

Review Article

Health Risks and Food Safety Issues Related to the Microbiological Quality of Local Juices Produced and Consumed in West Africa

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Abstract

Local artisanal juices occupy an important place in the dietary habits of West African populations. However, the conditions of their production often give rise to microbiological risks linked to traditional processing, packaging, and preservation methods. This study was conducted through a literature review of scientific articles, technical reports, and institutional documents available between 2019 and 2024. The databases consulted included Google Scholar, PubMed, AJOL, and ScienceDirect. Only documents relating to non-alcoholic juices produced and consumed in West Africa were included. Data from several studies conducted in Benin, Burkina Faso, Côte d'Ivoire, Mali, Senegal, and Togo revealed microbial loads that very often exceeded accepted standards. The most frequently isolated germs were *E. coli*, *Staphylococcus aureus*, *Salmonella spp.*, *Bacillus cereus*, yeasts, and molds. The presence of these microbial agents in juices produced and consumed locally in West Africa affects their microbiological quality and exposes consumers to various risks of collective food poisoning. These contaminations are linked to the quality of raw materials, the use of unsafe water, soiled utensils, non-compliance with hygiene rules by handlers, insufficient heat treatment and the absence of a cold chain. These deficiencies expose consumers to various health risks and constitute an obstacle to the development of safe and profitable value chains. It is imperative for West African countries to implement national training programs focused on good hygiene practices, strengthen access to drinking water and sanitation facilities, and develop a regulatory framework adapted to the reality of the informal sector. Simplified inspection and certification systems could be introduced to guarantee the safety of juices while supporting small producers.

Keywords

Microbiological Quality, Local Juices, Food Contamination, Food Safety and West Africa

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1. Introduction

Local juices are traditional drinks prepared from the fruits or leaves of tropical plants or indigenous spices. Nowadays, the consumption of these local juices is deeply rooted in West African dietary habits and cultural practices. Highly prized for their natural taste, accessibility, and purported medicinal properties, these juices are ubiquitous in public spaces, including markets, schools, hospitals, bus stations, and social events [1, 2].

The most commonly consumed include ginger (*Zingiber officinale*) juice, bissap (*Hibiscus sabdariffa*) juice, tamarind (*Tamarindus indica*) juice, baobab (*Adansonia digitata*) juice, and nere (*Parkia biglobosa*) juice. The marketing of these artisanal beverages represents a significant source of incomes for many women processors and street vendors [3].

However, the microbiological quality of these juices is raising growing public health concerns. Prepared in an artisanal manner, without sterilization or pasteurization processes, often using non-potable water and under precarious hygienic conditions, these products are exposed to significant microbial contamination. Several recent studies have highlighted the presence of pathogenic bacteria such as *Escherichia coli*, *Staphylococcus aureus*, *Salmonella spp.*, as well as yeasts and molds [4-6]. These microorganisms can cause foodborne illness, particularly in children, the elderly, or immunocompromised individuals [7].

The lack of a harmonized regulatory framework in West African countries, the low level of training of stakeholders, and the inadequacy of official control systems make it difficult to accurately assess their microbiological quality. Despite their economic and nutritional role, local juices are poorly regulated by food safety policies in many West African countries [8]. Based on a literature overview, this work aimed to contribute to the valorization of local juices in West African countries by highlighting their possible health risks and food safety issues.

2. Methods

The methodology consisted of conducting a systematic literature review in academic databases (Google Scholar, PubMed, African Journals Online, and ScienceDirect) to identify reliable sources such as relevant articles, journals, and reports on the microbiological quality of local juices in West Africa. Keywords related to the microbiological quality of local juices in West Africa were used. Predefined selection criteria included studies published in peer-reviewed scientific journals, reports from public health organizations, and relevant research papers. They excluded all sources that did not address microbiological

quality, or that did not cover West Africa and local juices used as alcoholic beverages. A data analysis was conducted by synthesizing the results of the selected studies and the analytical methods used. The expected results aim to:

- 1) summarize the traditional methods of preparing local juices in West Africa,
- 2) assess the microbiological quality of local juices produced in West Africa by identifying the main pathogens and microbiological contaminants,
- 3) identify the health risks associated with the consumption of local juices,
- 4) determine the food safety issues related to manufacturing and preservation practices,
- 5) propose recommendations to improve the microbiological quality of local juices.

