# AVAILABILITY OF CASSAVA PROCESSING MACHINES IN LIBERIA: EFFECT ON HEAVY METALS CONTAMINATION OF GARI

*By*

Wasiu Awoyale, Robert Asiedu, William K.C. Kawalawu, Busie Maziya-Dixon, Adebayo Abass, Michael Edet & Peter Kolawole

Cassava 2017 TECH CONFERENCE
22–23 NOVEMBER, LAGOS ORIENTAL HOTEL

# HIGHLIGHTS

Introduction

Materials & Methods

Results & Discussions

Acknowledgement

Conclusion & Recommendation

# INTRODUCTION



- Cassava is the second staple consumed in Liberia after rice
- Gari is a popular cassava food in Liberia and most parts of West Africa and some countries of Central Africa
- Available gari production machines in Liberia
- Quality/safety of gari produced in Liberia
- Need for a study on gari production machines and evaluation of heavy metals in the product

# MATERIALS & METHODS



- **Assessment of available processing machine:** One hundred & sixty well-structured questionnaires were used for the collection of information on the available cassava processing machines in eight Counties (Rivercess, Grand Bassa, Bomi, Margibi, Sinoe, Gbarpolu, Montserrado and Grand Capemount)
- **Sample collection:** Sixty-one gari samples (white gari-45, yellow gari-1, Coconut-fortified gari-4, Groundnut-fortified gari-10, and Groundnut-moringa-fortified gari-1) were collected from the processors for assessment
- **Heavy metal analyses:** Iron, zinc, copper and aluminium contents of the samples were determined using the method described by Jones *et al.* (1990)
- **Statistical analysis:** Analysis of variance (ANOVA), separation of the mean values (using Duncan's Multiple Range Test at $p<0.05$) and frequency distributions were calculated using Statistical Package for Social Scientists (SPSS) software (version 21.0)

# MATERIALS & METHODS



Table 1. Processing methods for *gari* from fresh cassava roots in Liberia

| Type of gari | Processing method |
|---|---|
| White gari | Peeling, washing, grating, bagging and dewatering, granulation and roasting in earthenware pots. |
| Yellow gari | Same processing steps as above with mixing of palm oil to the granules before roasting |
| Coconut-fortified gari | Grating and roasting of matured coconut pulp before mixing with white gari |
| Groundnut-fortified gari | Roasting and milling of groundnuts before mixing with white gari |
| Groundnut-moringa-fortified gari | Drying of fresh moringa leaves, milling and mixing with groundnut-fortified gari |

# RESULTS & DISCUSSIONS



Table 2. Available cassava processing machines/equipment in Liberia

| | Rivercess | | Grand Bassa | | Bomi | | Margibi | | Sinoe | | Gbarpolu | | Montserrado | | Grand Capemount | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Machine** | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % |
| **Peeling** | | | | | | | | | | | | | | | | |
| **No** | 17 | 100 | 22 | 100 | 20 | 100 | 21 | 100 | 15 | 100 | 20 | 100 | 18 | 100 | 20 | 100 |
| **Yes** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Grating** | | | | | | | | | | | | | | | | |
| **No** | 12 | 71 | 19 | 86 | 19 | 95 | 19 | 57 | 13 | 72 | 16 | 80 | 19 | 95 | 13 | 65 |
| **Yes** | 5 | 29 | 3 | 14 | 1 | 5 | 9 | 43 | 5 | 28 | 4 | 20 | 1 | 5 | 7 | 35 |
| **Pressing** | | | | | | | | | | | | | | | | |
| **No** | 13 | 76 | 19 | 86 | 19 | 95 | 18 | 86 | 16 | 89 | 20 | 100 | 19 | 95 | 19 | 95 |
| **Yes** | 4 | 24 | 3 | 14 | 1 | 5 | 3 | 14 | 2 | 11 | 0 | 0 | 1 | 5 | 1 | 5 |
| **Sieving** | | | | | | | | | | | | | | | | |
| **No** | 15 | 88 | 19 | 86 | 19 | 95 | 20 | 95 | 18 | 100 | 20 | 100 | 18 | 90 | 20 | 100 |
| **Yes** | 2 | 12 | 3 | 14 | 1 | 5 | 1 | 5 | 0 | 0 | 0 | 0 | 2 | 10 | 0 | 0 |
| **Drying** | | | | | | | | | | | | | | | | |
| **No** | 17 | 100 | 19 | 100 | 20 | 100 | 20 | 95 | 18 | 100 | 20 | 100 | 18 | 90 | 20 | 100 |
| **Yes** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 2 | 10 | 0 | 0 |
| **Chipping** | | | | | | | | | | | | | | | | |
| **No** | 15 | 88 | 22 | 100 | 20 | 100 | 21 | 100 | 18 | 100 | 20 | 100 | 18 | 90 | 20 | 100 |
| **Yes** | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 0 | 0 |
| **Mechanical Roaster** | | | | | | | | | | | | | | | | |
| **No** | 15 | 100 | 22 | 100 | 20 | 100 | 21 | 100 | 18 | 100 | 20 | 100 | 18 | 90 | 20 | 100 |
| **Yes** | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 0 | 0 |
| **Roasting pan** | | | | | | | | | | | | | | | | |
| **No** | 12 | 29 | 5 | 23 | 6 | 30 | 8 | 38 | 0 | 0 | 9 | 45 | 20 | 0 | 0 | 0 |
| **Yes** | 5 | 71 | 17 | 77 | 14 | 70 | 13 | 62 | 18 | 100 | 11 | 55 | 0 | 100 | 20 | 100 |

