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Research Article

Nutritive and Organoleptic Properties, of Three Local (Nigerian) Foods Prepared from Downy Mildew Resistant Yellow Maize

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ABSTRACT
Downy mildew resistant yellow maize was processed into Aadun, egbo and ogi with 12 – 17.48% moisture range. The crude protein range in raw and finished products was 8.4 – 9% for ether extractive, fibre and ash, values were 1.47 – 2.80%, 0.17 – 1.77% and 0.19 – 2.28% respectively, for the raw and processed product dry matter (80.52 – 95.76%) and carbohydrate (70 – 83.65%). The most predominant mineral elements in the maize were Ca (333.08ppm), K (434ppm), Na (392ppm), Mg (465ppm) and Zn (106ppm). The remaining minerals, present in low concentration are Fe (33.07ppm), Cu (1.02ppm) and Mn (0.732ppm). Looses in these minerals through conversion of maize into food products were as follows: Fe (64 – 97%), Ca (14.6 – 91.8%), Na (16 – 45.5%), K (15 – 60%), Mg (2.7 – 23.3%) and Zn (45 – 52%) respectively in aadun, egbo, and ogi. Conversion of raw maize into product meals resulted in complete loss of Cu in both ogi and aadun and loss of Mn only in ogi. The laboratory Egbo was significantly ($p<0.05$) better than its commercial counterpart only in colour and texture.
Key words: *Yellow maize, Egbo, Adun, Ogi, Nutritive and Organoleptic.*

INTRODUCTION

Maize, *Zea mays,* otherwise referred to as corn, belongs to the grass family, Poaceae [1]. Maize is a short duration plant with a height range of 8 – 10 meter [2] and extensive fibrous root system. Corn ranks the third most important cereal staple, following wheat and rice, for humans and animals.

As a utility and energy rich raw material, maize has been converted to many end – use products e.g. starch, glucose syrup, oil, beer and bread [3, 4]. Conversion of maize into cultural diets remains inexhaustible (5Aseidu, 1989). In the united state and Canada, maize is mainly used as livestock feeds, forage silage, sweetener and some fermented and distilled to produce grain alcohol [2]. Arepa a thick unleavened cake, mowe and tortillas are common maize foods in Columbia, South, Central and Latin America [6].

In Nigeria the fresh corn may be roasted or steam cooked on cob and consumed as such. The dry grain can be fermented and converted into a porridge known as ogi in Nigeria (7Akingbala et al, 1981), uji in Kenya, Mehewu in South Africa and as Kenky in Ghana [8].

Corn is widely cultivated in tropical rain forests, of West Africa, South, Central and Latin America [6]. Many cultivars of maize are known to have been widely worldwide, some mainly for food, e.g . Popcorn, sweet corn, dent, flint, starch/floury corn.

The maize kernel, a hard, one-seeded fruit (caryopsis) consist of seed coat (pericarp), germ (embryo) and endosperm, constituting about 82.84%. The endosperm provides 88% starch and 8.0% crude protein and 33% oil and The crude fibre in the kernel comes mainly from the seed coat [9, 10].

In view of the fact that maize is amenable to transformation into different novel products local or international, the purpose of this study was to evaluate the three tradition corn foods fabricated from Downy Mildew yellow maize for the acceptability of food/diet.

MATERIALS AND METHODS

Source of Raw Materials

Downy Mildew Resistant yellow maize used in this study was obtained from the Agric Farm of University of Ado Ekiti, Ekiti State of Nigeria.

Sample Treatment

The Maize grains were mechanically removed with shelling machine from the cobs and all extraneous matter was also separated by hand picking. The grains were sun dried and thoroughly conditioned before milling.

Food Preparations

Dry, clean maize grains were divided into three portions (each being 1.5kg) preparatory to their conversion into typical Nigerian traditional snacks/foods.

Aadun Production

The dry maize grains were roasted in earthened pot at 160^0c for a period of 20 – 25 min. toa highly brown colour. The roasted corn was cooled to room temperature and milled with hammer mill, sieved with a 40 mesh sieve, packed into a screw – capped bottle stored in a domestic deep freezer maintained slightly below 0^0c pending use or analysis. This resulting powder is traditionally commonly referred to as aadun flour.