Although local juices are traditional beverages enjoyed by West African populations for various reasons, their artisanal preparation, carried out under mostly precarious hygienic conditions, exposes these products to potentially dangerous contamination. The microbiological quality of these juices raises major public health concerns. By providing recommendations to improve the microbiological quality of these juices, we can not only protect the health of consumers, but also support the women who depend on them economically.

3. Preparation Methods of Traditional Juice in West Africa

In West Africa, the preparation of traditional juices relies on artisanal practices that are largely passed down informally between generations. These juices are generally obtained from local products such as bissap flowers (*Hibiscus sabdariffa*), ginger roots (*Zingiber officinale*), baobab fruits (*Adansonia digitata*), tamarind (*Tamarindus indica*), or nere seeds (*Parkia biglobosa*). Based on the available results, eight local juices retained with six West African countries were selected for this review: Benin, Burkina Faso, Ivory Coast, Mali, Senegal and Togo. Local populations appreciate these local juices prepared from tropical plant products and attribute certain virtues to them based on their beliefs. These considerations have earned them scientific interest among several West African scientists. The table summarizes the popular juices and the reasons for their appreciation. The juices retained at the end of the documentary search are presented in Table 1.

Table 1. Main local juices produced and consumed in West Africa.

Plants	Scientific Name	Used part of the plant	Somes alleged virtues	Reference
Baobab	<i>Adansonia digitata</i>	Fruits	Manage blood sugar levels, Antimicrobial and antiviral, Rich in antioxidants Rich in fiber promotes satiety	[9]
Bissap	<i>Hibiscus sabdariffa</i>	Flowers	Energy-rich antioxidant, Regulates blood circulation	[10, 11]
Citron	<i>Citrus lemon</i>	Fruits	Regulates digestion	[12, 13]
Gingembre	<i>Zingiber officinale</i>	Roots	Promotes digestion, Stimulates the immune system, acts against nausea and vomiting, powerful natural anti-inflammatory, anti-fatigue tonic, strong antioxidant	[14, 15]
Goyave	<i>Psidium guajava</i>	Fruits	Helps with vomiting, diarrhea and nervous breakdowns	[16, 17]
Mangue	<i>Mangifera indica</i>	Fruits	Antioxidant, maintains epithelial tissues, fights constipation	[18, 19]
Nere	<i>Parkia biglobosa</i>	Fruits (powders)	Anti-hemorrhagic, antineuralgic, diuretic, febrifuge, tonic, antiseptic and vermifuge properties.	[20, 21]
Tamarin	<i>Tamarindus indica</i>	Fruits	Source of vitamins and minerals, Antioxidant properties	[22, 23]

3.1. Pretreatment and Sorting of Raw Materials

Flowers, fruits, or roots are purchased at local markets, often in bulk. They are manually sorted to remove visible impurities (dust, plant waste). At this stage, systematic washing with potable water is often not carried out [1, 6].

The preparation method varies depending on the juice and recipe, but generally follows the steps below:

3.2. Infusion or Maceration

Ingredients are boiled (e.g., ginger, bissap) or macerated in water for several hours (as with tamarind or baobab). The liquid is then filtered through cloths or strainers, which are often reused and rarely disinfected [5]. In some cases, maceration is carried out at room temperature, which promotes microbial growth if the process is prolonged.

3.3. Addition of Complementary Ingredients

Sugar, lemon, or artificial flavoring are generally added to improve taste. In some cases, chemical preservatives (sorbates, benzoates) are added empirically, without controlled dosage [3, 4].

3.4. Filtration and Packaging

The juice is filtered one last time before being packaged in recycled plastic bottles (often soda bottles). Containers are not sterilized, and bare-hand contact is common, which promotes contamination [24, 25].

3.5. Storage and Sale

Juices are sold on the street, exposed to heat, dust, and insects. The lack of a cold chain increases the risk of microbial proliferation. Vendors sometimes use coolers, but the quality of the ice is not guaranteed, as it often comes from uncontrolled sources [2].

