

## Short Communication

# Microbiological safety of gari, lafun and ogiri in Akure metropolis, Nigeria

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The microbiological safety of three locally fermented foods (gari, lafun and ogiri) was investigated in this work. Ten different samples each of the fermented foods were collected at the central market (Oja Oba). The mean total bacterial count in the samples of gari, lafun and ogiri were  $14.3 \times 10^4$ ,  $13.2 \times 10^5$  and  $10.2 \times 10^6$  cfu/g, respectively. Also the mean total viable count of mould was  $1.6 \times 10^4$ ,  $3.7 \times 10^5$  and  $8.2 \times 10^6$  cfs/g, respectively. Bacteria isolated from gari include *Corynebacterium* species, *Lactobacillus* species, *Bacteriodes* species, *Pseudomonas* species and *Actinomyces* species while the isolated moulds from gari include *Scolecotrichum graminis*, *Tallospora aspera*, *Passalora bacilligera*, *Varicosporium* sp., *Culicidospora gravaida* and *Diplococcium spicatum*. Bacteria isolated from lafun include; *Streptococcus* sp., *Lactobacillus* species and *Listeria* species while the isolated the isolated moulds were *Articulospora inflata*, *Aspergillus niger*, *Aspergillus rapens*, *Aspergillus flavus* and *Lemonniera aquatica*. Also, the bacteria isolated from ogiri were *Bacillus* sp., *Pediococcus* sp., *Streptococcus* sp. and *Lactobacillus* sp. while the mould isolated from ogiri were *Rhizopus stolonifer*, *Aspergillus fumigatus* and *Triscelophorus monosporus*. Even though some potential pathogenic bacteria like *Listeria* and *Bacillus* were isolated from the fermented foods, the low count recorded for them is not enough to establish any health risk.

**Key words:** Fermented foods, bacteria, fungi, safety.

## INTRODUCTION

Fermented foods are of great significant because they provide and preserve vast quantities of nutritious foods in a wide diversity of flavours, aromas and textures which enrich the human diet (Steinkraus, 1997). Nigeria is endowed with a wide range of fermentable indigenous staple foods that serve as raw materials for agro-allied cottage industries. These industries utilize small-scale equipment while adding value to such local produce (Latunde- Dada, 2000). Although fermented food condiments have constituted a significant proportion of the diet of many people, Nigerians have exhibited an ambivalent attitude in terms of consumers' tastes and preferences for such foods (Achi, 1992). The Introduction of foreign high technology products especially processed ones because of globalization and liberation of the economy radically changed the Nigerian food culture into a mixed grill of both foreign and local dishes (Ojo, 1991). Fermented products remain of interest since they do not require refrigeration during distribution and storage. The traditional condiments have not attained commercial status

due to the very short life, objectionable packaging materials, stickiness and the characteristic putrid odour (Arogba et al., 1995).

The fermented foods in Nigeria can be classified into groups according to the substrates or raw materials employed (Odunfa, 1985). These include products from tubers (gari, lafun and fufu all products of cassava), cereals (ogi, pito, and burukutu all products of maize, sorgum or millet), legumes (iru and dawadawa products of locust beans and soya beans, respectively), fruit (ogiri, a product of melon), beverages (palm wine) and milk (wara-kishi). The microflora involved in the fermentation of these foods have been isolated and characterized (Oyewole and Odunfa, 1990). The method of preparation of gari and lafun has been explained by Latunde-Dada, (2000) while the method of preparation of ogiri was explained by Achi (1992).

According to Steinkraus (1995, 1996, 1997) fermented foods have a very good safety record even in the developing world where foods are manufactured by

**Table 1.** The total viable counts (TVC) of bacteria in gari (G), lafun (L) and ogiri (O) in Akure metropolis, Nigeria.

