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PRODUCTION AND QUALITY EVALUATION OF COOKIES PRODUCED FROM THE BLENDS OF COCOYAM AND MALTED SOY BEAN FLOUR

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Abstract

Composite cookies were produced from the ratio of 100: 0 %, 90:10, 80:20 and 70:30 for cocoyam and malted soy bean respectively. The samples were compare with 100 % wheat flour (Control) Cookies produced were evaluated for Proximate, functional, mineral and sensory evaluations. The

Keywords

cookies, cocoyam, malted soya bean, quality evaluation, malnutrition

INTRODUCTION

Cookies are nutritive snacks produce from unpalatable dough that is processed into appetizing product through the application of heat in an oven (Anozie *et a l.,* 2014). Cookies are ready to eat, convenient and in-expensive food product containing digestive and dietary principle of vital importance (Olaoye *et al.*, 2007). They differ from other baked foods like bread because they are low moisture content making them comparatively free from microbial spoilage and increase the self-life and eating quality of the product (Hanan, 2013).

In the recent year, there have been an increase demand for gluten free and

results obtained from functional analysis of the composite flour were oil absorption capacity (0.90 – 1.13), water absorption capacity (1.00 – 2.13) swelling capacity (2.25 – 4.42), bulk density (0.36 – 0.48). The proximate composition of the samples ranged from (3.06 – 5.00%), (13.01 – 16.99%), (5.36 – 17.42%), (1.62 – 2.04%), (1.84 - 4.89%), and (55.84 – 73.17%) for moisture, crude protein, fat, crude fibre, ash content and carbohydrate, respectively. Mineral content obtained were calcium (0.01 – 0.08 mg/100g) and phosphorous (0.10 - 0.16mg/100g), iron (0.02 - 0.93 mg/100g) and zinc (0.02 – 0.02 mg/100g). Sensory evaluation of the bread samples showed that (100% wheat flour) sample was the most acceptable followed by the cookies produced from 100 % "cocoyam". While cookies made from 70 % cocoyam and 30 % malted soy bean was the least acceptable to the panelist. Cookies produced from substitutions with malted soy bean flour enhanced the protein content of the cookies and would reduced the malnutrition problem in the developing country.

Nutritious products that are suitable for people with celiac diseases and other health problem. Cocoyam and soybean flour is therefore used as a substitute for wheat flour to produce cookies that is rich in dietary fiber and to reduce the cause of celiac disease and improve the nutrition status of baked product. (Hanan, 2013)

Cocoyam *(Xenthosoma sagilthfelium*) is a monocotyledon plant and a tropical plant grown primarily as a root crop for its edible corm. It is an important source of energy and a well-recognized staple food, with a very good source of dietary fiber (Boudjeko *et al., 2005).*

Nutritionally, cocoyam has a greater advantage over other tuber and root crops. It is rich in vitamin B6 and Magnesium which help to control high blood pressure and protect the heart. (Boudjeko *et al., 2005*).

Soybean *(Glycine max)* is an annual herbaceous legume plant of the pea family Leguminosae and subfamily Papilionnidea (Pampluna and Roger, 2004). It is an excellent source of protein (35-40%) and the seed is reported as the richest in food value of all plant foods consumed in the

world (Kure *et al.,* 1998). Soybean is a cheap source of quality protein that is superior to all other plant foods because it has a good balance of essential amino acid and it contains a reasonable amount of methionine lacking in cereal, which makes it a good supplement for cereal. (Fukushima, 2008). Malted soybean is legumes that has been dried in a process known as malting, the malting process involve soaking, germination and drying. The aim is to change the legume into malt with enzyme and vitamins content. Enzymes produced during malting convert starch into more digestible maltose and increase the absorption rate of vitamin during digestion. The malting process predigest the soybean (Misty, 2004).

MATERIALS AND METHODS

Source of Materials

Cocoyam (*Xanthosoma sagittifollium*) was purchased from Oje market Ibadan, Oyo state. Soy beans, milk powder, sugar, egg, salt, margine, and other ingredients was obtained from Owode market Sango Saki. Equipments, and other facilities used in the research work was obtained from the laboratory of Food Science and Technology, of The Oke-Ogun Polythenic Saki.

