WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Nutritional and Tourists' Sensory Evaluation of Enriched Ipekere at Ikogosi Warm Spring, Ekiti State.

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ABSTRACT

Ipekere made with improved maize, soybean, and ginger pastes underwent nutritional and sensory assessments. The composite paste underwent experimental design using the Optimal Mixture Design of Response Surface Methodology. Maize paste (86.85-91.09%), soybean paste (5.91-10.15%), and ginger paste (0-3%) were the variables. Responses included mineral compositions and proximity. In order to create Ipekere, four (4) pastes were chosen and employed. These Ipekere were then taste-tested by visitors to Ikogosi Warm Spring, Ikogosi. The results showed that the enriched ipekere had significantly higher protein, fat, ash, and fiber contents while having lower moisture and carbohydrate levels. The enriched ipekere's improved nutritional value indicates that the items are wholesome, and the decreased moisture and carbohydrate content denotes a more shelf-stable item. The tourists in Ikogosi Warm Spring, Ikogosi, accepted the enriched ipekere's organoleptic qualities. For ipekere enrichment, a composite paste of 86.06% maize, 14.1% soybean, and 3.0% ginger was deemed the most suitable combination.

Keywords: Nutritional, Tourists, Sensory, Ipekere, Ikogosi Warm Spring

INTRODUCTION

The pursuit of smells capes and tastes in food has driven tourists to visit a destination where food is an attribute perceived as an attraction to a destination besides its climate, accommodations, and attractive scenery, according to Atinah et al. (2010). Local food may not be the primary motivation for a tourist to visit a destination, but it occupies a substantial role as a secondary or partial motivation in choosing a destination. Additionally, Mak et al. (2012) found that visitor' interests in and preferences for cuisine influence their choice of destination in a study of tourists' preferences for a place. In addition to being a basic requirement for travelers, food is also a crucial component for comprehending and learning more about the local culture and identity, which enhances the perception of a location (Lopez-Guzmain & Sanchez-Canizares, 2012). Henderson et al. (2012) and Mkono et al. (2013) highlighted the role that food plays in tourists' overall enjoyment as well as how it may act as a lasting memory of a place.

Nummedal and Hall (2006) defined local food as food that is cultivated and prepared locally without the addition of any foreign ingredients. According to Ajala et al. (2017), the majority of locally cultivated staple crops in Nigeria used to create food are primarily starches with very little protein and a poor amino acid profile. Many regional cuisine products can be made from maize, a popular staple crop. These regional dishes include pap, aadun, agidi, and ipekere. All foods made from maize are mostly starchy, so they require supplements to improve their nutritional qualities. Ipekere, a regional food item made from maize and unique to the southwest of Nigeria, is produced locally. It is made by frying food in palm oil. Considering that Ipekere is made from maize, it is high in starch but low in protein (Oluwamukomi et al., 2017). A high-protein local crop, soybeans, might be added to maize as a good complement. Protein, fat, and minerals have all been discovered to be abundant in soybean (Nwokolo, 1996). Additionally, ginger is a well-known ingredient in food production and has been discovered to be an antioxidant-rich in fiber and minerals (Arotupin et al., 2019). According to Shakpo and Sunsahunsi (2016), it is also biomedical and neuro-nutritional.

Therefore, the aim of this study is to construct different proportions of a mixture of maize, soybean, and ginger paste in the manufacturing of ipekere, a local dish, using an experimental methodology. To ascertain the product's sensory acceptability, the effects of the composite pastes are assessed on the proximate and mineral compositions as well as the sensory evaluation of the optimized ipekere conducted among tourists at the tourist attraction Ikogosi Warm Spring and Resort. A popular tourist spot in Ekiti State is the Ikogosi Warm Spring and Resort, where warm and cold water mix. It can be found at Ikogosi, which is part of Ekiti State's Ekiti West Local Government Area.

MATERIALS AND METHODS

Dried seeds of maize (Zea mays L), soybean (Glycine max) and Ginger (*Zingiber officinale Rose*) used in this study were obtained from Oja Koko in Owo, Ondo State, Nigeria, and were all of the analytical grades.

