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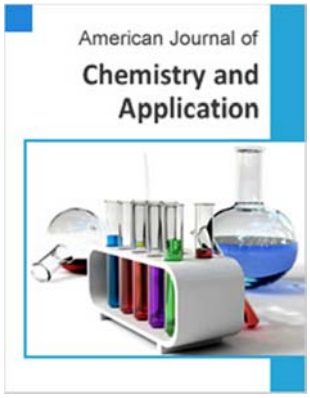

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Determination of Aflaxtoxin in Some Edible Oils Obtained from Makurdi Metropolis, North Central Nigeria

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Abstract
The concentration of aflatoxin (B1, B2 and G1, G2) in soya bean oil, groundnut oil, beniseed oil, palm kernel oil, melon oil and coconut oil were ascertained using Enzyme Linked Immuno Sorbent Assay Reader and the result showed that the concentration of aflatoxin in soya beans oil was 1.843 µg/L, groundnut oil 1.879 µg/L, beniseed was 1.900µg/L, palm kernel oil was 1.869 µg/L, melon seed oil was 0.8352µg/L, and coconut oil was 1.8552 µg/L. The overall results therefore shows that the edible oils are satisfactory for consumption due to low amount of aflatoxin present, when compared with National Agency for Food and Drug Administration and Control (NAFDAC) standard of 10 µg/L of aflatoxin for food that require heating before consumption and 4 µg/L of aflatoxin for food that do not require heating before consumption.

1. Introduction

A mycotoxin is a toxic secondary metabolite produced by organisms of the fungus kingdom, commonly known as molds [3, 4]. The term mycotoxin is usually referred to the toxic chemical products produced by the fungi that readily colonized crops [3]. One mold species may produce many different mycotoxins (major groups include aflatoxin, ochratoxin, citrinin, ergot, patulin and fusarium) as given in figure 1 and figure 2, while the same mycotoxin may be produced by many species [5]. Mycotoxins are also referred to as a group of structurally diverse secondary metabolites produced by various fungal species and these toxic compounds can contaminate foodstuffs, crops or human foods [7]. The ingestion of these contaminated materials may be pathogenic to animals and humans as they lead to serious health problems, such as liver, kidney or nervous system damage, immunosuppressant and Carcinogenesis. [3]. Due to widespread nature of fungi in the environment, mycotoxins are considered unavoidable contaminants in food and feeds [4]. One of the most effective measures to protect the public health is to establish reasonable regulatory levels of these toxins [8].

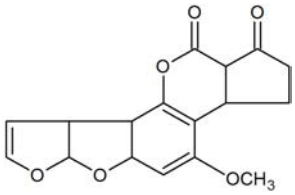

Figure 1. *Aflatoxin B_1.*

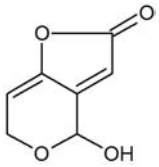

Figure 2. *Structure of Patulin.*

Numerous, studies have been performed on the occurrence of mycotoxin in raw commodities and foodstuffs [1, 3], however, due to the trace property of mycotoxin, their accurate and rapid qualitative and quantitative analysis still remains a challenging task [6]. Groundnut oil is known to retain a luscious taste that makes it the preferred oil for chefs all over the world [6]. Other seeds from which edible oils are extracted includes palm kernel, soya bean, coconut and beniseed. Although these oils are not highly rated as groundnut oil and most times not even produced in large quantities in Benue state due to the methods of processing and storage, it is advisable to test for the total level of aflatoxin in the oil samples. Deaths have mainly been reported with the home grown maize that had not been treated with fungicides or properly dried before storage. Also harvesting of crops before maturity have been found to make them more susceptible to infection [16]. Aflatoxin must be inactivated or removed, if values of food substances are to be fully maintained [13]. This study was designed to determine the concentrations of aflatoxin in the various edible oil samples mentioned earlier that were obtained from Makurdi in Benue state, Nigeria.

2. Material and Methods

The various samples of soya bean, groundnut oil, palm kernel, melon seeds, beniseeds and coconut oils were collected at Modern market Makurdi. The samples collected were stored in clean sample bottles, and then kept in the laboratory for analysis.

2.1. Sample Collection

The various edible oil samples namely: soya bean oil, groundnut oil, palm kernel oil, and coconut oil were collected at Modern market Makurdi in Benue State, Nigeria. Also obtained at the same market were melon seeds and beniseeds samples.

These samples were collected manually using sample bottles and were cork, labeled and taken directly to the laboratory for analysis. Several grams of the melon seeds were grinded using manual grinder and crushed for three hours to extract the melon oil from the seeds. The oil extracted was filtered through a mesh and transferred into a sample container. The same procedure was repeated for the extraction of the beniseeds oil sample.