Isolate	G <sub>1</sub>	G <sub>2</sub>	G <sub>3</sub>	G <sub>4</sub>	G <sub>5</sub>	G <sub>6</sub>	G <sub>7</sub>	G <sub>8</sub>	G <sub>9</sub>	G <sub>10</sub>	Mean
TVC/cfu/g X 10 <sup>4</sup>	21	20	16	20	11	21	13	13	5	3	14.3 cfu/g x 10 <sup>4</sup>
Isolate	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>	L <sub>7</sub>	L <sub>8</sub>	L <sub>9</sub>	L <sub>10</sub>	Mean
TVC/cfu/g X 10 <sup>5</sup>	2	24	20	15	11	16	12	3	16	13	13.2 cfu/ g x 10 <sup>5</sup>
Isolate	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	O <sub>4</sub>	O <sub>5</sub>	O <sub>6</sub>	O <sub>7</sub>	O <sub>8</sub>	O <sub>9</sub>	O <sub>10</sub>	Mean
TVC/cfu/g X 10 <sup>6</sup>	16	10	11	8	9	9	15	9	8	7	10.2 cfu/ g x 10 <sup>6</sup>

people without training in microbiology or chemistry but fermented foods by themselves cannot solve the problems of contaminated drinking water and improper personal hygiene in food handlers. These problems make the safety of fermented foods debatable and questionable in developing countries. Some authors have shown that *Escherichia coli*, *Salmonella enteritidis*, *Listeria monocytogenes* and *Shigella* have high survival rate in fermented foods (Inatsu et al., 2004). The objective of this work is to determine the microorganisms associated with gari, lafun and ogiri sold within Akure metropolis.

## MATERIALS AND METHODS

Ten samples each of gari, lafun and ogiri were collected from local sellers at Ojo Oba Market, Akure, Nigeria. The samples were screened for the presence of spoilage bacteria and pathogenic bacteria and fungi. Nutrient Agar was inoculated with 10<sup>-5</sup> or more dilution of the sample(s) for bacteria and Potato Dextrose Agar was inoculated with 10<sup>-3</sup> or more dilution of the sample (s) for fungi. The NA plates were incubated at 35°C for 24 h and PDA plates were incubated at 25°C for 48 - 72 h.

Representative colonies from Nutrient Agar plates were picked on the basis of culture and purified by subculturing on another NA plate. When pure cultures have been obtained, they were coded and characterized using conventional methods (Cowan and Steel, 1985). For fungi, a smear of the mycelial growth on PDA was prepared on sterile slides, obtained with cotton blue in lactophenol and observed under the microscope for identification.

## RESULTS AND DISCUSSION

Table 1 shows the total viable counts and average total viable counts of the bacteria in samples of gari, lafun and ogiri collected from sellers. The average total viable bacterial counts were 14.3 x 10<sup>4</sup>, 13.2 x 10<sup>5</sup> and 10.2 x 10<sup>6</sup> cfu/g in gari, lafun and ogiri, respectively. While the average total viable fungal counts were 1.6 x 10<sup>4</sup>, .7 x 10<sup>5</sup> and 8.2 x 10<sup>6</sup> cfs/g in gari, lafun and ogiri, respectively (Table 2). A total of ten bacteria species were isolated from the samples collected. Five bacteria; *Pseudomonas* sp., *Bacteriodes* sp., *Actinomyces* sp., *Corynebacterium* sp. and *Lactobacillus* sp. were isolated from gari samples, four bacteria; *Streptococcus* sp., *Pseudomonas* sp., *Lactobacillus* sp. and *Listeria* sp. were isolated from lafun samples and four bacteria; *Lactobacillus* sp., *Streptococcus* sp., *Pediococcus* sp. and *Bacillus* sp. were

also isolated from ogiri samples (Table 3). A total of fourteen mould species were isolated from samples collected from the sellers (Table 3). Six mould isolates; *Scolecotrichum graminis*, *Tallospora aspera*, *Passalora bacilligera*, *Varicosporium species*, *Culicidospora gravida* and *Diplococcium spicatum* were isolated from gari samples, five mould isolates; *Articulospora inflata*, *Aspergillus niger*, *Aspergillus rapens*, *Aspergillus flavus* and *Lemonniera aquatica* were isolated from lafun samples, and three mould isolates; *Rhizopus stolonifer*, *Aspergillus fumigatus* and *Triscelophorus monosporus* were found in ogiri samples.