Processing of Soybean Paste, Maize Paste, and Ginger Paste

Maize paste: Dried yellow-maize grains were properly sorted and soaked in water before grinding into a paste

Soybean Paste: Soybean seeds were sorted and soaked in hot water overnight in order to soften the seeds. The soybean seeds were then milled into a paste.

Ginger Paste: Fresh ginger were sorted and peeled. They were cut into smaller pieces before grinding into a paste.

Formulation of the Mixture

Optimal Mixture Design of Response Surface Methodology (Design Expert 8.0.3.1) Start-Ease Inc. Minneapolis USA Trial Version was used to formulate the mixture. The variables were Corn paste (86.85 – 91.09%), Soybean paste (5.91 – 10.15%), and Ginger paste (0 – 3%) which generated 16 experimental runs. The responses were proximate and mineral composition. The four best samples obtained from the optimization result were added to the standard sample of 100% maize flour to make a total of five samples that were used for further analysis. The five samples were used to produce ipekere which was subjected to sensory evaluation.

Table 1: Optimization Table for Sixteen Experimental Runs

S/N	MF	SF	GF	Proximate
1	92.658	5.64603	1.69601	
2	85	14.1	0.9	
3	86.499	10.501	3	
4	85	14.1	0.9	
5	92.658	5.64603	1.69601	
6	88.0287	11.9713	0	
7	99.398	0.169211	0.432756	
8	95.0431	4.95689	0	
9	89.3489	7.65108	3	
10	94.3526	2.6474	3	
11	92.658	5.64603	1.69601	
12	99.398	0.169211	0.432756	
13	96.9298	0.0701744	3	
14	92.658	5.64603	1.69601	
15	90.8136	9.18635	0	
16	97.0448	2.53267	0.422544	

Production of Ipekere

The maize-soybean flour blends was divided into two equal halves. One half of the blend was mixed with salt, onion and grounded pepper. The mixture was then stirred continuously for 5minute to form a homogeneous paste. The paste was scooped with a big spoon and fried in hot palm oil (Arotupin*et al.*, 2019).

Production Process for Ipekere

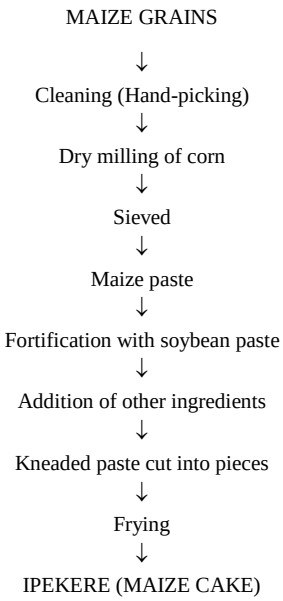

Fig. 1: Flow Chart for the Production of Ipekere (Maize Cake)
Source: Shakpo and Osundahunsi, (2019)

This method was adopted as used by Shakpo and Osundahunsi, (2019)

Determination of Proximate and Mineral Composition of the Maize-Soyabean Flour Blends

The proximate and mineral composition of the blends were determined by the methods of Analysis of the Association of Official Analytical Chemists (2005).

RESULTS AND DISCUSSION

Proximate Composition of the samples

Table 2 displays an approximation of the composite paste's composition. Samples A (6.54%), B (7.03%), C (6.76%), and D (6.63%), which were the optimal samples, had lower moisture contents than sample E, a sample made entirely of maize, which had a moisture content of 9.94%. The product will have a longer shelf life if the moisture content is reduced (Elleuche *et al.*, 2011). The shelf life of the product increases with decreasing moisture content (Akhtaret *et al.*, 2008). Ipekere made from the optimized flour paste will have strong shelf stability since the lowered moisture content will increase product shelf stability. Ipekere samples A (10.66%), B (15.19%), C (9.62%), and D (14.18%), which were made from optimized pastes, had higher protein levels than sample E (9.44%), which was made from 100% maize paste. The increased protein content of the improved ipekere was a result of the addition of soybean paste. This supports the findings of Akinola and Enujingba (2017) regarding the use of defatted African oil bean seed, a member of the same leguminosae family as soybean, in place of maize. The bigger rise in protein content of the optimized samples was caused by the higher protein content of soybean, a leguminous plant.