4. Challenges Associated with Traditional Methods of Preparing Local Juices

The artisanal processing of local juices in West Africa relies on ancestral know-how, often passed down informally. While these methods are culturally valued and economically accessible, they nevertheless present numerous food safety challenges. Several structural, technical, and behavioral factors compromise the microbiological quality of finished products. The processing steps (washing, grinding, infusion, filtration, bottling) are often carried out in uncontrolled environments with rudimentary hygiene. The water used to wash raw materials or utensils is sometimes unsafe to drink, and the equipment (basins, bottles, funnels) is rarely disinfected. A study conducted in Benin revealed that 65% of juice producers did not have access to a drinking water source and that 72% used recycled containers without adequate disinfection [26]. Traditional juices are mostly sold raw, without pasteurization or boiling. This lack of heat treatment allows the survival of pathogenic or spoilage microorganisms,

including *Salmonella* spp., *Escherichia coli*, *Staphylococcus aureus* and various yeasts [27, 28]. Storage at room temperature is common, particularly in peri-urban and rural areas. The lack of a cold chain favors bacterial proliferation, especially when juices are stored for several hours after production [29]. The majority of small producers lack training in good hygiene practices (GHP) or food safety. Knowledge is empirical, inherited from experience, without scientific validation. This leads to risky practices: using dirty linen for filtering, handling without handwashing, or storing on the floor [30]. The informal juice production sector often escapes health inspections. Food surveillance systems do not adequately cover small artisanal units due to a lack of resources or a specific legislative framework [31]. The investments needed to improve quality (sterile filters, pasteurizers, cold rooms) are out of reach for most stakeholders. Furthermore, irregular access to electricity is a major limitation to the use of preservation technologies [32]. These interconnected challenges expose consumers to increased risks of foodborne

illness, particularly among vulnerable groups (children, pregnant women, the elderly). They also hamper the structuring and competitiveness of the local juice sector on urban and export markets.

5. Available Data on the Microbiological Quality of Local Juices in West Africa

Available data on the microbiological quality of local juices in West Africa show a high prevalence of contamination of fecal, environmental, or poor hygiene practices (Table 2). Several studies have been conducted in various countries in the region, revealing frequent non-compliance with international microbiological standards. These results illustrate the urgent need to strengthen microbiological controls, producer training, and regulatory oversight of the informal local juice production sector.

Table 2. Summary of results of microbiological quality of local juices in West Africa.

Country	Type of juice	Main isolated Microorganisms	Non compliance rate of samples	Reference
Benin	Pineapple, baobab, ginger	Total Coliforms, <i>E. coli</i> , <i>S. aureus</i>	68% (coliforms), 35% (fecal coliforms)	[26]
Burkina Faso	Artisanal fruit juices of mango and guava	<i>E. coli</i> , <i>S. aureus</i> , molds, <i>Clostridium</i> spp. (sporadic)	50% (according to local criteria)	[3]
Côte d'Ivoire	Bissap, ginger, tamarind	<i>coli</i> , <i>Salmonella</i> spp., <i>S. aureus</i>	60% (total germs >10 ⁷ CFU/mL)	[27]
Mali	Baobab, nere, Bissap, tamarind	<i>coli</i> , <i>Enterobacter</i> spp., <i>Klebsiella</i> spp., yeasts, molds	> 70% (microbial load >10 ⁶ CFU/mL)	[28]
Senegal	Bissap, tamarind	<i>Bacillus cereus</i> , yeasts, molds	55% (noncompliance ECOWAS)	[33]
Togo	Lemon, ginger	Total Coliforms, molds, <i>Enterobacteriaceae</i>	62% (charges > Codex Standards)	[34]

6. Contamination Factors and Sources of Risk

Artisanal production of local juices in West Africa is exposed to numerous sources of microbiological contamination throughout the processing chain. The fruits used, often harvested in unhygienic conditions and stored carelessly, constitute a primary source of contamination. They can be contaminated by dust, insects, dirty hands, or contaminated surfaces. The water used to wash raw materials, utensils, or containers is often unsafe to drink, representing a major vector for the introduction of pathogenic microorganisms, including *Escherichia coli* and *Salmonella* spp. [26, 28].