2.2. General Procedure

About 5g each of the oil samples were weighed in a sample extraction bottle using an electric analytical balance and 25 ml of 84:16 Acetonitrile: H_2O was added and shaken for 3 minutes at 250 rpm using orbital shaker. The resultant mixtures were filtered through a 226 Aflatoxin clean-up column to remove color and other co-extractive (substances that are not required). The filtrate was concentrated to 500 µL (0.5 ml) using a heating block. The 500 µL filtrate was constituted with 50 µL of 70:30 Methanol: H_2O.

2.3. Aflatoxin Well Method

In this study the absorbance and concentration of aflatoxin in the samples were measured using Enzyme Linked Immino Sorbent Assay (ELISA) and data obtained was as follows:

100 µL of the mixture of aflatoxin standard solutions (0 µg/L, 1 µg/L, 2 µg/L, 4 µg/L, 10 µg/L, 20 µg/L), conjugate and samples were transferred into the aflatoxin coated well and incubated at room temperature for 15 minutes. The well was washed thoroughly and dried with cotton wool. 100 µL of substrate was added and incubated for 5 minutes and color was developed. A stop solution was added and then inserted into the carrier strip in the ELISA reader. Triplicate readings using stripes were carried out and the average values recorded.

3. Result and Discussion

The mean absorption and concentration of aflatoxin standards and oil samples using stripes are as shown in Table 1. The order of the edible oil samples was (soya bean oil, groundnut oil, beniseed oil, palm kernel oil, melon oil and coconut oil).

In the aflatoxin well, the standards position began from 1-8 while the samples position began from 9-14.

Table 1. *Mean standard and samples aflatoxin values.*

Carrier position	Standard [C1-C8] and sample [A-F]	Mean Absorbance	Mean (ppb or µg/L) concentration
1	C1	2.42	0.000
2	C2	1.85	1.000
3	C3	1.7	2.000
4	C4	1.6	4.000
5	C5	1.3	10.000
6	C6	0.85	20.000
7	C7	0.35	30.00
8	C8	0.01	40.00
9	A	2.116	1.843
10	B	1.418	1.879
11	C	2.035	1.900
12	D	1.608	1.869
13	E	2.254	0.8352
14	F	1.875	1.8552

Figure 3 gives calibration curve foe the aflatoxin standard solution and the range within which the concentrations in a samples could be detected by the Enzyme linked Immino Sorbent Assay. Concentrations of aflatoxin in the samples within the curve should not exceed 10 µg/L for food that required heating before consumption with reference to National Agency for Food and Drug Administration and Control (NAFDAC) specification. Therefore, the concentration of aflatoxin in soya beans oil, beniseed oil, palm kernel oil, melon oil and coconut oil as obtained from the calibration curve are satisfactory.

3.1. Soya Beans Oil

The aflatoxin levels in the extracted soya beans oils are as shown in Table 1 above, the concentration of aflatoxin in soya beans oil was found to be 1.843 µg/L and falls within the allowable specification of NAFDAC for 4 µg/L of food that do not require heating before consumption and 10 µg/L of food that require heating before consumption.

3.2. Groundnut Oil

The afatoxin levels in the extracted groundnut oil is as shown in Table 1. The concentration of aflatoxin in groundnut oil as read by the enzyme linked Immuno Sorbent Assay from was 1.879 µg/L, and was found to be within the acceptable specification of NAFDAC of 4 µg/L of food that do not require heating before consumption and 10 µg/L of food that require heating before consumption.

3.3. Beniseed Oil

The afatoxin levels in the extracted beniseed oil is as shown in Table 1 above, the concentration of aflatoxin in beniseeds oil was found to be 1.900 µg/L. These aflatoxin levels in beniseed oil fall within the maximum allowable specification of National Agency for Food and Drug Administration and Control (NAFDAC) for 4 µg/L, of food that do not require heating before consumption and 10 µg/L, of that require heating before consumption.

