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Acceptability Evaluation of Cookies Formulated from Composite Flour of Wheat, Carrot and Tiger Nut Flour.

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ABSTRACT

Cookies are one of the low cost processed foods that are most widely consumed all over the world. They have some notable advantages over conventional snacks in that they are cheaper, easy to use at home or even during travel, easily available in wide variety of shapes, sizes, tastes, packs, and appeals to all age groups. This research was undertaken to formulate and produce cookies from composite flours of wheat, carrot and tiger nut. Four samples of cookies were produced at different proportion of wheat/carrot/ tiger nut composite flours in the following ratios; 100%: 0%:0% (Formulation I), 75%: 15%:10% (Formulation II), 50%:25%:25% (Formulation III) and 40%:30%:30% as (Formulation IV). Carrot tubers were trimmed, scrapped, cut and blanched. Then, the blanched carrots were soaked in ice cube to prevent further cooking, dry milled, blended, sieved and packaged. Also, tiger nut seeds were sorted, washed, dried, cooled, dry milled, sieved and packaged. Flour blends were prepared by mixing wheat flour with carrot flour and tiger nut flour respectively. Each of this blends were mixed with Sugar (30g), baking powder (1.5g), Salted butter (10g), Eggs (30g), Shortening (10g) and milk powder (5g) and were for baking cookies. Cookies samples were subjected to sensory evaluation within 24 hours after production. The following attributes namely: taste, aroma, texture, appearance, color and overall acceptability were assessed on the cookies samples using a 9-point hedonic scale. Twenty five (25) panelists familiar with cookies were involved in the assessment. The choices for the panelists were based on availability and interest and care was taken to ensure that they were neither sick nor allergic to baked products. The panelists were instructed to rinse their mouth with water after each tasting. Results were analyzed statically using Analysis of Variance (ANOVA). The mean of sensory scores varied with increased in addition of carrot and tiger nut flours to the wheat flour. There was no significant difference in the general acceptability of cookies from blended samples, except from formulation I which 100% wheat flour. The mean of sensory scores, however, showed that the panelists preferred the cookies from formulation II (75%: 15%:10%). This study has shown that, cookies of acceptable quality can be produced from composite flours of wheat, carrot and tiger nut, which would increase nutritional status, thereby contributing towards overcoming malnutrition challenges developing countries.

Keywords: cookies, formulation, carrot, tiger nut and composite.

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1. INTRODUCTION

Cookies are a flat, crisp flour-based baked food product usually consumed as snacks. The principal ingredients for biscuits are flour, fat, sugar and water; while other ingredients include milk, salt, flavoring agent and aerating agent (Wade, P., 1988). In Nigeria, cookies are second to bread as the most consumed cereal foods, because they are readily available in local shops as ready to eat, convenient and inexpensive food products containing digestive and dietary principles of vital importance (Kulkami, S.D., 1997). Biscuits are nutritive snacks made from unpalatable dough that is transformed into appetizing products through the application of heat in the oven in the process of baking (Olaoye, O.A, *et al.*, 2007). Cookies are considered as energy giving food because they are rich source of fat and carbohydrate and they are also a good source of protein and minerals (Kure, O.A., *et al.*, 1998).

Consumption of cookies and similar foods made from wheat has become so popular in Nigeria that total elimination of wheat from the dietary pattern of cookies could have nutritional and socio economic implications. Ready-to-eat baked products consumption is growing rapidly in Nigeria resulting to increasing reliance on imported wheat for their production (Akpapunan, M.A. and Darbe, J.W. 1999). In Nigeria, staple crops that are grown other than wheat such as cassava, yam or sweet potatoes, tiger nut bread fruits, rice and cereals can be used for baked foods (Oluwamukomi, M.O., *et al.*, 2011). The inclusion of other staple crops such as sweet potatoes and tiger nut which are locally grown and readily available in the production of baked foods such as cookies will boost Nigeria's economy through job creation, reduction in importation of wheat and the likes. Efforts are therefore, made to partially replace wheat flour with non-wheat flours in order to increase the utilization of Nigeria's indigenous crops as well as contribute to lowering cost of production of bakery products (Ayo, J.A and Gaffa, T., 2002).

Many researchers have delved into studying the physical and baking properties of composite cookies from starchy staples like cassava, cocoyam and plantain (Horsfall, M.D. *et al.*,). Oluwole and Karim (2006), produced cookies from various blends of Bambara, cassava and wheat flours respectively, Duru *et al.*, (2019), produced biscuit from wheat and tiger nut while Onabanjo and Ighere (2014), produced cookies from a blend of sweet potatoes and wheat flour.

