A simple Method for the Detection of Aflatoxins in Groundnuts

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Abstract: Avery simple method was established, to detect the contamination of Groundnut by afltoxin since they are classified by the international Agency for Research on cancer as group 1 carcinogen for humans. Groundnut for this study were brought from the local market of Khartoum State. The sorted and cleaned nuts were divided into 3 groups A, B and C. Then each group was put in a sieve then dipped in tap water for 1 min. (group A), 3 min. (group B) and 5 min. (group C). The experiment repeated in hot water. Then the nuts were air dried, for one hour, this result in the appearance of brown colour spots only on the external testa of the blanched nuts. Sample B, which was dipped in hot water for 3 min, was considered the best, since the spots were clear with definite boarders. Then another new sample (D) was dipped in hot water for 3 min. to confirm the result observed in sample (B). Sample B and D were exposed to another drying treatment, half of the sample were air dried and the other half oven dried. In both treatments sorting of the nuts was done according to the spots size (small, medium and large). The aflatoxin content in each group was detected by Flourometer. The spots size on the surface of the nuts, were found to be positively correlated to Aflatoxin content.

Keyword: aflatoxin, groundnut, boiling

Introduction:

Aflatoxins are the name for a group of toxic metabolites known as B_1, B_2, G_1, G_2, M_1 and M_2 that are produced mainly by two fungi namely *Aspergillus flavus* and *Aspergillus parasiticus* .These toxins occur naturally and have been found in a wide range of commodities used for animal and human consumption (Wright *et al.,* 2002). Aflatoxin B_1 toxicity, for example, is ten times of potassium cyanide. World Health Organization (WHO) accepted that aflatoxin should be classified as a Group 1 carcinogen (IARC 2002).

Occurrence of aflatoxins is influenced by certain environmental factors and therefore, the extent of contamination is vary with geographic location, agricultural practices, and the susceptibility of commodities to fungal invasion before harvest and during storage and/or processing. Generally aflatoxin is associated with the protein portion of groundnut and not found in refined oil (Woodroof 1983).

There are a variety of well established methods reported for analysing aflatoxins in many different foodstuffs, such as thin layer chromatography, high-performance liquid chromatography, ultra-pressured layer chromatography, near infrared spectroscopy, immunoassay and a fluorescence-based mode of detection and chemometric algorithms to produce quantitative results (Zhang *et al*., 2001)

Food safety is one of the democratic rights of a healthy nation. So governments laboratories need sensitive, accurate sampling and precise methods for analysis, to avoid consuming aflatoxin-contaminated food and to ensure that aflatoxins levels are below the recommended limits. Limiting factor for exports to developed countries regulation is stringent to 4 µg /kg (Kingswoods 2004).

Groundnuts are grown for oil and as a food commodity; more than a third of the groundnuts grown on a world wide basis are used as food. In India, 75-80% of groundnut are crushed for oil, in contrast only 10-12% of groundnut production in the US is used for crushing. This is indicative of the economic importance of the nuts (Sanders 2002). However, according to the Food and Agriculture Organization (FAO), more traditional oil crops like groundnut and sesame seeds continue to be important in the food supply and food security of many countries, e.g. Sudan and Myanmar (Bruinsma, 2003). Groundnut is one of the major oilseeds in Sudan, with an annual production of 987 thousand metric ton (Ministry of Agriculture and Forsty, 2015). The proximate composition of groundnut is carbohydrate 12.5%, oil 46.4% , protein 25.6%, crude fibre 6.2% and energy 563 kcal/100g (McKevith 2005).The traditional method of roasting groundnuts, involve boiling for few minutes, air drying for approximately one hour, then roasting .

The aim of this work was to determine the optimum boiling period of nuts in order to detect aflatoxin level and to correlate size of spots with aflatoxins content.

Materials and Methods:

Shelled groundnuts was bought from Khartoum local market. The ground nuts were cleaned then divided to three groups. Each group was further divided to 300 g samples.

