

*Full Length Research Paper*

# Assessing the health impacts of cyanide exposure in cassava consumers in Liberia

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**Cassava is a staple crop widely consumed across Liberia, yet its improper processing poses health risks due to the presence of cyanogenic glycosides. This study assessed the health impacts of cyanide exposure among cassava consumers in seven counties in Liberia. Data were collected from 135 respondents using structured questionnaires focused on cassava production, cassava processors, consumption patterns, health symptoms, and awareness of cassava toxicity. Results showed high daily consumption of cassava, including raw forms, with limited awareness of its toxic potential between local and improved varieties. While only 26% reported minor health symptoms, a significant majority neither associated these with cassava nor sought medical help. Statistical analysis revealed weak correlations ( $r = 0.10$ ) between income and consumption, and no clear link between cassava intake and health issues likely due to consumption of only local variety, limited acknowledge on its toxic potential and underreporting. The findings highlight the urgent need for public education, improved processing practices, and policy interventions to mitigate health risks linked to cyanide exposure from cassava consumption in Liberia.**

**Key words:** Cassava consumption, cyanide exposure, food safety, public health, Liberia.

## INTRODUCTION

Cassava (*Manihot esculenta*) is a staple food crop widely grown and consumed in many parts of the world (Fathima et al., 2023), including Liberia (Awoyale et al., 2020). It serves as a primary source of carbohydrates and plays a significant role in food security and income generation for smallholder farmers. Due to its resilience to harsh climatic conditions and adaptability to various soil types, cassava remains a preferred crop for many rural

households (Immanuel et al., 2024).

However, despite its importance, concerns have emerged regarding its production, consumption patterns, and potential health risks associated with its intake (Mombo et al., 2017). The production of cassava in Liberia varies by region, with farmers cultivating different varieties based on consumer's preference, yield potential, market demand, and resistance to pests and diseases.

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**Figure 1.** Map of Liberia.

Traditional and improved cultivation methods are employed, with fewer farmers using fertilizers to enhance productivity. The scale of cassava production influences household income, with larger farms having the potential to contribute significantly to local economies. However, challenges such as low productivity, poor soil fertility, awareness about improved varieties and limited access to agricultural inputs remain obstacles to increased cassava production (Dogba et al., 2020). Cassava consumption is deeply ingrained in Liberian dietary habits. It is processed into various forms such as fufu, gari, and cassava flour, among others. While cassava provides essential nutrients, its consumption is not without risks. Improper processing and preparation can lead to exposure to toxic compounds such as cyanogenic glycosides, which can cause adverse health effects, including acute poisoning. Additionally, frequent consumption of improperly processed cassava has been linked to chronic health issues such as neurological disorders and gastrointestinal distress (Jackson et al., 1992).

Understanding the relationship between cassava production, consumption, and associated health issues is crucial for informing policy interventions and promoting safe agricultural and dietary practices. This study aims to assess the current state of cassava farming and consumption in Liberia, identify potential health risks linked to cassava intake, and explore ways to mitigate these risks through improved processing and public

awareness.

## MATERIALS AND METHODS

### Study area

The study was conducted from July to August 2023 in Liberia, focusing on several counties Bong, Bomi, Grand Bassa, Margibi, Cape Mount, Montserrado, and Nimba where cassava production and consumption are prevalent. Liberia has a tropical climate with distinct wet and dry seasons, which is conducive to cassava farming. The selected study areas represent diverse agroecological zones and farming practices, thereby ensuring comprehensive coverage of cassava-related issues. Figure 1 shows the map of Liberia.

### Sampling

A stratified random sampling technique was employed to 135 select respondents for the study. Farmers and consumers were chosen from different counties, ensuring representation of both urban and rural populations. The sample included individuals involved in cassava production and households that frequently consume cassava products.

### Data collection

Primary data were collected through structured questionnaires administered to respondents. The questionnaire covered key aspects such as demographic characteristics, farm size, cassava varieties cultivated, production and processing methods, fertilizer

**Table 1.** Demographic characteristics of the respondents.

Item	Frequency	Percentage
<b>Gender</b>		
Male	73	54
Female	62	46
<b>Age</b>		
20-30	19	14.07
31-40	48	35.56
41-50	47	34.81
51-60	16	11.85
>60	5	3.70
<b>Education level</b>		
College	5	3.70
High school	23	17.04
Illiterate	63	46.67
Primary education	32	23.70
Secondary education	12	8.89

usage, harvest quantity, income from cassava sales, and consumption patterns. Additionally, respondents were asked about any health issues experienced after consuming cassava and their awareness of cassava toxicity.