Wheat is an important source of carbohydrates. It is a major source of vegetable protein in the human diet, with a protein content of about 13%, which is relatively low in protein quality for supplying essential amino acids (Kim, J.E., *et al.*, 2019). Wheat, eaten as a whole grain, is a source of many nutrients and fiber. Glutenin and gliadin are functional protein found in wheat that contributes to the structure of dough. Wheat does not contain adequate of vitamin A precursors as well as minerals (Jariyah, J., *et al.*, 2018).

Tiger-nut (*Cyperus esculentus*) is an underutilized crop which has been found to be cosmopolitan perennial crop of the same genus as the papyrus plant (Oddemelan, S.A., 2003). The high crude lipid, carbohydrate contents and its fairly good essential amino acid composition makes it a valuable source of food for man and can be consumed raw or processed into other valuable products. According to Belewu & Abodunrin (2009) and Adejuyitan *et al.*, (2009), tiger-nut produces high quality oil about 25% of its content and oil was implicated as lauric acid grade oil, non- acidic, stable and very low unsaturation.

Cyperus esculentus has been reported to be “health” food since consuming it can prevent heart disease and thrombosis (blood clot formation in the blood vessel) (Chukwuma, E.R. *et al.*, 2000). It is considered a good flour additive for bakery industry since it contains high amount of natural sugar thereby avoiding the necessity of adding extra sugar and the tiger-nut Flour does not lose any of its nutritious properties in the milling process (Akajiaku, L.O. *et al.*, 2018).

Carrot (*Daucus carota* L) is one of the important nutritious root vegetables grown throughout the world. It is an excellent source of phytonutrients such as phenolics, polyacetylenes and carotenoids (Babic, *et al.*, 1993; Hansen *et al.*, 2003; Block, 1994). The main physiological function of carotenoids is as precursor of Vitamin A (Nocolle, *et al.*, 2003). Carotenoids are potent antioxidants present in carrots which help to neutralize the effect of free radicals. Reports are having showed that have inhibitory mutagenesis activity thus, contributing to decrease risk of some cancers (Dias, J.S., 2012). This study aim to investigate the production and consumer acceptability of cookies produced from composite flours of wheat enrich with carrot flour.

2. METHODS AND MATERIALS

2.1. Sample Collection

Wheat flour, tiger nut and carrot (*Daucus carota* L) used for this study were purchased from Muda lawan market at Bauchi, Bauchi State, Nigeria. The wheat flour was a commercial baker’s grade milled by Golden Penny, Nigeria. Other ingredients such as sugar, margarine, fresh eggs, sodium bicarbonate (baking powder) were also purchased from the market and transported to the Department of Food Technology, Federal Polytechnic. Bauchi, Nigeria.

2.2 Sample preparation

2.2.2 Preparation of carrot powder

Carrot tubers were prepared using the method described by Mohammed and Hussein (1994). The carrots were trimmed, scrapped, washed and cut into 1cm cube and thoroughly mixed. The carrot cubes were blanched in a water bath (Precision stainless steel, model- 184) at 70°C for 20mins with solution of 2% glycerol, 1% calcium chloride and 0.1% sodium metal bisulphate which were dissolved in distilled water (to prevent loss of carotenoid). Immediately after blanching, the carrot were soaked in distilled water contain ice cubes for 0°C for 15mins to prevent further cooking.

The blanched carrot cubes were placed in a stainless pan and dried in oven at 72°C for 48hrs. After drying, the cubes removed and blend with food processor (Cuisinart, Smart powder Duet^(R) BFP-703). The powder was later dried in food dehydrator at temperature of 70°C for 15mins. It was dried until moisture content below 0.34%. The powdered carrot was sieved and package in cellophane bag for subsequent used.

2.2.3 Tiger Nut Flour

The method described by Eke-Ejiofor and Deedam (2015), was adopted for tiger nut flour production. The dry brown tiger nuts were sorted to remove particles, thoroughly washed to remove dirt, dried in an oven at 105 °C for 25 min, cooled, milled, sieved and packaged in clean, dry plastic containers and covered tightly to avoid moisture absorption.