Experiment1

Samples of groundnut were put in a sieve then dipped in tap water for 1 min. (group A), 3min (group B) and 5min (group C). The experiment repeated in hot water. Samples of group A, B and C were pooled separately then each group was divided further into two halves, one half was air dried for one hour and the other was oven dried at 105 ± 5 °C.

Experiment2

Group (B) which was blanched in hot water for 3minutes, showed clear brown colour spots with clear borders. Groundnuts were inspected and categorized according to the spots size: small, medium and large size. Then each category was divided further into two: half air dried for one hour (B_1, B_2, B_3) and the other half oven dried at 105 ±5 °C (B_4, B_5 and B_6). The experiment was repeated with another new sample (D) to confirm the results of sample (B).

Then each category was divided further into two: half air dried for one hour (D_1, D_2, D_3) and the other half oven dried at 105 ±5 °C (D_4, D_5 and D_6).

The samples were sent to the Sudanese Standard Meteorology Organization (SSMO) laboratories for detection of Aflatoxins by Vicam equipment, using AOAC (1984) Fluorometer procedure for corn, raw groundnuts and groundnuts butter. The AOAC method determine aflatoxin content as low as10ppb

Results and Discussion

The 3 minute treatment of Samples (B) and (D) was considered to be the best treatment to show alfatoxins content, since the spots were clear with definite boarders. In case of the 1 minute treatment the spots were not clearly defined, while in case of the 5 minutes dipping resulted in removal of testa.

The alfatoxins content was more in large spots and decreased with spot size as indicated in tables 1, 2, 3, and 4 for samples B and D for both methods of drying (air and oven dried). The testa was removed from the nuts to clarify the colour of the spots. Plates 1, 2 and 3 showed the size of spots in the nuts which reflect the concentration of aflatoxin.

The colour of testa of air dried nuts was lighter than oven dried ones. The experiment was repeated for groups D_1, D_2, D_3 D_4, D_5 and D_6.

This work needs to be refined by repeating it taking in consideration: harvesting, drying packing and storage methods. It was observed that the women who traditionally roast the nuts removed only around 5 - 10% of the nuts after dipping in hot water for about five minutes then air dried for about half an hour before roasting. However, in the experiments performed almost half the nuts were infected. The only logical explanation is that the groundnuts obtained from the Khartoum markets were highly contaminated. It seemed that the ladies do not pay much attention in their inspection of nuts to ones with small spots.

This necessity will require that governmental departments concerned with food safety, should check the groundnuts and nuts products for aflatoxins content and also to raise the awareness of people of dangers of consuming infected groundnuts.

Conclusion:

This simple method (blanching) would be of great help, to detect contaminated groundnut. Hence, the risk of exposure to these potentially hazardous toxins would be reduced, which will be reflected in the improvement of population health and the economic standard of living preventative strategies are needed to reduce the formation of aflatoxin before and after harvest in groundnut and other susceptible crops.

Table (1) Aflatoxin content in groundnuts boiled for 3 min.
then air dried for one hour

Samples No.	Mean Aflatoxin Content (ppb)
B_1 (large spots)	185
B_2(medium spots)	94
B_3 (small spots)	18

Table (2) Aflatoxin content in groundnuts boiled for 3 min.
then oven dried at 105 ±5 °C

Samples No.	Mean Aflatoxin Content (ppb)
B_4 (large spots)	190
B_5 (medium spots)	99
B_6 (small spots)	21

Table (3) Aflatoxin content in groundnuts boiled for 3 min.
then air dried at 105 ±5 °C for one hour

Samples No.	Mean Aflatoxin Content (ppb)
D_1 (large spots)	185
D_2 (medium spots)	92
D_3 (small spots)	24

Table (4) Aflatoxin content in groundnuts boiled for 3 min.
then oven dried at 105 ±5 °C

Samples No.	Mean Aflatoxin Content (ppb)
D_4 (large spots)	193
D_5 (medium spots)	104
D_6 (small spots)	21

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Plates Show infection of Groundnuts by Aflatoxin