#### Data analysis

The collected data were analyzed using both descriptive and inferential statistical methods. Frequency distributions, percentages, and means were used to summarize demographic and production-related data. Correlation analysis was performed to determine the relationships between cassava consumption and reported health issues. The findings were interpreted to provide insights into policy implications and recommendations for improving the safety of cassava production and consumption in Liberia. IBM SPSS version 27 was used for all statistical analyses.

## RESULTS AND DISCUSSION

### Socioeconomic and demographic profile of respondents

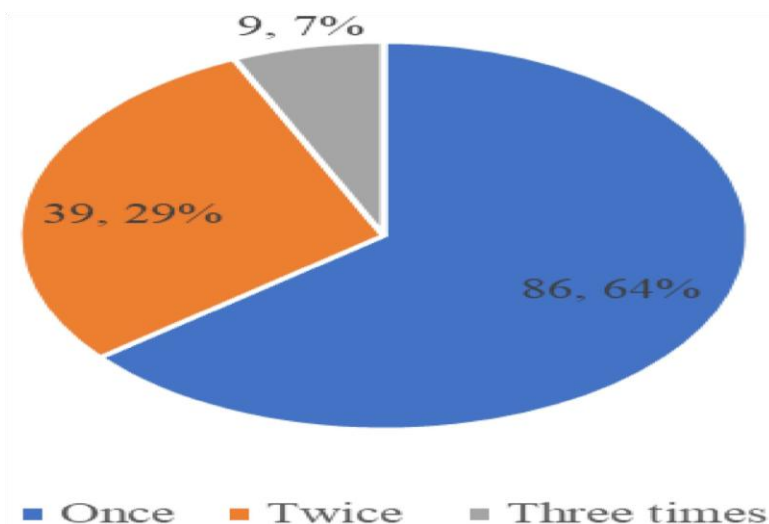
This provides an overview of the respondents' background, which is crucial for understanding patterns of cassava consumption and potential health risks. The 135 respondents interviewed across seven counties had an average age of 40 years, and most households consisted of around seven members. Monthly income varied but averaged around \$65. These figures highlight the prevalence of large family units, likely contributing to higher food demand and increased cassava consumption. While cassava is an affordable and readily available food source, such income levels may limit

access to dietary diversity or health services, factors that could compound the risk of cyanide toxicity. Table 1 shows the demographic characteristics of the respondents.

### Cassava consumption patterns and processing methods

Cassava was confirmed as a staple food in all seven counties studied. The data shows that cassava is consumed daily by all participants, with 63% consuming it once a day, 29% twice a day, and the remaining 7% three times a day. The average daily intake was found to be about 769 g of cassava per person, which is substantial. Various processed forms of cassava were reported, with fufu being the most common (63 respondents), followed by GB, Gari and mixed forms such as GB with Deepah. Despite being a root crop requiring adequate processing to remove harmful compounds, 100% of respondents reported consuming raw cassava, raising public health concerns. Figure 2 shows the frequency of cassava consumption by the respondents. The preparation techniques varied among the communities, suggesting inconsistencies in processing quality and completeness. While some techniques (e.g., fermenting) are effective in reducing cyanogenic compounds, the informal nature of cassava processing in many areas may result in significant exposure to residual cyanide.

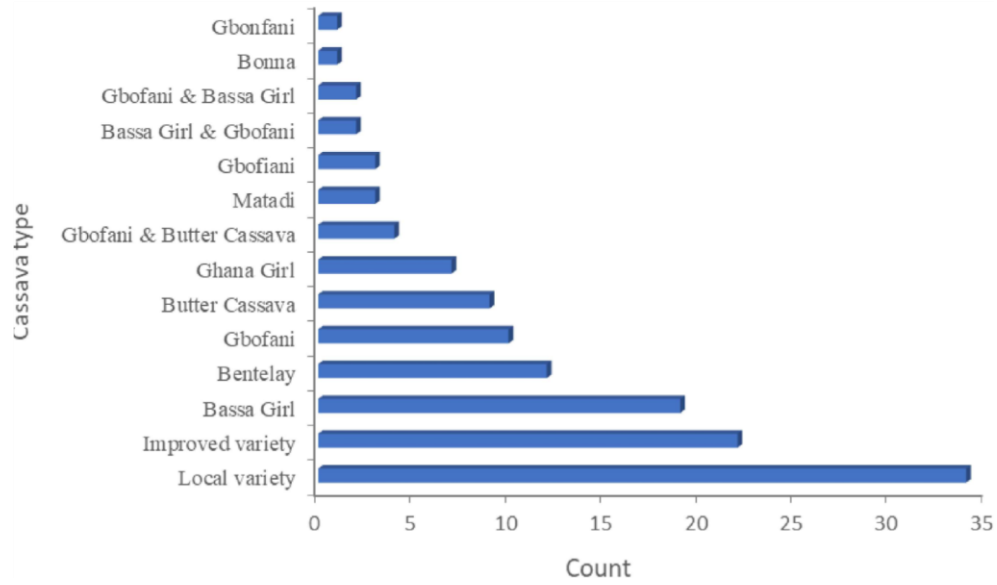
The analysis of cassava varieties consumed by respondents across the seven counties revealed that the