This result concurred with Otunola et al.'s (2012) findings about the impact of defatted groundnut paste on kokoro. The optimized ipekere samples A (8.18%), B (9.57%), C (7.76%), and D (8.84%) all had fat contents that were significantly greater than sample E's (6.95%). The greater fat content of the ipekere sample made from the optimized pastes was caused by the soybean paste and ginger paste in the optimized samples. This is consistent with Awolue et al. (2017), who found that soybean and tiger nuts were responsible for the increased fat content of snacks made from maize. Foods with higher fat contents are more likely to oxidize and perish, which may affect how long they stay fresh on the shelf (Awolu et al., 2015). Samples A had an ash percentage of 1.89%, Sample B of 1.56%, Sample C of 1.71%, and Sample D of 1.59%. The fat level of the enriched ipekere was higher than the 1.30 percent ash content of the ipekere made entirely of maize. The higher ash level in the enriched ipekere was caused by the addition of soybeans and ginger pastes; according to Alabi and Anuonye (2007), soy-supplemented cereal meals were found to have high mineral content. According to Alabi and Anunoye (2007), the ash content of foods reveals the availability of minerals in the diet. The enriched ipekere had higher crude fiber levels than ipekere made entirely of maize paste. While 0.81% was obtained for 100% maize paste, Sample A was 1.89%, Sample B was 1.00%, Sample C was 1.11%, and Sample D was 0.78%.

The increased fiber content of the enriched ipekere was caused by the addition of ginger and soybean pastes. According to Islam et al. (2017), a food's fiber content lowers blood cholesterol, constipation, and colon cancer. The carbohydrate level of the enriched ipekere was similar to the 71.92% found in ipekere made from 100% maize paste (sample A: 71.65%, sample B: 65.63%, sample C: 73.04%, and sample D: 67.98%). Each sample included a healthy

amount of carbs. Sample B, which has the most soybean and ginger, had the lowest carbohydrate content. Because of their high carbohydrate content, enhanced ipekere can provide energy (Awolu *et al.*, 2015).

Table 2 : Proximate Composition of the Optimized Paste Blends

Parameter %	**Sample A**	**Sample B**	**Sample C**	**Sample D**	**Sample E**
	M S G	**M S G**	**M S G**	**M S G**	**M S G**
	92.658 5.64 6031.0	96.1.85 14.1 0.9	92.658 5.64603 1.69601	90.8136 9.18635 0	100% 0% 0%
Moisture	6.54± 0.30[b]	7.03± 0.04[b]	6.67± 0.15[a]	6.63± 0.16[c]	9.94± 0.20[c]
Protein	10.66± 0.20	15.19±0.11[a]	9.62± 0.15[b]	14.18±0.16[a]	9.44± 0.22
Fat	8.18± 0.18[c]	9.57± 0.06[b]	7.76± 0.10[b]	8.84± 0.13[a]	6.59± 0.22
Ash	1.89± 0.21[c]	1.56± 0.01[c]	1.71± 0.11[c]	1.59± 0.02[a]	30 ±
Crude fiber	1.08± 0.16[b]	1.00± 0.03[b]	1.11± 0.01[b]	0.78± 0.02[c]	0.81± 0.23
Carbohydrate	71.65±0.31[b]	65.63±0.04[b]	73.04±0.11[c]	67.98±0.01[c]	71.92± 0.21

M (Maize), S (Soybeans), G (Ginger) Values of Mean ± SD n = 3

Means followed by different superscripts within a row are significantly different ($P < 0.05$).