2.3. Formulation of Flour Blends

Flour blends were prepared by mixing wheat flour with carrot flour and tiger nut flour respectively. Flour was in the following percentage proportions of 100:0:0, 75:15:10, :50:25:25 and 40:30:30. Each of these blends were mixed with Sugar (30g), baking powder (1.5g), Salted butter (10g), Eggs (30g), Shortening (10g) and milk powder (5g) and were for baking cookies (table 1)

Table 1: Formulation table for composite flour of wheat, tiger nut flour blended with carrot powder

Ingredients	A	B	C	D
Wheat flour	100g	75g	50g	40g
Carrot flour	0g	15g	25g	30g
Tiger nut flour	0g	10g	25g	30g
Sugar	30g	30g	30g	30g
Baking powder	1.5g	1.5g	1.5g	1.5g
Butter	10g	10g	10g	10g
Egg	30g	30g	30g	30g
Shortening	10g	10g	10g	105g
Milk powder	5g	5g	5g	5g

KEY:

- A: 100 % (wheat flour), 0% (carrot flour) 0% (tiger nut flour).
- B: 75% (wheat flour), 15% (carrot flour), 10% (tiger nut flour)
- C: 50% (Wheat flour), 25% (carrot flour), 25% (tiger nut flour)
- D: 40% (wheat flour), 30% (carrot flour), 30% (tiger nut flour).

2.4 Sensory Evaluation

Cookies samples were subjected to sensory evaluation within 24 hours after production. The following attributes namely: taste, aroma, texture, appearance, color and overall acceptability were assessed on the cookies samples using a 9-point hedonic scale with 9 as extremely liked and 1 as extremely disliked (Ihekoronye, A.I. and Ngoddy, P.O., 1985).

Twenty five (25) panelists familiar with cookies were involved in the assessment. The choice for the panelists were based on availability and interest and care was taken to ensure that they were neither sick nor allergic to baked products, The panelists were instructed to rinse their mouth with water after each tasting.

2.5. Statistical Analysis

Results were analyzed statically using Analysis of Variance (ANOVA) and means were separated by Least Significant Difference (LSD) procedure (Ihekoronye, A.I. and Ngoddy, P.O., 1985).

3. RESULTS AND DISCUSSION

Table 2: Sensory assessment of cookies blended with wheat/carrot/tiger nut flour

Parameters	A	B	C	D
Appearance	7.62 ± 1.20 ^c	7.22±0.23 ^b	6.48±0.50 ^a	6.24±1.42 ^c
Aroma	7.24±1.00 ^a	6.94±0.84 ^c	6.40±0.10 ^b	6.38 ±0.01 ^c
Texture	6.80±2.04 ^c	6.72±0.02 ^b	6.48±0.08 ^b	6.38±0.04 ^a
Taste	7.30±0.02 ^c	7.22±0.16 ^c	6.13±0.18 ^c	6.04 ±0.20 ^b
Color	6.68±0.14 ^b	6.84±0.0 ^a	6.64±0.14 ^a	6.40±0.04 ^a
General Acceptability	7.44±0.04 ^a	7.20±0.12 ^c	6.48±0.16 ^a	6.08±0.140 ^c

Values are means of triplicate determination ±SD. Value on the same column with the same superscript are significantly different (P <0.05)

KEY:

- A: 100 % (wheat flour), 0% (carrot flour) 0% (tiger nut flour).
- B: 75% (wheat flour), 15% (carrot flour), 10% (tiger nut flour)
- C: 50% (Wheat flour), 25% (carrot flour), 25% (tiger nut flour)
- D: 40% (wheat flour), 30% (carrot flour), 30% (tiger nut flour).

The results of sensory evaluation of wheat/carrot/tiger nut blends showed significant difference ($P \leq 0.05$) at all levels of substitution in terms of appearance while samples C and D do not show much significant difference ($P > 0.05$) in terms of taste, texture, color aroma and general acceptability (table 2). Substitution levels of 75% wheat: 15% carrot: 10% tiger nut (B) composite flours are selected based on general acceptability by the panelist. The control of (100:0:0) wheat cookies sample has the highest values for overall sensory parameters assessed. The sensory scores were found decreasing with addition of carrot and tiger nut flour.

The study has shown that wheat, carrot and tiger nut composite flour has the potential of producing cookies of acceptable quality without altering the sensory properties of the final products. These substitutions also served as conditioners, improving the nutritional value of cookie as well as channeling our nature’s goodness in producing ready to eat snacks whose consumptions are on the increase in Nigeria and as well reduce total dependency on wheat which in turn will reduce production cost by reducing importation cost.

4. CONCLUSION

The study has shown that cookies of acceptable quality can be produced from composite flour of wheat, carrot and tiger nut. The substitution of carrot and tiger nut in cookies production would promote production, value addition and diversification of underutilized vegetable in developing countries. This would be great for wealth and enhance food security. The cookies supplement with carrot and tiger nut flours were well accepted. This would not only save foreign exchange used on wheat importation, provide nutritious cookies and prevent malnutrition but would also reduce the postharvest loss of carrot and tiger nut by value addition, i.e conventional foods.

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