**Figure 2.** Frequency of cassava consumption by the respondents.

local variety was the most widely reported, accounting for 34 instances, which underscores its dominance in household diets and traditional farming systems in Liberia. This was followed by the improved variety with 22 mentions, indicating a moderate but growing adoption of improved cultivars, which may be linked to the presence of national Research institution and agricultural extension efforts or awareness of their potential health/yield benefits. The variety Bassa Girl was cited 19 times, reflecting its popularity as a local cultivar, likely due to taste preference or cultural familiarity. Other frequently

reported varieties included Bentelay (12), Gbofani (10), Butter Cassava (9), and Ghana Girl (7), each reflecting regional variations in naming and availability. A few respondents identified mixed varieties such as Gbofani and Butter Cassava (4), Bassa Girl and Gbofani (2), and Gbofani and Bassa Girl (2), suggesting either co-consumption or lack of clear variety differentiation. Less common varieties such as Matadi (3), Gbofani (3), Bonna (1), and Gbonfani (1) were rarely reported, indicating limited distribution or use. Figure 3 shows the type of cassava mostly consumed by the respondents.



**Figure 3.** Type of cassava mostly consumed by the respondents.

### Health experiences related to cassava intake

Although cassava consumption is widespread, only 26% of respondents reported experiencing any health symptoms, most of which were minor, such as bloating and gas. Notably, the majority of respondents (approximately 74%) either reported no health issues or provided non-specific responses such as “*other*.” This pattern may indicate limited awareness or an underestimation of the health effects associated with cyanide exposure. Furthermore, 96% of respondents who experienced symptoms did not seek medical attention, likely due to limited awareness or restricted access to healthcare services. These findings underscore the importance of health education and clinical awareness, particularly in communities that rely heavily on cassava as a staple food. Evidence from the literature indicates that chronic cyanide exposure, even at low levels, is associated with conditions such as konzo, a neurological disorder, and goiter, especially when compounded by protein-deficient diets.

### Awareness and perception of cassava toxicity

The study uncovered a critical gap in public knowledge about the potential toxicity of cassava. Only 6 respondents (4.4%) were aware that cassava could be toxic if not processed correctly. Even fewer could articulate the nature or types of toxicity associated with it. This lack of awareness was particularly striking given the high rates of cassava consumption, including in raw form. It suggests that public education on the safe handling and preparation of cassava is either absent or ineffective in the study areas. The combination of frequent raw cassava intake and limited knowledge of toxicity creates a dangerous scenario where people may unknowingly expose themselves to health risks. The findings call for urgent, community-focused education campaigns that teach people about cyanogenic glycosides, proper processing techniques, and the symptoms of cyanide poisoning. A basic correlation analysis was conducted to assess whether cassava consumption levels were associated with household income. The results indicated a very weak positive correlation ( $r = 0.10$ ), implying that income does not strongly influence how much cassava is consumed. Instead, consumption seems more culturally and habitually driven, pointing to cassava's entrenched role in the Liberian diet. No statistically significant association was observed between the level of cassava consumption and the incidence of reported health issues. This may be due to underreporting of symptoms, lack of awareness, or the non-specific nature of self-reported health effects. More robust testing, including biochemical assays or clinical health evaluations, would be required to detect chronic cyanide exposure and establish definitive

causal links.

### POLICY IMPLICATIONS AND RECOMMENDATIONS

The study highlights cassava's central role in ensuring food security across Liberia, but it also underscores the urgent need for policy intervention. The widespread lack of knowledge about cassava toxicity, coupled with the habitual consumption of raw cassava, could potentially lead to long-term public health issues if not addressed. Education campaigns promoting safe cassava processing should be implemented through Research Institutions, agricultural extension services, community health initiatives, and school programs. Additionally, efforts should be made to encourage the use of low-cyanide cassava varieties, improve access to processing equipment, and promote alternative dietary options to reduce overdependence on cassava. A multidisciplinary approach involving public health professionals, agricultural experts, and community leaders will be necessary to translate these findings into sustainable improvements in health and nutrition.

### CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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