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## High Levels of Fungal and Aflatoxin Contamination of the Production Stages of the Local Brew (Ajono) consumed in Uganda

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Fermentation.*

Local brew commonly known as Ajono is a widely consumed alcoholic beverage in Uganda. Handling practices along the production stages of the local brews may create a conducive environment for fungal colonization. This study aimed to assess fungal and aflatoxin contamination along the different production stages of Ajono from Soroti District in Eastern Uganda. A total of 180 samples were collected from the different stages along Ajono production. An interview guide was used to assess the processing practices while fungal contamination was assessed using standard microbiological methods. The study found that there are three main stages during Ajono production, namely; millet grain, fermented paste, and the liquid (Ajono) stages. During the paste fermentation stage, brewers used plastic drums (50%), pits (47%) or pots (3%) as fermentation vessels. Samples from plastic drum fermentation vessels had higher levels of fungal contamination than those from the pits and pots. Furthermore, several moulds genera including *Aspergillus* spp., *Fusarium* spp., *Alternaria* spp., *Rhizopus* spp., *Penicillium* spp., *Cladosporium* spp., and *Acremonium* spp. were identified along the production stages, with *Aspergillus* spp. as the most prevalent moulds at all stages of Ajono production. Two yeast genera; *Saccharomyces* spp. and *Candida* spp. were also isolated. Total Aflatoxin B and G group was detected along the production stages of Ajono with the highest prevalence (78.6%) seen in the liquid Ajono from pit fermenters and 68.8% in drum fermenters. Overall, all three stages of Ajono production; millet grain, fermented paste, and the liquid Ajono stages were highly contaminated with aflatoxigenic fungi which may cause adverse health effects under continued and sustained consumption of the brew.

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**INTRODUCTION**

In Africa, local brews are traditionally prepared in homesteads and many of them confer some cultural values. These local brews are believed to constitute the highest proportion of alcohol consumption in Sub-Saharan Africa (Papas *et al.*, 2010). In addition, these local brews hold various names across the different ethnic groups and are usually made from carbohydrate rich agricultural produce (Sefa-Dedeh *et al.*, 1999). In Uganda, there is a diversity of locally processed traditional brews including; Kweete, Tonto, Waragi, and Ajono (Mwesigye and Okurut, 1995). Ajono is a widely consumed alcoholic beverage in Uganda known by different names in different regions of the country. For instance, in Eastern Uganda it is called "Ajono", in Central Uganda, it is known as "Malwa" while in Northern Uganda it is known as "Kongo ting". Ajono is a traditional alcoholic beverage made principally from finger millet (*Eleusine coracana*) which is a cereal crop (Oduori and Kanyenji, 2005). It is a fermented alcoholic beverage produced mainly at the household level valued for its taste, flavour and aroma (Muyanja *et al.*, 2010). In addition to serving as a means of socio-economic empowerment of households, Ajono is used for merry making at weddings, childbirth celebrations and for consolation of bruised souls during mourning of the diseased.

The preparation of the cereal-based local brews is carried out in environments conducive for fungal colonization and therefore, high chances of mycotoxin contamination. Handling practices involved in the preparations of the ingredients for production of the local brew can also result in

mould growth. For instance, the most commonly found filamentous fungi in stored cereal grains are *Aspergillus*, *Penicillium* and *Fusarium* species (Bullermann and Bianchini, 2011). These fungi can cause food spoilage, bio-deterioration and are capable of producing different mycotoxins. *Aspergillus* species are the most common toxigenic species in various grains, legumes, oil seeds, foods, and feeds (Bankole and Adebajo, 2003; Bueno *et al.*, 2015; Nsabiyumva *et al.*, 2023). *Aspergillus flavus* and *Aspergillus parasiticus* are the most predominant fungi responsible for aflatoxin contamination of crops prior to and during post-harvest handling (Creppy, 2002; Payne and Yu, 2010).

Fungal invasion and contamination of cereals often begins before harvest and can continue during post-harvest handling as well as handling practices of the local brew along the production stages (Misihairabgwi *et al.*, 2018). The raw materials for local brew production may be contaminated with aflatoxins resulting from poor pre-harvest or post-harvest practices. Presence of aflatoxins in food and animal feeds is potentially hazardous to the health of both humans and animals (Samuel *et al.*, 2013). For example, aflatoxins have been associated with several health concerns including hepatocellular carcinogenesis, immunosuppression and organ toxicities (Kowalska *et al.*, 2017). In this regard, local brew production is often done following a number of stages that may involve unhygienic handling practices and processes such as fermentation and malt roasting that may predispose these brews to fungal contamination. Despite being widely consumed by the

all stages of Ajono production. However, the liquid Ajono stage had Aflatoxin levels significantly above the maximum acceptable levels for EU for both pit and plastic drum fermenters. The plastic drum as a fermenting vessel produced fermented paste with high levels of aflatoxins compared to pit fermenters. On the other hand, millet grain stage had the least aflatoxins levels below EU regulatory limits. All samples had aflatoxin levels significantly below the maximum regulatory levels for the EAC.

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#### Conflict of Interest Statement

The authors declare no conflict of interest.

#### Availability of Data Statement

The data supporting this study are included within the article.

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