Preparation of Cocoyam

The cocoyam cormel (*xanthosoma Sagittifolium*) was processed into flour using the method described by (Oti and Akobundu, 2007). The cocoyam cormel was peeled, sliced and washed in water. The slices were blanched at 75^{o}c for 15minutes. The blanched sliced was oven dried at 60^{o}c for 9 hours and was milled into flour and sieved. The cocoyam flour was stored in polythene bag, labelled and kept in a cool dry place for further analysis.

Malted soybean flour was processed using the method of (Iwe, 2003) The clean Soybean seeds was soaked overnight in a stainless steel bucket, drained and was spread on a clean jute bag, covered to screen from direct sun light. The seeds were allowed to germinate for 96 hrs. at room temperature and dried in cabinet dried at 60°C for 8 hrs., milled into flour using hammer mill. The flour was sieved with the aid of a 425 µm sieve to obtain a uniform particle size of flour and was packaged in polyethylene bag and stored at 46^{o}C.

Formulation of Blends

Cocoyam flour and malted soy bean flour were blended in different ratio (100:0 %, 90: 10 %, 80: 20 % and 70: 30%, respectively) while wheat flour (100%) was used as control The blended composite flour were coded as 421 (Wheat flour 100 %), 422, 423, 424 and 425

Preparation of cookies from cocoyam and malted soy bean flour

The method described by Joel et al (2014) was used with slight modification. The pre- weighed composite flours were thoroughly mixed with other baking ingredients (salt, sugar and baking powder, shortening and eggs) in a mixer to form batter. The batter was rolled to a sheet of uniform thickness, passes through a series of molding, shaping and stamping and baked in the oven for 45min at 260^{oc} cooled and stored in polyethylene nylon for analysis.

Analyses

Physical Attributes

Weight, thickness and spread ratio were determined according to the method described by AACC (2000)

Proximate composition of the Cookies.

The proximate composition: moisture, crude protein, fat, ash and crude fiber were determined according to the method of AOAC (2002). Carbohydrate was determined by the difference of (100 - % moisture, % protein, %fat, %ash and % crude fiber)

Determination of mineral analysis

Calcium, phosphorous, iron and zinc were determined by AOAC (2000) method using atomic absorption spectrophotometer (AAS) (Perkin-Elmer-Crop, Norwalk, Model 560)

Functional Properties of flour blends

The water and oil absorption capacity, bulk density and swelling index were determined according to the method of Onwuka (2005) with slight modification.

Sensory Evaluation

The cookies samples were subjected to acceptability test: colour, taste, texture, aroma, crispness and overall acceptability by 20 semi- trained panelists, using a 9-point hedonic scale with 1= dislike extremely and 9= like extremely (Iwe, 2001)

Statistical Analysis

Data obtained were analysed using analysis of variance (ANOVA) and the significant difference observed among various treatment at $p < 0.05$ was separated with Duncan's Multiple Range Test using the Statistical Package for Social Statistics (SPSS) version 20 (Iwe, 2002)

Results and Discussions

Physical Analysis of the Cookies Sample

The result of the mineral properties of cookies samples produced from blends of cocoyam flour and malted soybean flour is shown in Table 1. Weight of the cookies ranged from 6.70 to 11.7 0%. Decrease in weight occurred with an increase in the incorporation level of malted soybean flour. Diameter of the cookies ranged from 3.0 to 3.4. Significantly difference ($p< 0.05$) existed in all the samples. Thickness of the cookies ranged from 0.61 to 0.7 mm, sample 424 having the lowest value of 0.61 mm while sample 425 having the highest value of 0.7mm. The hydrophilic nature of the flour used in the products could result to decrease in thickness. (Chinma and Gernah 2001). Spread ratio of the cookies ranged from 42.80 to 55.7%, sample 425 having the least value of spread ratio while the highest spread ratio was recorded in sample 424.Significant differences of ($p \leq 0.05$) existed in all the cookies samples.

