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Foreword

The African Organization for Standardization (ARS) is an African intergovernmental organization made up of the United Nations Economic Commission for Africa (UNECA) and the Organization of African Unity (AU). One of the fundamental mandates of ARSO is to develop and harmonize African Standards (ARS) for the purpose of enhancing Africa’s internal trading capacity, increase Africa’s product and service competitiveness globally and uplift the welfare of African communities. The work of preparing African Standards is normally carried out through ARSO technical committees. Each Member State interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, Regional Economic Communities (RECs), governmental and non-governmental organizations, in liaison with ARSO, also take part in the work.

ARSO Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare ARSO Standards. Draft ARSO Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an ARSO Standard requires approval by at least 75% of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ARSO shall not be held responsible for identifying any or all such patent rights.

This African Standard was prepared by the ARSO Technical Harmonization Committee on Agriculture and Food Products (ARSO/THC 02).

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Introduction

Garri is a creamy-white, granular flour with a slightly fermented flavor and a slightly sour taste made from fermented, gelatinized fresh cassava tubers. It is commonly consumed either by being soaked in cold water with sugar, coconut, roasted groundnuts, dry fish, or boiled cowpea as complements or as a paste made with hot water and eaten with vegetable sauce. When properly stored, it has a shelf-life of six months or more.
Garri — Specification

1 Scope

This African Standard applies to garri destined for direct human consumption which is obtained from the processing of cassava tubers (*Manihot esculenta* Crantz).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

ARS 471, *Food grade salt — Specification*

CD-ARS 835:2013, *Fresh sweet cassava — Specification*

CD-ARS 836:2013, *Fresh bitter cassava — Specification*

CD-ARS 844:2013, *Cassava and cassava products — Determination of total cyanogens — Enzymatic assay method*

CAC/GL 50, *Codex general guidelines on sampling*

CODEX Stan 192, *General standard for food additives*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

CODEX STAN 228, *General methods of analysis of contaminants*

ISO 1842, *Fruit and vegetable products — Determination of pH*

ISO 2591-1, *Test sieving — Part 1: Methods using test sieves of woven wire cloth and perforated metal plate*

ISO 4833, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of microorganisms — Colony-count technique at 30 degrees C*

ISO 5498, *Agricultural food products — Determination of crude fibre content — General method*

ISO 6579, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection of *Salmonella* spp.*

ISO 6888-1, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) — Part 1: Technique using Baird-Parker agar medium*

ISO 6888-2, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) — Part 2: Technique using rabbit plasma fibrinogen agar medium*
3 Definitions

For the purpose of this standard the following definitions apply.

3.1 gari
Gari is the finished product obtained by artesinal or industrial processing of cassava tubers (Manihot esculenta Crantz). The processing consists of peeling, washing and grating of the tubers, followed by fermentation, pressing, fragmentation, granulation, drying if necessary, sifting and suitable heat treatment. Gari is presented as flour of variable granule size.

NOTE Suitable heat treatment means toasting, grilling or any other method of cooking capable of producing the characteristic organoleptic properties of the product. During the heat treatment, there is a partial gelatinization of the starch and the dehydration of gari grains.

4 Essential quality and compositional requirements

4.1 Raw materials


4.2 Optional ingredients

4.2.1 Edible oil or fat — Shall comply with the relevant African Standards.

4.2.2 Edible salt — Shall comply with ARS 471.

4.3 General quality factors

4.3.1 Gari shall be safe and suitable for human consumption.

4.3.2 Gari shall be free from abnormal flavours, odours, and living insects.

4.3.3 Gari shall be free from filth (impurities of animal origin, including dead insects) in amounts which may represent a hazard to human health.

4.3.4 According to good manufacturing practices, gari shall be practically free from extraneous matter.

4.4 Organoleptic properties

The colour of the gari shall be yellow (with palm oil) or white without palm oil. Taste and odour of gari shall be characteristic of the product as acceptable in a given locality.
4.5 Enrichments

Gari may be enriched with vitamins, proteins and other nutrients as may be permitted in the regulations of the destination country.

4.6 Specific quality factors

Gari shall conform to the requirements specified in Table 1.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requirements</th>
<th>Method of test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content, %, by mass, max.</td>
<td>7.0</td>
<td>ISO 712</td>
</tr>
<tr>
<td>Total acidity, determined as lactic acid</td>
<td>0.6 – 1.0 %</td>
<td>ISO 7305</td>
</tr>
<tr>
<td>Crude fibre, % m/m, max</td>
<td>2.0</td>
<td>ISO 5498</td>
</tr>
<tr>
<td>Sodium chloride (NaCl) on dry weight basis, %, max</td>
<td>2.0</td>
<td>Annex B</td>
</tr>
<tr>
<td>Total cyanide content, mg/kg, max</td>
<td>20.0</td>
<td>CD-ARS 844:2013</td>
</tr>
<tr>
<td>Total ash, % m/m, max</td>
<td>1.50</td>
<td>ISO 2171</td>
</tr>
<tr>
<td>Acid insoluble ash, %, by mass, max</td>
<td>0.2</td>
<td>Annex A</td>
</tr>
</tbody>
</table>

4.7 Classification

Classification of garri may be done on the basis of particle size determined by use of test sieves complying with ISO 2591-1. Where classification is done, the classes in Table 2 shall be established.