Egbo Production

The 1.5kg weight of clean maize grains, meant for egbo preparation, was degermed (removal of pericarp) using a peeling machine. This machine also removes substantial part of the maize germ, leaving predominantly the endosperm. This starch rich portion was milled, sieved and stored as done for aadun flour.

Ogi Production

The maize grains meant for ogi preparation were steeped in a large container for 72hrs and processed into ogi by the method of Akingbala et al (71981). The softened grains were thoroughly washed, milled and sieved under water using muslin cloth. The ogi slurry was allowed to sediment and the supernatant on top was drained off. The resulting starchy cake solid was slightly dewatered with screw press and stored below 0^0c in the deep freezer pending further processes and analysis.

Sensory Evaluation of Products

Aadun was finally produced by thoroughly mixing aadun flour (3 parts), sugar (1 part) and red oil (2 parts). Egbo was prepared into a thick suace by mixing and cooking together egbo powder (3 parts) and water (10 parts). More water was added to prevent drying out and burning. Ogi pap was prepared, first by pasting ogi cake with cold water followed by pouring hot water until it formed a smooth consistent gel.

All the laboratory prepared corn products were sensorily assessed and compared with their commercial counterparts, using a 5 – hedonic rating scale, 5 excellent, 4 good, 3 very fair, 2 fair and 1 very poor. A crew of ten trained panelists, provided with paired products in well lit booths, was used. Results were subjected to ANOVA and Duncan Multiple Range Test using Microsoft SPS Version II Package.

Chemical Analysis

Proximate analysis and mineral composition of corn products were carried out by the methods of analysis of analysis of the Association of Official Analytical Chemists (AOAC, 111990). Crude protein was estimated by multiplying crude nitrogen % by 6.25 while carbohydrate was obtained by difference. Phosphorus was estimated by phosphovanadomolybdate complex formation measurable calorimetrically at 420nm.

RESULTS AND DISCUSSION

Table 1 reports the proximate composition (%) of Downy Mildew Resistant Yellow maize and three typical Nigerian foods or snacks fabricated from it. The raw material moisture content (12%) was below 14%, the statutory moisture content for stored cereal grains. The high dry matter found in aadun flour produced from roasted corn was noticeable.

The relatively high moisture levels in both egbo and ogi apparently stemmed from the modes of their production - steam cooking of egbo and soaking or fermentation with conventional unit operations (wet milling, sieving under water and sedimentation of ogi magma)

Ogi was the most refined of all the products, having been very low in fibre 0.17% and ash (0.19%) due to the separation of the starchy endosperm from corn's periparp (12Agunbiade and Longe 1999). Losses in other analytes are not uncommon in raw materials subjected to processing. Losses in nutritive values of about 0.38 to 0.60 in crude fibre may be due to partial or total debranning of the raw materials in the course of aadun and egbo production. These three corn products are, no

doubt, energy – rich, offering consumers a potential source of utilizable energy, especially for the convalescent.

Table 2 refers to the mineral composition of raw maize with its three by – products. The major minerals in the test corn and its products were Ca, K, Mg, Na, and Zn, others were present in minor concentrations. Generally, heavy mineral losses in the conversion of the maize to indigenous meals resulted in the least mineral retention in ogi. While about 50% of maize Cu was retained in egbo production, in aadun and ogi no Cu was retained. Manganese was completely lost on conversion of maize to ogi while egbo and aadun retained all. The level of Zn, Ca, Na, K, and Mg are considered enough to take care of the physiological need of human body; otherwise mineral supplement may be a saving grace.

Table1: The proximate composition (%) of Downy Mildew Resistant Yellow maize and three typical Nigerian foods or snacks fabricated from it.