Table 1: Result of the Physical Analysis of Cookies

Samples	Weight	Diameter	Thickness(mm)	Spread ratio
421	$6.70^{c} \pm 0.28$	$3.3^{a} \pm 0.08$	$0.66^{c} \pm 0.01$	$50.0^{b} \pm 0.02$
422	$7.10^{b} \pm 0.42$	$3.3^{d} \pm 0.05$	$0.65^{c} \pm 0.02$	$50.70^{b} \pm 0.04$
423	$11.70^{a} \pm 0.99$	$3.2^{c} \pm 0.05$	$0.69^{b} \pm 0.01$	$46.30^{c} \pm 0.02$
424	$11.60^{d} \pm 0.57$	$3.4^{d} \pm 0.00$	$0.61^{e} \pm 0.01$	$55.70^{a} \pm 0.02$
425	$10.25^{c} \pm 1.06$	$3.0^{a} \pm 0.05$	$0.70^{a} \pm 0.00$	$42.80^{c} \pm 0.04$

Keys:

Sample 421 - 100% wheat flour, Sample 422 -100 % cocoyam flour, Sample 423- 90 % cocoyam flour +10 % malted soybean flour, Sample 424 - 80 % cocoyam flour + 20 % malted soybean flour and Sample 425 - 70 % cocoyam flour + 30 % malted soybean flour

Proximate Composition

The result of the mineral properties of cookies samples produced from blends of cocoyam flour and malted soybean flour is shown in Table 2. Moisture content of the sample ranged from 3.06 to 5.00 %, cookies produced from (80 % cocoyam flour and 20 % malted soybean flour) having the lowest value. Atobatele *et al., (*2016), reported the value of (5.45%) in the chemical composition and sensory evaluation of cookies baked from the blends of soya bean and maize flours which was comparable to the value obtained (5.00 %). Protein content of the cookies varied from 13.01 to 16.99%, sample 425 having the highest content of 16.99%. The protein content of the samples increased significantly with the increased of the substitution level of malted soya bean flour. Similar protein content value was reported by Ayo *et.,al* (2014), in Production and evaluation of malted soybean-acha composite flour bread and biscuit.

Also from Table 4.2, the fat content of the cookies ranged from 5.36 to 17.42 %. Least value was shown in sample 421. An increase in the fat content of sample 425 could be due to the high fat content of the malted soybean (Iwe, 2003). Crude fiber of the sample ranged from 1.62 to 2.04 %. Agu *et al..,* (2015) reported similar value in the evaluation of quality attribute of soy breakfast cereal flour. Ash content of the sample ranged from 1.84 to 4.89 %, sample 421 having the least ash content while sample 425 having the highest ash content. Oluwamukomi *et al.,* (2010) reported similar ash content in the physiochemical and sensory properties of wheat-cassava, soy enriched composites cookies. Carbohydrate content of the sample ranged from 55.84 to 73.17 %. Sample produced from 70% cocoyam and 30 % malted soybean flour having the lowest Carbohydrate content of 55.84%. Okpala *et al.,*(2010) recorded (72.28%) in the Nutritional and evaluation of cookies produced from pigeon pea, cocoyam and sorghum

flour blends which was comparable to the value (73.17%) obtained in this work.

Table 2: Result of the Proximate Analysis of the Cookies Samples

Samples	Moisture %	protein %	fat %	Fiber %	Ash %	Cah%
421	5.00 ^{a}± 0.07	13.01^{d}± 0.19	5.36 ^{c} ± 0.98	1.62^{b}±0.13	1.84 ^{d} ±0.30	73.17 ^{a} ±1.67
422	4.18 ^{b} ± 0.11	13.84 ^{c} ± 0.12	9.94 ^{b} ±1.03	1.78 $^{a\,b}$ ±0.02	3.39 ^{c} ±0.15	64.42 ^{b} ±1.04
423	3.06 ^{c} ± 0.07	15.72 ^{b} ±0.19	11.48 ^{b} ±0.74	1.95 ^{a} ± 0.09	3.99 ^{b} ±0.15	63.29^{b}±1.37
424	4.33 ^{b} ±0.16	16.82^{a}± 0.00	16.35 ^{a} ±0.92	2.00 ^{a} ± 0.11	4.31 ^{b} ±0.05	56.97 ^{c} ±1.51
425	4.45 ^{b} ± 0.28	16.99 ^{a} ± 0.25	17.42 ^{a} ±1.29	2.04 ^{a} ±0.10	4.89 ^{a} ±0.16	55.84 ^{c} ±0.00

