

PRELIMINARY STUDIES ON IMPROVEMENT ON PRESERVATION OF 'EBA' (GARI).

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ABSTRACT

'Eba' is prepared from gari a creamy white granular flour with a slightly fermented flavour and sour taste made from fermented cassava tubers. Gari (Eba) is a staple food that is widely known in Nigeria and West African countries but it has a short shelf life of 2 or 3 days. This research investigated the fungi associated with spoilage of eba and attempted at improving its shelf life. Hot extracts from *Allium cepa*, *Allium sativum*, *Carica papaya* and *Zingiber officinale* were used to prepare eba and stored for 3 days. Six tasters were employed to compare their odour, taste and colour with control. After 3-days, the associated fungi were isolated. A total of six fungi from three genera (*Aspergillus glaucus*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Penicillium sp.* and *Rhizopus stolonifer*) were isolated and identified from gari and eba. The four botanical extracts tested gave a significant suppression of the fungi. At the end of three days, the growth of fungi was totally insignificant. *A. sativum*, followed by *A. cepa* gave a significant ($P>0.05$) suppression. The taste and colour did not change even after the day-3 but the aroma changed. Therefore, this study recommends the use of extracts from these botanical for the preservation and improvement of shelf life of eba.

Keywords: Gari, Eba, Extracts, Deterioration, fungi growth

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INTRODUCTION

Gari is a fermented product of cassava which is widely consumed across West Africa, Central Africa and in some parts of North and Southern Africa. It is white dry granular flour with a slightly fermented flavor and a slightly sour taste. Gari can be consumed directly without cooking. Alternatively, it is soaked in water with sweeteners prior to consumption or is made into a stiff gel by mixing with hot water called 'eba' (Okigbo and Ogbonnaya, 2006).

'Eba' is a staple stiff gel local food in tropical countries made by mixing gari with hot water. However, it is not very

easy to get it stored ordinarily for 2 to 3 days without getting spoilt (Okigbo and Ogbonnaya, 2006). The usual practice is therefore to store in refrigerator, rooms, kitchen, etc. Considering the level of poverty looming in the homes where gari is consumed as *eba* in third world countries, refrigerator could not be procured and in addition the source of electricity is epileptic in nature. Alternative sources of preservation is needed. Hence, the choice of medicinal plants. Alternative sources of preservation is needed. Hence, the choice of medicinal plants

The use of plants by man started from the time immemorial and through his inquisitiveness, he has been able to separate the edible plants from the poisons ones. Man also discovered that some plants can be used for both preventive and curative purposes of his ailment (James *et al.*, 2009). Sofowora (1984); Barnett and Barry (2010); Djanna *et al.* (2011) reported that plant and plant parts have been used efficiently as spices, preservatives besides medicinal purpose. Therefore, prolonging or extending its shelf life is very paramount. In this regard, this research was carried out to isolate and identify the fungi associated with spoilage of *eba* (gari) and the efficacy of the extracts from four consumable medicinal plants: Onion (*Allium cepa*), Garlic (*Allium sativum*), Pawpaw (*Carica papaya*) and Ginger (*Zingiber officinale* L) at improving its shelf life.

MATERIALS AND METHODS

Collection and extraction of Plant Materials

Plant used in this study *Allium cepa*, *Allium sativum*, *Carica papaya* and *Zingiber officinale* were collected from market and locally cultivated plants in Lapai, Niger State. Their names were authenticated in the herbarium of Biology Department, Ibrahim Badamasi Babangida University, Lapai, Nigeria. Soxhlet extraction method was used to extract the plant materials after air dried and pulverized. The extracts were stored in refrigerator (4°C) and used within 24 hours.

Collection of Gari and Preparation of Eba

White gari were bought from the market, in Lapai, Nigeria. The samples were put in

sterile polythene bags and were used immediately to prepare eba.

Isolation of Fungi from Gari and Eba

One gram of sample was aseptically transferred into 9ml of sterile distilled water in a test tube and shaken properly to allow even distribution of microorganism present in the sample, using serial dilution method, 10^{-1} and 10^{-2} were used as stock solution for the isolation on PDA. Three replicates plates were incubated at room temperature for 48 hours. Sub culturing was done to obtain pure cultures of the isolate after 48 hours. The pure cultured colonies were observed, characterized and identified (Amadi and Adebola, 2008; Amadioha, 2000, Barnett *et al.*, 2010). Stock cultures were also prepared using slant PDA in McCartney bottles and stored in a refrigerator at 4°C.

Screening of Plant Extract for the Shelf life of Eba

Modified food poisoning method was used. Eba was aseptically prepared by sprinkling 50g of gari into 30ml each of the hot extract from *Allium cepa*, *A. sativum*, *Carica papaya* and *Zingiber officinale* at 100°C in 50ml stainless bowl. Hot water of the same temperature was used to substitute extract (control). Three replicates of each were made and observations were made daily for 3 days for fungi growth.

Tasters

Six tasters were employed to compare the taste, odour and colour of eba prepared with extract to ordinary water which

served as control, immediately and after 3days of preparation.

Data analysis

The result obtained were analyzed by percentage occurrence, percentage growth inhibition and subjected to Analysis of Variance (ANOVA).The mean percentage were separated using Duncan Multiple Range Test.

RESULTS

Fungal Isolates

A total of six fungi species from three genera (*Aspergillus glaucus*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Penicillium* sp and *Rhizopus stolonifer*) were isolated from gari bought from Lapai market and re-isolated from eba(gari) after 3days of storage (Table 1). Out of the four fungi isolated, *Rhizopus stolonifer* has the highest percentage occurrence of 21.4% followed by *A. niger*

with 20.7%, *Penicillium* sp 17.9% *A. glaucus*(15.0%), *A. flavus*(15.0%)and *A. fumigatus*(10.0%)(Table 2).