Parameters	Raw Maize	Egbo	Aadun Flour	Ogi Cake
Dry matter	88.05 ± 3.02	28.52 ± 0.86	95.75 ± 4.25	84.32 ± 3.01
Crude Protein	9.00 ± 0.56	8.55 ± 0.65	8.62 ± 0.70	08.40 ± 0.54
Ether Extractive	2.80 ± 0.32	1.85 ± 0.26	1.47 ± 0.22	01.67 ± 0.00
Crude fibre	3.77 ± 0.65	1.95 ± 0.40	1.23 ± 0.48	0.17 ± 0.00
Ash	1.28 ± 0.25	0.90 ± 0.20	0.79 ± 0.31	0.19 ± 0.00
Total Carbohydrate	83.15 ± 3.52	86.75 ± 4.01	87.89 ± 3.65	97.47 ± 4.46

Table 2: The mineral composition of Downy Mildew Resistant Yellow maize with its three by – products

Product	Fe	Cu	Zn	Mn	Ca	Na	K	Mg
Raw maize	33.066	1.015	105.932	1.732	333.083	392.083	434.090	465.377
Egbo	7.014	0.507	58.474	0.732	285.014	326.250	368.181	441.996
	(78.78)	(50.04)	(44.80)	(0.00)	(14.59)	(16.79)	(15.18)	(5.02)
Aadun	12.024	ND	55.084	0.732	175.070	279.916	264.090	452.787
	(63.64)	(100)	(48.00)	(0.00)	(47.53)	(28.61)	(39.16)	(2.70)
Ogi cake	1.062	ND	50.847	ND	27.310	175.000	173.636	357.464
	(96.79)	(100)	(52.00)	(100)	(91.82)	(55.37)	(60.00)	(23.19)

Values are duplicate means. The figures in parentheses represent the mineral losses (%) to processing.
ND – Not Detected

Table 3 compare the organoleptic properties (appearance, colour, aroma, taste and texture) of laboratory prepare with market production. Laboratory produced aadun was significantly ($p<0.05$) better than commercial product in all sensory properties except taste. Laboratory produced ogi was significantly ($p<0.05$) better than the market product in appearance, colour and aroma.

Under laboratory conditions meticulous attention was paid to cleanliness and these did not permit the use of rusty or weevil damaged raw maize which is a common practice among food vendors who not only are unmindful of raw material standards, but are also tempted to maximize their profit at the expense of consumers. These observed slight differences in the quality of the laboratory and commercial products may be due to: (1) the differences in the concentration of added flavouring agents in both productions. (2) the variation in the unit operations adopted e.g. extraction rates.

Table 3: The organoleptic properties of the laboratory and commercially produced by-products of Yellow maize.

Product	Appearance	Colour	Aroma	Texture/Consistency	Aroma
Ogi Lab	4.60 ± 0.52^{a}	4.50 ± 0.53^{a}	4.20 ± 0.40^{a}	3.80 ± 0.42	4.20 ± 0.68^{a}
Ogi market	3.50 ± 0.53^{b}	3.20 ± 0.48^{b}	3.30 ± 0.48^{b}	3.80 ± 0.42	3.20 ± 0.52^{b}
Aadun Lab	3.80 ± 0.63^{a}	4.50 ± 0.71^{a}	3.80 ± 0.80^{a}	3.90 ± 0.57	4.10 ± 0.58^{a}
Aadun market	3.20 ± 0.80^{b}	3.70 ± 1.14^{b}	2.70 ± 0.63^{b}	3.90 ± 0.57	2.70 ± 0.68^{b}
Egbo Lab	4.50 ± 0.54	4.40 ± 0.75^{a}	3.90 ± 1.05	3.70 ± 0.63	4.30 ± 0.63^{a}
Egbo market	4.10 ± 0.51	3.30 ± 0.63^{b}	3.80 ± 0.46	3.70 ± 0.60	3.30 ± 0.65^{b}

Values are means of duplicate determinations ± Standard Deviation. Values with different superscripts are significantly ($P<0.05$) different

CONCLUSION

These three local corn foods are highly acceptable as energy giver. Ogi and aadun has been commercialized as highly enduring products beyond the confines of Nigeria. Egbo, in its drying form could also be a very good candidate for commercialization if well package resulting from these possibilities, the three products can definitely serve as good foreign earners for Nigeria. This will also reduce food shortage… especially in tropical region, South of Sahara. The starch-rich products are usually consumed as balance diet (for ogi with 'akara/oole', for aadun enrobed with cashew or groundnut and for egbo with fish or beef stew).

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