Means value with the same superscript within the column are not significantly different ($p > 0.05$)

Keys:

Sample 421 - 100% wheat flour, Sample 422 -100 % cocoyam flour, Sample 423- 90 % cocoyam flour +10 % malted soybean flour, Sample 424 - 80 % cocoyam flour + 20 % malted soybean flour and Sample 425 - 70 % cocoyam flour + 30 % malted soybean flour

Mineral Analysis

The result of the mineral properties of cookies samples produced from blends of cocoyam flour and malted soybean flour is shown in Table 3. There were significant differences between the calcium content of the samples. An increase in the calcium content recorded from the cookies produced from 70% cocoyam and 30% malted soybean flour could due to the fact that cocoyam is naturally rich in calcium, with high incorporation level of malted soybean flour which is also rich in calcium. Phosphorus content of the cookies varied from 0.10 to 0.16 mg/kg, minimum value of 0.10 was recorded in sample 421 while a maximum value of 0.16 mg/kg was recorded in sample 425. The iron content of the cookies increases with an increase in the incorporation level of malted soybean. All the samples analyzed for zinc have the same value of 0.02mg/kg. and there was no significant different in all the samples. The value 0.02mg/kg. obtained was lower than 0.24 mg/ k reported by Atobatele, *et al.,* (2016) for Chemical

Composition and Sensory Evaluation of Cookies Baked from the blends of soya bean and maize flours

Table 3: Result of the Mineral Analysis of the Cookies Sample

Samples	Calcium (mg/kg)	Phosphorus(mg/kg)	Iron(mg/kg)	Zinc (mg/kg)
421	0.01^{c}±0.00	0 .10^{c}±0.00	0 .02^{e}±0.00	0 .02^{b}±0.00
422	0.01^{d}±0.00	0.10^{c}±0.00	0. 52^{c}±0.00	0.02^{a}±0.00
423	0 05^{a}±0.00	0 .15^{b}±0.00	0 .63^{d}±0.00	0.02^{b}±0.00
424	0.06^{c}±0.00	0 .15^{b}±0.00	0 .83^{a}±0.00	0 .02^{b}±0.00
425	0.08^{b}±0.00	0.16^{a}±0.00	0.93^{b}±0.00	0.02^{a}±0.00

Means value with the same superscript within the column are not significantly different ($p > 0.05$)

Keys:

Sample 421 - 100% wheat flour, Sample 422 -100 % cocoyam flour, Sample 423- 90 % cocoyam flour +10 % malted soybean flour, Sample 424 - 80 % cocoyam flour + 20 % malted soybean flour and Sample 425 - 70 % cocoyam flour + 30 % malted soybean flour

Functional Properties

The result of the functional properties of the flour blends of cocoyam and malted soybean flour is shown in Table 4. Bulk density of flour blend ranged from 0.57 to 0.78 g/cm^3, Bulk density of the flour decreases with an increase level of malted soybean flour. Bulk density measure the heaviness of the flour (Abraham and Jayamuthungal, 2014). Water absorption capacity of the samples varied from 1.00 to 2.13 %, Water absorption capacity describes how the flour associate with limit amount of water (Singh, 2001). Oil absorption capacity of the sample ranged from 0.90 to 1.13 % Swelling capacity of the sample varied from 2.50 to 3.73 (g/g), sample 425 having the lowest value of 2.50 (g/g).

