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Short Communication

Effect of nixtamalization on aflatoxins, functional and acceptability of maize

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INTRODUCTION

Maize (*Zea mays)* is a cereal grain that was domesticated in Mesoamerica and then spread throughout the American continents and to the rest of the world after European contact with the Americas in the late 15th and early 16th centuries (The European Food Information Council, 2006). Maize is one of the most commonly grown food grain in the world and among the main staple crop in African countries especially the East African party including Rwanda. It has been noted that biotic and abiotic stresses associated with these countries result in the growth of toxigenic fungi that produce mycotoxins in maize during all stages of production viz. pre-harvest, post-harvest, and processing (Adebowale et al., 2012).

Maize is sold and consumed in both fresh cobs and dried grain in Rwanda, this study is focused primarily on dried maize and secondary products, primarily maize flour. Generally, In Rwanda, maize flour is used for making a stiff porridge popularly known as "*ubugari"* and thin porridge known as "*Igikoma*". The word '*ubugari*' originated from "*ugali*" Kiswahili word which is a language spoken in East African Countries particularly Kenya and Tanzania in the neighborhood of Rwanda. This stiff porridge is eaten with a sauce made from beans; peas and sometimes combined with different vegetables and fish, while the thin porridge is used as breakfast by Rwandan families and even boarding school students. Maize flour is also mixed with malted sorghum flour used to make an alcoholic beverage, which is used as a drink during wedding ceremonies, especially in rural areas of Rwanda (Bressani et al., 1990).

In Rwanda, the average temperature varies between 14°C and 30°C while the relative humidity is between 71% and 79%, conditions favorable to fungi growth Therefore, safe agriculture and food processing methods are needed to stop fungi growth in consumed foodstuffs. Osuret and others (2016) reported that poor crop planting, harvesting, and storing practices contributes to aflatoxins contamination of foods.

Aflatoxins are fungal metabolites that are toxic, mutagenic, and carcinogenic and thus cause undesirable effects on animal and human health when ingested with feed or foodstuff. Aflatoxins are produced by fungal, *Aspergillus flavus*, and *Aspergillus parasiticus* that mainly contaminate foods such as groundnuts, maize, and millet. There are four major types of aflatoxins; B1, B2, G1, and G2 based on their fluorescence under UV light, and their two metabolites M1 and M2. However, the most harmful mycotoxin is known as AFB1. AFB1 and AFB2 naturally produced by *A. flavus* while *A. parasiticus* produces the other four aflatoxins types.

Some essential factors that affect aflatoxin contamination include the climate of the region, the genotype of the crop planted, the minimum and maximum daily temperatures, and the daily net evaporation Moreover, aflatoxin contamination is also promoted by stress or damage to the crop due to drought before harvest, the insect activity, poor timing of harvest, the heavy rains during and after harvest, and an inappropriate drying of the crop before storage. Also, poor harvesting practices, improper storage, and inadequate conditions during transport and selling can contribute to fungal growth and proliferation of mycotoxins as reported by Optimal conditions for fungal development are 36ºC to 38ºC, with high humidity of above 85%.

Suitable conditions for the growth of the fungi and toxin production occur in most areas of Africa and aflatoxin contamination of food is a widespread problem across the continent. Ingestion of foods contaminated with AFs

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causes acute and chronic effects such as liver damage, bile duct proliferation, edema, lethargy, impair the function of macrophages, reduce the antibody response to vaccines, all of which result in sickness or death. The study of (William *et al*., 2004) estimated that 4.5 billion of the world's population is exposed to aflatoxins because they are also everywhere. In Africa, the consumption of aflatoxin-contaminated foods may be linked to recent increased liver cancer cases and has even resulted in fatal cases. Indeed, in rural Kenya, in 2004 an Eastern African country, the consumption of aflatoxins contaminated maize resulted in 317 cases of aflatoxicosis, with the death of 125 persons (Cecile et al.,2015)

Since aflatoxin is the most well-known mycotoxin, studies on the cause, its prevention, and control have been practiced in various countries. However, contaminated mycotoxins in foods and feeds can be removed, inactivated, or detoxified by physical, chemical, and biological means depending on the conditions. Though each aflatoxin prevention technique has its limitations, the treated products should be safe from the chemicals used and their essential nutritive value should not be deteriorated. However, more evidence is needed to clarify the influence of cooking maize in alkaline solution (Nixtamalization) to reduce aflatoxin levels. Furthermore, the previous studies suggested that nixtamalization has several benefits over unprocessed grains for food preparation: they are more easily ground; their nutritional value is increased; flavor and aroma are improved and mycotoxins are reduced (Guzman et al.,1995)

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