# RESULTS & DISCUSSIONS

Table 3. Heavy metal composition of *gari* products in Liberia

| **Samples** | N | Fe (ppm) | Cu (ppm) | Zn (ppm) | Al (ppm) |
|---|---|---|---|---|---|
| White gari | 90 | 45.00±52.86a | 0.94±1.00a | 5.47±6.49a | 136.59±165.13a |
| Cocoanut-fortified gari | 8 | 60.75±66.58a | 0.93±1.00a | 4.64±5.38a | 104.16±124.83a |
| Yellow gari | 2 | 64.90±91.78a | 1.25±1.77a | 7.85±11.10a | 87.15±123.25a |
| Groundnut- fortified gari | 20 | 42.93±51.14a | 0.93±0.99a | 6.04±6.86a | 180.52±221.25a |
| Groundnut-moringa- fortified gari | 2 | 44.35±62.72a | 0.70±0.99a | 3.50±4.95a | 118.75±167.94a |
| **Counties** | | | | | |
| Montserrado | 52 | 51.89±61.46a | 0.92±0.98a | 4.92±5.32ab | 105.01±179.45b |
| Bomi | 6 | 25.62±29.31a | 0.90±1.01a | 4.07±4.67b | 1112.85±128.02a |
| Gbarpolu | 6 | 25.80±29.40a | 1.00±1.16a | 10.88±14.85a | 138.68±154.91b |
| Grand Bassa | 20 | 25.36±29.74a | 0.91±0.96a | 4.76±5.65ab | 145.60±151.80b |
| Rivercess | 4 | 50.20±58.68a | 1.00±1.15a | 5.80±7.07ab | 141.92±165.13b |
| Margibi | 20 | 55.65±59.92a | 0.88±0.93a | 6.10±6.65ab | 110.00±143.34b |
| Grand Cape mount | 12 | 47.29±51.79a | 0.87±0.93a | 5.49±6.11ab | 177.98±274.55b |
| Sinoe | 20 | 37.36±42.29a | 1.10±1.17a | 5.85±6.21ab | 127.53±131.09b |
| **Mean** | | 43.87 | 0.94 | 5.49 | 257.45 |
| P Samples | | NS | NS | NS | NS |
| P Counties | | NS | NS | NS | NS |
| P Samples x Counties | | NS | NS | NS | NS |

P-Phosphorus, Fe-Iron, Cu-Copper, Zn-Zinc, Al-Aluminium, NS-Not significant
Means with different letters along the same column are significantly different ($p<0.05$)

# CONCLUSION & RECOMMENDATION



- The *gari* produced in Liberia may be safe for consumption since the zinc and copper contents were below the recommended maximum limit stipulated by the FAO/WHO
- However, there is a need for caution in the use of mild or galvanized steel instead of stainless steel materials as food contact surfaces, as well as painting of processing machine surfaces with metallic polish because of the high iron and aluminium contents in the *gari*

# ACKNOWLEDGEMENT


# THANKS FOR LISTENING