Table 4: Result of the Functional Analysis of the Flour Blend Samples

Samples	BD(g/cm^3	TBD	WAC%	OAC	SC(g/g)
421	0.78^{d}±0.02	0 .48^{c}±0.00	1.00^{c}±0.03	0.90^{b}±0.00	3.73^{a}±0.32
422	0.71^{b}±0.01	0.49^{a}±0.09	1.65^{b}±0.02	1.11^{a}±0.02	4.23^{a}±0.35
423	0 .62^{d}±0.03	0 .47^{bc}±0.01	1.64^{b}±0.07	1.13^{a}±0.00	4.38^{a}±0.40
424	0.59^{c}±0.02	0.38^{abc}±0.01	1.56^{b}±0.06	1.13^{a}±0.00	4.42^{a}±0.45
425	0 .57^{a}±0.01	0 .36^{ab}±0.00	2.13^{a}±0.06	1.13^{a}±0.00	2.50^{b}±0.38

Means value with the same superscript within the column are not significantly different ($p > 0.05$)

Keys:

Sample 421 - 100% wheat flour, Sample 422 -100 % cocoyam flour, Sample 423- 90 % cocoyam flour +10 % malted soybean flour, Sample 424 - 80 % cocoyam flour + 20 % malted soybean flour and Sample 425 - 70 % cocoyam flour + 30 % malted soybean flour

Keys

BD =Bulk density, TBD= Tapped bulk density, WAC= Water absorption capacity

OAC=Oil absorption capacity, SC= Swelling capacity

Sensory Evaluation of the Cookies

The result of the Sensory attributes of the Cookies produced from the Blends of Cocoyam and Malted soybean are presented in Table 5. The cookies produced from 100 % wheat (control) was rated best by the panelist in all the sensory parameters: colour, taste, texture, aroma, crispness and overall acceptability. Ranked next was the cookies produced from 100 % cocoyam flour. While cookies made from 70% cocoyam and 30 % malted soyabean rated least r by the panelists. All the samples evaluations have score above like moderately.

Table 5: Sensory Evaluation of the Cookies Sample

Sample	Colour	Taste	Texture	Aroma	Crispiness	overall Accept.
421	8.50^{a}±.88	8.30^{a}±.92	7.50^{a}±1.42	7.80^{a}±1.10	7.50^{a}±1.53	8.45^{a}±1.09

422	6.25 ^{b}±1.83	6.60^{b}±1.95	6.15 ^{b}±1.74	6.10^{b}±2.18	6.35 $^{a\,b}$±1.75	7.10^{a}±1.41
423	5.20^{b}±2.26	5.55^{c}±1.84	5.70^{c}±2.53	5.50^{c}±1.96	5.55^{b}±2.98	5.50^{c}±1.63
424	5.70^{b}±2.10	5.60 ^{bc}±2.62	5.25 ^{bc}±2.26	5.25^{c}±2.38	5.70^{b}±2.67	5.44^{c}±1.86
425	5.10^{b}±1.91	5.20 ^{bc}±2.22	5.10 ^{c}±2.22	5.22^{c}±2.59	5.35^{b}±3.09	5.35^{c}±1.68

Means value with the same superscript within the column are not significantly different ($p > 0.05$)

Keys:

Sample 421 - 100% wheat flour, Sample 422 -100 % cocoyam flour, Sample 423- 90 % cocoyam flour +10 % malted soybean flour, Sample 424 - 80 % cocoyam flour + 20 % malted soybean flour and Sample 425 - 70 % cocoyam flour + 30 % malted soybean flour

Conclusion

From the study, it was observed that cookies sample produced from flour blend using the ratio of 70% cocoyam flour and 30% malted soybean generally have the highest protein, ash, fiber and mineral content than other cookies samples produced from flour and other ratio. Cookies produced from flour blends of cocoyam and malted soybean using different ratio was competed favorably with the cookies produced from wheat flour. This result suggested that cocoyam can serve as a good substitute for wheat flour in the production of cookies and the addition of soybean could improve it nutritional quality and also reduce the importation cost of wheat flour.

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