Mineral Composition

Table 3 displays the findings of the mineral compositions of the optimized maize, soybean, and ginger pastes. Of all the optimized pastes discovered to contain calcium, 100% maize paste had the greatest concentration (8.92 ppm). However, the optimized pastes' calcium levels are sufficient for the body. Bone and tooth development require calcium (Song, 2017). The sodium content of the optimized pastes is higher than that of 100% maize paste, which had the lowest sodium amount at 209 ppm. The higher sodium level in the optimized pastes is due to the addition of soybean and ginger pastes. For the body to operate normally, sodium is necessary (Lowell, 2019). The optimized product's zinc level was decreased from ipekere, which was manufactured entirely of maize paste (20 ppm). Zinc is abundant in maize. Zinc has a crucial role in immune system health and metabolism (West, 2022). Compared to 100% maize paste, the ipekere made from the optimized pastes has increased potassium content. Potassium can be found in soybeans in good amounts (Cherney, 2019). The iron content of the ipekere made from the optimized paste and the ipekere made from 100% maize paste differed significantly. Leguminous plants like soybeans contain a lot of iron because of this (Oluwamukomi *et al.*, 2017). In order for the body to produce blood, iron is necessary (Britannica, 2023). When compared to ipekere made from 100% maize paste, the optimized flour paste's phosphorus concentration was greater. More manganese is present in 100% maize paste than in paste that has been optimized thanks to phosphorus.

Table 3: Mineral Composition of the Optimized Paste

Parameter (ppm)	**Sample A**	**Sample B**	**Sample C**	**Sample D**	**Sample E**
	M S G	**M S G**	**M S G**	**M S G**	**M S G**
	92.658 5.64 6031.0	96.1.85 14.1 0.9	92.658 5.64603 1.69601	90.8136 9.18635 0	100% 0% 0%
Ca	251.00	51.00	359.00	365.00	892.00
Na	646.00	54.40	51.200	558.00	209.00
Zn	18.00	16.00	17.00	15.00	20.00
K	7500.00	8450.00	8000.00	7050.00	6550.00
Fe	147.00	117.00	129.00	119.00	64.00
P	2398.00	2298.40	2201.60	1852.30	1985.00
Mn	5.00	7.00	8.00	7.00	20.00

M (Maize), S (Soybean) G (Ginger)

Result of the Sensory Evaluation of Optimized Ipekere

Table 4 displays the findings of the sensory assessment conducted among visitors to Idanre Hill. Sample E, an ipekere produced entirely of maize paste, and samples A and B, two enriched goods, scored better in terms of color than the other samples. The samples' appearances did not differ significantly from one another. The best samples in terms of flavor, texture, crispness, and inclusion of soybean and ginger paste were Sample B and Sample C. The samples were all generally accepted, with no notable differences. The best products overall, however, were Ipekere made from 100% maize paste and Sample B (85% maize, 14.1% soybean, and 0.9% ginger).

Table 4 : Result of Sensory Evaluation

Sample	M%	S%	G%	Appearance	Colour	Taste	Texture	Flavour	Crispness	Overall Acceptability
A	92.658	5.64603	1.09601	7.01^{b}	7.01^{a}	7.00^{a}	7.10^{a}	6.60^{b}	7.00^{b}	7.40^{a}
B	86	14.10	0.9	6.98^{a}	6.90^{c}	7.50^{b}	7.30^{c}	6.90^{b}	7.20^{b}	7.50^{a}
C	92.658	5.646	1.696	7.10^{a}	7.03^{b}	7.10^{a}	7.10^{b}	6.50^{a}	7.10^{a}	7.40^{a}
D	90.81	9.186	0	7.04^{b}	7.00^{b}	7.10^{a}	7.00^{b}	6.60^{a}	7.10^{a}	7.90^{a}
E	100	0	0	7.30^{a}	7.10^{a}	7.20^{a}	7.20^{a}	6.90^{a}	7.20^{a}	7.70^{a}

M = Maize Paste %, S = Soybean paste %, G – Ginger paste %

CONCLUSION

In this study, a maize paste optimized with soybean and ginger paste has been created and assembled using an experimental design. It was discovered that adding soybeans and ginger to the Ipekere made from the improved maize paste boosted its protein and mineral content. Additionally, the samples' moisture contents significantly decreased. Therefore, the product's shelf life will be stable. While the protein level increased significantly, the ratio of carbohydrates also reduced noticeably. As a result, the enriched snacks are healthier. The classic Ipekere made from 100% maize paste has similar sensory qualities to the enriched products, which are not considerably different. In Ikogosi Warm Spring, Ekiti State, the tourists approved of the enriched Ipekere. The enriched Ipekere's sensory qualities are just as acceptable as those of Ipekere made entirely of maize paste. The enriched Ipekere are more alluring to tourists visiting the destination due to their higher nutritional contents and sensory qualities.

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