<table>
<thead>
<tr>
<th>Class</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra-fine grain garri</td>
<td>Garri of which not less than 80 % of the weight shall pass easily through a sieve with aperture below 355 microns.</td>
</tr>
<tr>
<td>Fine grain garri</td>
<td>This is garri of which not less than 80 % of the weight shall easily pass through a sieve with aperture 1000 microns but of which less than 80 % of the weight shall easily pass through a sieve with aperture 355 microns.</td>
</tr>
<tr>
<td>Coarse (medium) grain garri</td>
<td>This is garri of which not less than 80 % of the weight shall easily pass through a sieve with aperture 1.40 mm but of which less than 80 % of the weight shall easily pass through a sieve with aperture 1.00 mm.</td>
</tr>
<tr>
<td>Extra coarse grain garri</td>
<td>This is garri of which not more than 20 % of the weight shall easily pass through a sieve with aperture 1.40 mm.</td>
</tr>
<tr>
<td>Unclassified garri</td>
<td>This is garri which has not been classified by the sieve method to determine its category according to grain size.</td>
</tr>
</tbody>
</table>

5 Food additives

Food additives, if used in the preparation of garri, shall comply with CODEX STAN 192.

6 Contaminants

6.1 Pesticide residues

Gari shall conform to maximum residue limits for pesticide residues established by the Codex Alimentarius Commission for this commodity.
6.2 Heavy metal contaminants

When analyzed in accordance with CODEX STAN 228, garri shall be free from heavy metals in amounts which may represent a hazard to human health.

6.3 Other contaminants

6.3.1 Garri shall comply with the maximum levels of CODEX STAN 193.

6.3.2 Garri shall contain not more than 10 microgram per kilogram aflatoxin of which not more than 5 micrograms per kilogram may be aflatoxin B1 when tested in accordance with ISO 16050.

7 Hygiene

7.1 Garri shall be prepared and handled in a hygienic manner in accordance with ARS 53 and shall conform to microbiological limits specified in Table 2.

Table 2 — Microbiological limits for garri

<table>
<thead>
<tr>
<th>S/N</th>
<th>Micro-organism(s)</th>
<th>Requirements</th>
<th>Method of test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total plate count, cfu/g</td>
<td>$10^3$</td>
<td>ISO 4833</td>
</tr>
<tr>
<td>2</td>
<td>Staphylococcus aureus cfu/g max</td>
<td>$10^2$</td>
<td>ISO 6888</td>
</tr>
<tr>
<td>3</td>
<td>Escherichia coli, cfu/g, max.</td>
<td>absent</td>
<td>ISO 7251</td>
</tr>
<tr>
<td>4</td>
<td>Salmonella, per 25g, max.</td>
<td>absent</td>
<td>ISO 6579</td>
</tr>
<tr>
<td>5</td>
<td>Coliforms g (per 100 g)</td>
<td>absent</td>
<td>ISO 4832</td>
</tr>
<tr>
<td>6</td>
<td>Bacillus cereus, per 25g, max.</td>
<td>absent</td>
<td>ISO 7932</td>
</tr>
<tr>
<td>7</td>
<td>Yeasts and moulds, cfu/g, max.</td>
<td>$10^3$</td>
<td>ISO 21527-2</td>
</tr>
</tbody>
</table>

7.2 To the extent possible in good manufacturing practice, the product shall be free from objectionable matter.

7.3 When tested by appropriate methods of sampling and examination, the product:

(a) shall be free from microorganisms in amounts which may represent a hazard to health;

(b) shall be free from parasites which may represent a hazard to health; and

(c) shall not contain any substance originating from microorganisms in amounts which may represent a hazard to health.

7.4 During handling, storage and transportation, effective measures must be taken to prevent cross contamination with chemicals, microbial or physical contaminants.

8 Packaging

8.1 Garri shall be packaged in containers which will safeguard the hygienic, nutritional, technological, and organoleptic qualities of the product.

8.2 The containers, including packaging material, shall be made of substances which are safe, made of food grade material and suitable for the intended use. They should not impart any toxic substance or undesirable odour or flavour to the product.

8.3 When the product is packaged in sacks, these must be clean, sturdy and strongly sewn or sealed.
8.4  The net weight of the packages for gari may be required to meet the relevant regulations of the destination country.

9  Labelling

9.1  In addition to the requirements of ARS 56, the following specific labelling requirements shall apply and shall be legibly and indelibly marked:

(a) common name of the product "Garri";
(b) the size of the grain in accordance with 4.7;
(c) name, and physical address of the manufacturer/ distributor and/or trade name/ brand name;
(d) date of manufacture;
(e) list of ingredients in descending order of proportion;
(f) lot identification;
(g) expiry date;
(h) the net weight in metric units;
(i) storage instructions;
(j) declaration of flavouring agent or spice used; and
(k) instructions on disposal of used package.

