore the feasibility of using instant noodles as a vehicle for vitamin A fortification. While several technological and implementation challenges remain, this food appears to have the potential to be an effective food vehicle for vitamin A fortification [10]. Orange Fleshed Sweet Potato (OFSP) is considered to be promising in biofortification programs. The intense orange flesh is due to the high content of beta carotene, an average 115mg per kilogram of this nutrient per fresh root [11]. The present study aimed to develop noodles, study the physicochemical properties and determine the acceptability of noodles formulated with orange flesh sweet potato (OFSP) and sesame blends.

II. Materials and Methods

Wheat flour, salt, edible oil and sesame seed were gotten from Owode local market at Offa Kwara State. Orange fleshed sweet potatoes were gotten from a farm at Okuku, Osun State and transported down to Offa, Kwara State. Orange fleshed sweet potatoes and sesame seeds were processed into flour in the production of noodles. A pasta-making machine model: Dolly Mini P3, City; Italy was used in this study in which relatively dry dough is forced into the holes in the die under a pressure of approximately 6895kpa. Standard weight of raw materials was used for each experimental run. Figures 1 and 2 showed the production flow charts of OFSP and sesame flours.

Sample Formulation

Samples	**Wheat**	**OFSP**	**Sesame**
Sample A	100	___	___
Sample B	90	5	5
Sample C	80	10	10
Sample D	80	15	5

Samples	**Wheat**	**OFSP**	**Sesame**	**Water**	**Oil**	**Salt**
A	500g	___	___	400ml	10ml	8g
B	225g	12.5g	12.5g	200ml	5ml	4g
C	200g	25g	25g	200ml	5ml	4g
D	200g	37.5g	12.5g	200ml	5ml	4g

Noodles Production

The samples were mixed, kneaded and extruded using a Pasta maker after which the shaped noodles were steamed at 60^0C for 15 minutes. The steamed noodles were then dried for 3 hours at 70^0C. Figure 3 shows the production of noodles.

Proximate analysis

The determination of the chemical composition of the noodles samples viz: moisture content, ash content, protein content, fat content, crude fiber and content were determined by methods described by [15]. Carbohydrate was calculated by difference method.

Sensory Analysis

Sensory evaluation of the noodles samples were carried out by 10 panelists on a 9 point hedonic scale for different parameters such as colour, aroma, taste, texture and overall acceptability as described by [16].

Statistical Analysis

Data obtained were statistically analyzed using the analysis of variance (ANOVA) and the Duncan Multiple range test with significance level at $p<0.05$ [17].

III. Results and Discussion

Moisture Contents

Moisture contents of the noodles samples are shown in Table 1. Moisture content of a given product is critical for microbial growth and determination of shelf life [18]. Sample A (100% Wheat) had the highest moisture content (10.10%) and was significantly different ($p<0.05$) from other samples. The moisture content of Samples B, C and D (8.06%, 8.02% and 8.03% respectively) were not significantly different ($p>0.05$) and were below the 10% moisture level recommended for safe keeping of flour samples [19]. The lower the moisture content of a product, the longer the shelf life [20]. This indicated that Samples B, C, and D could be kept longer than Sample A; lower moisture content would elongate the shelf stability of the product.

Protein Contents

Table 1 shows the protein contents of the noodles formulations. Protein also termed the building block of the body because it is vital in the maintenance of body tissues including development and repair. Protein is also needed for growth, aids the immune system and also controls biochemical reactions in the body. The protein contents were significantly different ($p<0.05$) with Sample A having 12.92%. Sample B had 12.37%, Sample C having 11.89% and Sample D having 11.06%. The amount of OFSP and sesame incorporated into the noodles had a decreasing effect on the protein content of the noodles. The values obtained differed from the values obtained by [21] whose values for noodles from blends of Wheat, Acha, and Soybean were 14.92%, 13.38 and 26.47 respectively. This difference could be as a result of different ingredients used for the composite flour in producing the noodles.

Fat Contents

Fat contents of the noodles samples are shown in Table 1.The fat content in the samples varied significantly ($p<0.05$) from each other. The higher the level of sesame added, the higher the fat content. This was due to the fatty nature of sesame seed. Fat is needed to support certain metabolic processes in the body of living organisms and it is equally a source of energy. The values of fat ranged from 5.11% – 15.98%. Sample A (control sample) had the lowest fat content. This result was in line with reports of [21].

Crude Fibre Contents

Crude fibre increased significantly as the level of OFSP increased. This was due to the fact that sweet potatoes generally are a rich source of dietary fibre. Crude fiber is important in adding bulkiness to food and for prevention of certain diseases of the colon. The crude fiber obtained from various samples showed that Sample A had the lowest amount of crude fiber with 0.15% and was significantly different to sample B which had 0.82%. Samples C and D were not significantly different with 0.93% and 1.00% respectively. This trend was also observed in a study conducted by [22] in noodles produced from blends of Stinging Nettle Leaves and Wheat Flour.

Ash Contents

The total ash contents were in the ranged from 2.17% to 2.45%. The higher the OFSP and sesame added, the higher the ash content. The total ash content was significantly different with sample D having the highest total ash and sample A (100% Wheat) having the lowest total ash (2.17%). There was no significant difference between the total ash of Samples C and D which were 2.38% and 2.45% respectively. Sample B had a total ash content of 2.29%. Comparable results were recorded by [22].

Carbohydrate Contents

The carbohydrate content decreased with increase in the percentage of OFSP added. The carbohydrate content ranged from 61.50% - 69.58%. The carbohydrate content were significantly different among the samples; samples A, B, C and D having 69.58%, 68.70%, 63.79% and 61.50% respectively. The low amount of carbohydrate which is a major source of energy can be compensated for in other samples with high amount of fat as fat can also be utilized in the body to give energy. Similar carbohydrate results were obtained in the noodles produced from blends of Stinging Nettle leaves and Wheat flour [22].