Processing equipment (blenders, basins, funnels, bottles)

is frequently reused without proper cleaning or disinfection. Many artisanal producers use recycled containers, such as plastic water or beverage bottles, without prior heat or chemical treatment. These practices promote the accumulation of germs and the formation of biofilms, making contaminant removal more difficult [33]. Human handling is also a critical factor. In the majority of observed cases, producers lack training in good hygiene practices. Lack of handwashing, wearing dirty clothing, and using unclean cloths to filter juices are common practices. Cross-contamination between raw materials, surfaces, and finished products is common [30]. Failure to use heat treatments (boiling, pasteurization) allows pathogens to survive and promotes their proliferation. Furthermore, juices are often stored at room temperature, sometimes for several

hours, in environments where the cold chain is nonexistent or flawed. This situation is exacerbated by the lack of access to electricity in many rural or peri-urban areas [33]. Finally, the lack of strict regulation and official oversight is an aggravating factor. The informal juice production sector largely escapes health inspections due to limited institutional resources, an inadequate regulatory framework, or weak enforcement of existing regulations [29, 31]. The accumulation of these factors creates an environment conducive to microbiological contamination of local juices, compromising their safety for consumers and their potential for economic development in the region.

7. Health Consequences and Public Health Risks

The consumption of contaminated local juices poses a significant public health risk in West Africa. Frequently found microorganisms, such as *Escherichia coli*, *Salmonella spp.*, *Staphylococcus aureus* and *Bacillus cereus*, can cause diarrhea, food poisoning, and even serious infections, particularly in children and vulnerable individuals [28, 33]. Poisoning-related infections linked to the consumption of these artisanal beverages are exacerbated by the lack of pasteurization, poor hygiene, and the use of unsafe water. The lack of labeling, health controls, and a cold chain compound the risks. These often invisible contaminations contribute to the burden of diarrheal diseases, the overloading of healthcare facilities, and a growing distrust of local products. Consumption of contaminated local juices exposes consumers to gastrointestinal infections caused by *E. coli*, *Salmonella spp.*, and *Staphylococcus aureus*, which can cause diarrhea, vomiting, and foodborne illness, especially in vulnerable populations [28, 32].

The presence of yeasts, molds, and *Bacillus cereus* also poses risks, particularly through the production of toxins or allergens [33]. The lack of good hygiene and storage practices amplifies these dangers, with a significant impact on public health in the informal sector [30].

8. Conclusion and Recommendations

The widespread consumption of local juices in West Africa, while culturally, nutritionally, and economically important, presents major microbiological risks due to poorly regulated artisanal production practices. Analysis of available data shows frequent contamination by pathogens such as *Escherichia coli*, *Salmonella spp.*, and *Staphylococcus aureus*, exposing consumers to foodborne illness. In the same vein, we recommend for future research, taking stock of the presence or absence of pesticide residues and heavy metals in local juices will be a good follow-up to this work and will provide a complete overview of their microbiological and toxicological quality. To improve the safety of these products,

it is essential to increase awareness and train producers on good hygiene practices, promote access to drinking water and clean equipment, and introduce simple heat treatment and preservation methods. The development of a flexible regulatory framework adapted to the informal sector, combined with relaxed but regular microbiological controls, would ensure the safety of juices while supporting their economic potential. An inclusive and multisectoral approach is essential to sustainably secure this sector with its high social impact.

Abbreviations

AJOL	African Journals Online
CFU/mL	Colony Forming Units per Milliliter
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization
GHP	Good Hygiene Practices
HACCP	Hazard Analysis and Critical Control Points
ISA	Institut des Sciences Appliquées
INSP	Institut National de Santé Publique
LCV	Laboratoire Central Vétérinaire
LOQ	Limit of Quantification
USTTB	Université des Sciences, des Techniques et des Technologies de Bamako
WHO / OMS	World Health Organization

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Author Contributions

Conceived and designed the study: Aminata Sissoko, Boubacar Madio dit Aladiogo Maïga. Selected studies, collected, analyzed data and synthesized the results: Aminata Sissoko, Boubacar Madio dit Aladiogo Maïga. Wrote the original draft: Aminata Sissoko, Boubacar Madio dit Aladiogo Maïga, Mamadou Abdoulaye Konare, Aminata Diallo, Fasse Samake. All authors have read and approved the final manuscript.

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Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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