9.2  Information for non-retail containers shall either be given on the container or in accompanying documents, except that the name of the product, lot identification and the name and address of the manufacturer or packer shall appear on the container. However, lot identification and the name and address of the manufacturer or packer may be replaced by an identification mark, provided that such a mark is clearly identifiable with the accompanying documents.

9.3  A batch or lot number in clear or in code shall be included on the label, together with an expiry date in the form “Best before” or “Use before” indicating the last date on which the manufacturer can be sure that the product will be acceptable.

9.4  Storage instructions may also be included on the label. Where any nutritional claim is made referring to the gari, full nutritional information shall be given.

10  Sampling

Sampling shall be done in accordance with CAC/GL 50.

11  Criteria for conformity

A lot shall be declared as conforming to this standard if samples inspected or analysed for quality requirements conform to the provisions of this standard.
Annex A
(normative)

Determination of acid insoluble ash

A.1 Reagent

A.1.1 Dilute Hydrochloric Acid — 1:1, prepared from concentrated hydrochloric acid.

A.2 Procedure

A.2.1 Weigh accurately about 2 g of the dried material in a tared porcelain, silica or platinum dish. Ignite with a meker burner for about 1 hour. Complete the ignition by keeping in a muffle furnace at 500 °C to 570 °C until grey ash results.

Cool and filter through whatman filter paper No. 42 or its equivalent. Wash the residue with hot water until the washings are free from chlorides as tested with silver nitrate solution and return the filter paper and residue to the dish. Keep it in an electric air oven maintained at 135 ± 2 °C for about 3 hrs. Ignite the dish again for about 30 minutes, cool and weigh. Repeat this process till the difference between two successive weighings is less than 1 mg. Note the lowest weight.

A.3 Calculation

A.3.1 Acid insoluble ash, per cent by weight

\[
\text{Acid insoluble ash, per cent by weight} = \frac{100(M_2 - M)}{M_1 - M}
\]

where,

\(M_2\) = the lowest weight, in g, of the dish with the acid insoluble ash;

\(M\) = weight, in g, of the empty dish; and

\(M_1\) = weight, in g, of the dish with the dried product taken for the test.
Annex B
(normative)

Determination of the sodium chloride content

B.1 Scope
This method determines the content of chlorides.

B.2 Definition
The chloride content corresponds to the sum of all anions (halides) calculated as sodium chloride precipitable with silver ions in a nitric acid solution.

B.3 Principle
Quantitative precipitation of the halides extracted from the ash in a nitric acid solution with AgNO₃ in excess.

Back titration of the surplus AgNO₃ with ammonium thiocyanate, using ferric alum (ferric ammonium sulphate) as the indicator.

B.4 Reagents

B.4.1 Distilled or demineralized water

B.4.2 AgNO₃ solution, 0.1 N (16.9888 g AgNO₃)

B.4.3 NH₄SCN solution, 0.1 N (7.6113 g NH₄SCN). In practice a slightly higher weight is taken and the solution is adjusted by dilution against a 0.1 N AgNO₃ solution.

B.4.4 Cold saturated NH₄Fe(SO₄)₂.12H₂O solution (approximately 40 %). The ensuing brown colouring is eliminated by adding pure nitric acid dropwise.

B.4.5 HNO₃ (approximately 30 %)

B.4.6 Diethyl ether of nitrobenzene

B.5 Apparatus

B.5.1 Measuring flask, 100 ml

B.5.2 Burette, 50 ml

B.5.3 Erlenmeyer flask, 200 ml

B.5.4 Pipettes

B.5.5 Funnel, filtering paper

B.6 Procedure

The ash (residue after carbonisation and incineration of the potato crisp at a maximum temperature of 550 °C in a muffle furnace) obtained from 1 g – 2 g dry matter is extracted by means of 80 ml – 90 ml hot distilled water acidified with a few drops of nitric acid. The washings are filtered off into a 100 ml measuring flask; after cooling distilled water is added until the mark is reached (stock solution).
In proportion to the expected chloride content aliquot part of this solution, which should preferably contain 50 mg – 100 mg NaCl, taken off, distilled water being added to obtain a quantity of approximately 100 ml.

Subsequently 5 ml ferric alum solution (see B.4.4), 20 ml 0.1 N AgNO₃ solution (see B.4.2) and 5 ml – 10 ml ether or 1 ml nitrobenzene are added; titration is carried out by means of an ammonium thiocyanate solution 0.1 N (see B.4.3), until the red colouring remains after stirring.

**B.7 Expression of results**

Report in percentage by weight to one decimal place.

\[
\text{Chloride content} = \frac{5.65 \times (V_2 - V_3) \times V \times 100}{V_1 \times P}
\]

where,

- \( P \) is the test portion, in mg, incinerated;
- \( V \) is the mL of the stock solution derived from the ash;
- \( V_1 \) is the volume, in ml, stock solution used from titration;
- \( V_2 \) is the volume, in ml, AgNO₃ added;
- \( V_3 \) is the volume, in ml, NH₄SCN necessary for back titration.
Bibliography


CODEX STAN 151:1989(Rev. 1:1995), Standard for gari