Sensory Evaluation

Table 2 below shows the result for the sensory evaluation of noodles produced from wheat, OFSP and sesame blends. The scores of the sensory attributes were generally high in all samples of noodles after cooking. The taste of the samples also referred to as the gustatory sense, involves a chemical sense of direct stimuli dissolved by saliva and the taste buds, located primarily on the surface of the tongue. Sample A (8.10) was the most preferable in terms of taste while Sample C (6.30) was the least acceptable. This could be as a result of its being produced from whole wheat flour which consumers are already accustomed to. Sample A (8.0) was the

most preferred in terms of colour because it is the control sample while sample C (6.10) was the least acceptable because of the high percentage of OFSP and sesame blends which affected the colour of the samples. The low score for colour obtained by the sample C could be as a result of the high contents of both OFSP and sesame flours. In terms of aroma, which deals with perception of flavor, sample A (7.8) was the most preferred while Sample C (6.50) was the least preferred. The aroma of the flour blends might have overshadowed the normal aroma of the wheat.

Texture is the sensory dimension which is used to organize attributes like feel, shape, smoothness, and roughness. Sample A (7.90) was the most preferred amongst the samples while Sample C (6.70) was the least preferred. Sample was rated high for its texture because of gluten content in the wheat which contributed to its highly rated texture which was in contrast to the low score rate achieved by sample C with high contents of other flour blends (OFSP and sesame).

Overall acceptability deals with how well consumers accept or detest a sample. Sample A (8.10) was the most preferred because it was the control. Sample D (7.40) also had a high preference in all the attributes especially in the colour. Sample C (5.90) was the least preferred in all the attributes. This could be as a result of the high percentage of sesame in the sample.

IV. Figures and Tables

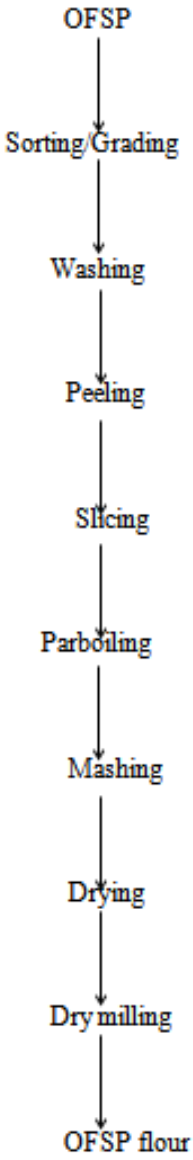

Figure 1: Flow Chart for Orange Fleshed Sweet Potato Flour; Source: [12]

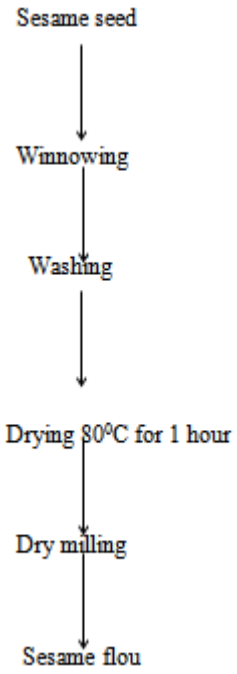

Figure 2: Flow Chart for Sesame Flour; Source: [13]

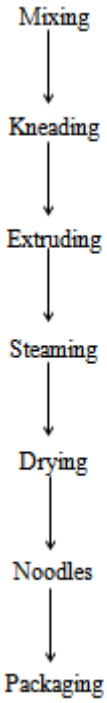

Figure 3: Flow Chart for Production of Noodles; Source: [14], with modifications

Table 1: Results for Proximate composition of Noodles Samples

Parameters/Samples	A	B	C	D
Moisture (%)	10.10±0.42^b	8.06±0.06^a	8.02±0.08^a	8.03±0.04^a
Protein (%)	12.92±0.04^d	12.37±0.06^c	11.89±0.57^b	11.06±0.08^a
Fat (%)	5.11±0.01^a	7.78±0.05^b	13.01±0.04^c	15.98±0.03^d
Crude Fibre (%)	0.15±0.01^a	0.82± 0.02^b	0.93± 0.05^c	1.00± 0.03^c
Total Ash (%)	2.17± 0.01^a	2.29± 0.04^b	2.38± 0.03^c	2.45± 0.03^c
Carbohydrate (%)	69.58±0.46^d	68.70±0.11^c	63.79± 0.14^b	61.50±0.14^a

*** Mean values with the same superscripts are not significantly different ($p \leq 0.05$).

Table 2: Results for Sensory Evaluation of Noodles Samples

Parameter/Samples	A	B	C	D
Taste	8.10^{d}	7.20^{c}	6.30^{a}	7.00^{b}
Colour	8.00^{d}	7.40^{b}	6.10^{a}	7.70^{c}
Aroma	7.80^{d}	7.10^{b}	6.50^{a}	7.20^{c}
Texture	7.90^{d}	6.10^{a}	6.70^{b}	7.40^{c}
Acceptability	8.00^{d}	7.20^{b}	6.40^{a}	7.60^{c}

*** Mean values with the same superscripts are not significantly different ($p \leq 0.05$)

V. Conclusion

Noodles can be produced from wheat, OFSP and Sesame blends. OFSP and sesame are potential sources of increased nutrients in human food. Addition of OFSP and sesame to wheat flour increased the amount of fat, fibre and ash while decreasing the moisture content which is good for longer shelf stability. This implies that wheat flour can be supplemented. Therefore substituting wheat flour with OFSP at 15% and sesame at 5% would give noodles which is more nutritious, affordable and acceptable.

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