Effects of Consumable Plant Extracts

The result obtained from the effects of the three plant extracts on growth of fungi isolated from stored eba revealed that the radial growth of the fungi were inhibited(Table 3). The antifungal effects of the extracts were significantly different(P<0.05) and varied with plant species. The results revealed that *Allium sativum* has the highest percentage growth inhibition on fungi growth, followed by *Zingiber officinale*, *Allium cepa* and *Carica papaya* has the least. *R. stolonifer* growth was inhibited by all the extracts and the least inhibited was *A. flavus*. *A. sativum* gave the highest inhibition of *R. stolonifer* (62.4%) and the least affected was *A. flavus* (22.8%).

Table 1. Occurrence of fungi on eba prepared in hot water after 3 days of storage

Isolates	Gari	Eba
<i>A. glaucus</i>	++	+++
<i>A. flavus</i>	++	+++
<i>A. fumigatus</i>	+++	+++
<i>A. niger</i>	+++	+++
<i>Penicillium</i> sp	+	++
<i>Rhizopus stolonifer</i>	++++	+++++

Key: + = Present - = Absent

When various hot plant extracts were used to prepare eba, a decrease in contamination was recorded under after 3 days of storage (Tables 4).

The response received from the tasters revealed that the extracts of *Allium cepa*, *Allium sativum* and *Zingiber officinal* did

not add any colour or taste to the preparation but the aroma changed. However, the extract from *Carica papaya* added slight bitter taste to the preparation but there was no change in aroma and colour.

Table 2. Percentage occurrence of fungi isolated from gari bought from the market in Lapai.

Isolates	Percentage occurrence
<i>Aspergillus flavus</i>	15.0
<i>A. niger</i>	20.7
<i>Penicillium</i> sp.	17.9
<i>A. fumigates</i>	10.0
<i>A. glaucus</i>	15.0
<i>Rhizopus stolonifer</i>	21.4

Table 3. Percentage growth inhibition of fungi isolated by plant extracts

Plant materials	*Mean % growth inhibition					
	<i>A. glaucus</i>	<i>A. flavus</i>	<i>A. fumigatus</i>	<i>A. niger</i>	<i>R. stolonifer</i>	<i>Penicillium</i> sp.
<i>A. cepa</i>	32.6 ^b	16.4 ^a	22.7 ^a	23.5 ^a	49.2 ^b	40.5 ^b
<i>A. sativum</i>	49.0 ^c	22.8 ^b	25.2 ^b	41.6 ^c	62.4 ^d	53.5 ^c
<i>C. papaya</i>	20.2 ^a	15.6 ^a	21.5 ^a	17.3 ^a	33.0 ^a	28.1 ^a
<i>Z. officinale</i>	37.7 ^b	18.2 ^a	20.6 ^a	33.3 ^b	52.3 ^c	41.5 ^b

Mean per fungi in a column that bears the same letters are not significantly different, but those that bears different letters are significantly different. (P < 0.05) in all the plant extracts used.

Table 4: Occurrence of fungal contamination on eba preserved with plant extracts after 3 day of storage

Isolates	<i>Allium cepa</i>	<i>Allium sativum</i>	<i>Carica papaya</i>	<i>Zingiber officinale</i>
<i>A. glaucus</i>	+	+	+	-
<i>A. flavus</i>	+	++	+++	+
<i>A. fumigatus</i>	-	-	++	-
<i>A. niger</i>	+	+	+	+
<i>Penicillium</i> sp.	-	-	+	-
<i>R. stolonifer</i>	-	-	+	-

Key: + = occurred - = absent

DISCUSSION

The organisms associated with the spoilage of eba (gari) in the present study were *Aspergillus glaucus*, *A. flavus*, *A. fumigatus*, *A. niger*, *penicillium* sp, and *Rhizopus stolonifer*. These fungi have been reported by the earlier researchers to be associated with spoilage of different kinds of foods(Okigbo and Ogbonnaya, 2006; Obadina *et al.*,2009). The source of contamination of gari might be from the market since these fungi were isolated before using it to prepare eba, also, the contamination might be as a result of exposing the gari to the air in the market when offer for sale. Amadi and Adebolav(2008) also reported six species of fungi from stored gari and suggested

that handling was a major factor in gari storage. This work revealed that extracts from *Alliumcepa*, *Alliumsativum*, *Caricapapaya* and *Zingiber officinale* were able to suppress the growth of fungi tested(Djana *et al.*, 2011). The antifungal properties of these botanicals, had been reported earlier (Akano *et al.*, 1996; Meena, 2002). The use of bulb of *Allium cepa* as antifungal activity against *Fusarium oxysporium* and *Colltotrichum* sp. Was reported by (Delaha and Garagusi, 2005; Nanir and Kadu,1997). Many water soluble antifungal substances have been found in the leaves of trees including *Carica papaya*. Akano *et al.* (1996) reported that leaves extracts of *Carica papaya* was reported to effectively inhibited the growth of *Powdery mildew*

fungi (*Erisiphe cichoracerrum*). The *in vitro* inhibition of radial growth and spore germination and the *in vivo* reduction in spoilage agreed with earlier reports of Akano *et al.* (1996); Ogiehor and Ikenebomeh (2005) and Jame *et al.* (2009) that some plant parts are preservatives beside their medicinal purpose. The differences observed in fungi toxic activity of the extracts might probably be due to the level of solubility in water of the active compounds or inhibitors in the extracts. The report of the taster confirmed the aromatic properties of some of these botanicals (Sofowara, 1984)). Therefore, this research revealed that the three plant extracts tested have potentials at controlling spoilage of *eba*, and prolonged its longevity.

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