The bacterial load and fungal load was highest in ogiri followed by lafun and lastly by gari. It can be inferred that ogiri was most susceptible to contamination with microorganisms may be due to mode of preparation and handling. The bacterial load varies from one seller to another. From the results it was clear that gari was bacteriologically safer for consumption compared to lafun and ogiri. *Listeria* sp. and *Bacillus* sp., sources of food borne illnesses, were isolated from lafun and ogiri respectively. *Lactobacillus* which is a probiotic was isolated from all the samples and it shows that the small-scale fermented foods are a good source of probiotics. Most of the fungi isolated from the fermented foods with an exception of *A. flavus* isolated from lafun and *Passalora bacilligera* isolated from gari were non-pathogenic. *A. flavus* produces aflatoxin which is carcinogenic. *Passalora bacilligera* which was isolated from gari is parasitic in nature (Hunter, 1980).

The microbiological safety of the fermented foods examined can be improved upon greatly by using quality raw materials, using unique starter cultures that have the ability to detoxify, maintaining proper hygienic standards in the processing environment and using proper packaging (Ijabadeniyi and Omoya, 2006b). Sellers should also ensure that they do not expose the fermented foods during display because this may predispose them to contamination. During sales and production, sellers and local processors must always wear gloves to discourage contamination.

In conclusion, fermentation foods such as gari, lafun and ogiri sold within Akure metropolis are considered safe for consumption because food pathogens such as *Salmonella*, *Shigella*, *E. coli*, *Campylobacter jejuni* and *Clostridium* were not isolated from them, although their safety can be insured and improved upon by adhering to

**Table 2.** The total viable counts (TVC) of fungi in gari (G), lafun (L) and ogiri (O) in Akure metropolis, Nigeria.

Isolate	G <sub>1</sub>	G <sub>2</sub>	G <sub>3</sub>	G <sub>4</sub>	G <sub>5</sub>	G <sub>6</sub>	G <sub>7</sub>	G <sub>8</sub>	G <sub>9</sub>	G <sub>10</sub>	Mean
TVC/cfs/g X 10 <sup>4</sup>	1	6	1	1	1	1	1	1	1	2	1.6 cfs/g x10 <sup>4</sup>
Isolate	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>	L <sub>7</sub>	L <sub>8</sub>	L <sub>9</sub>	L <sub>10</sub>	Mean
TVC/cfs/g X 10 <sup>5</sup>	2	8	2	3	3	9	-	3	3	4	3.7 cfs/ g x10 <sup>5</sup>
Isolate	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	O <sub>4</sub>	O <sub>5</sub>	O <sub>6</sub>	O <sub>7</sub>	O <sub>8</sub>	O <sub>9</sub>	O <sub>10</sub>	Mean
TVC/cfs/g X 10 <sup>6</sup>	10	6	8	9	10	8	11	9	4	7	8.2 cfs/ g x 10 <sup>6</sup>

**Table 3.** Microorganisms associated with some local fermented foods sold within Akure metropolis, Nigeria.

Fermented food	Bacteria	Moulds
Gari	<i>Pseudomonas</i> sp. <i>Bacteriodes</i> sp. <i>Actinomyces</i> sp. <i>Corynebacterium</i> sp. <i>Lactobacillus</i> sp.	<i>Scolecotrichum graminis</i> <i>Tallospora aspera</i> <i>Passalora bacilligera</i> <i>Varicosporium species</i> <i>Culicidospora gravida</i> <i>Diplococcium spicatum</i>
Lafun	<i>Streptococcus</i> sp. <i>Lactobacillus</i> sp. <i>Listeria</i> sp.	<i>Articulospora inflata</i> <i>Aspergillus niger</i> <i>Aspergillus rapens</i> <i>Aspergillus flavus</i> <i>Lemonniera aquatica</i>
Ogiri	<i>Lactobacillus</i> sp. <i>Streptococcus</i> sp. <i>Pediococcus</i> sp. <i>Bacillus</i> sp.	<i>Rhizopus stolonifer</i> <i>Aspergillus fumigatus</i> <i>Trisclorophorus monosporus</i>

suggestions stated above. More research should be done on the use of novel techniques like nanotechnology and irradiation to extend the shelf life of fermented foods and insure their safety.

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