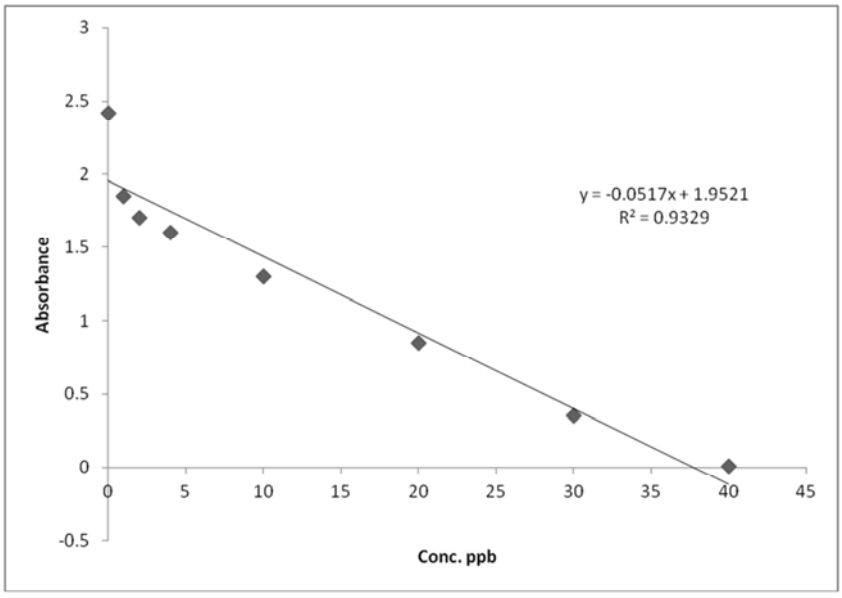

Figure 3. *A Calibration Curve For Aflatoxin Standard Solutions.*

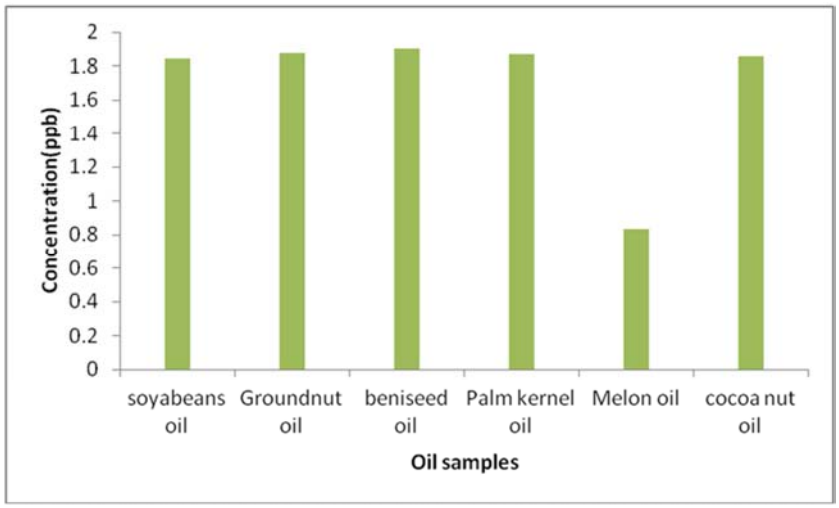

Figure 4. *Comparison of the concetrations of Aflatoxin in the various edible oil samples.*

3.4. Palm Kernel Oil

The palm kernel oil was extracted from palm kernels and from the result shown in Table 1 above, the concentration of aflatoxin in palm kernel oil was found to be 1.869 µg/L and hence falls within the maximum allowable specification of National Agency for Food and Drug Administration and Control (NAFDAC) for 4 µg/L, of food that do not require heating before consumption and 10 µg/L, of food that require heating before consumption.

3.5. Melon Seed Oil

The melon seed oil was extracted from melon seeds and from the result shown in Table 1 above, the concentration of aflatoxin in melon seed oil was found to be 0.8352 µg/L. This result shows the least aflatoxin levels in all the oil samples analyzed in this study and also shows that the melon seed oil aflatoxin levels fall within the maximum allowable specification of National Agency for Food and Drug Administration and Control (NAFDAC) for 4 µg/L, of food that do not require heating before consumption and 10 µg/L, of food that require heating before consumption.

3.6. Coconut Oil

Coconut oil was extracted from coconut and from the result shown in Table 1 above, the concentration of aflatoxin in coconut oil was found to be 1.8552 µg/L. and hence, the aflatoxin levels in coconut oil fall within the maximum allowable specification of National Agency for Food and Drug Administration and Control (NAFDAC) for 4 µg/L, of food that do not require heating before consumption and 10 µg/L, of food that require heating before consumption.

4. Conclusion

This study found that the concentrations of aflatoxin B (B1, B2, and G1, G2) in all the edible oil samples invested (soya beans oil, groundnut oil, beniseed oil, palm kernel oil, melon oil, and coconut oil) were within the National Agency for Food and Drug Administration and Control (NAFDAC) allowable specification of for 4 µg/L, of food that do not require heating before consumption and 10 µg/L, of food that require heating before consumption. The result also showed that the concentration of total aflatoxin was least in melon seed oil 0.8352 µg/L and approximately 2,0 µg/L, in soya bean oil, groundnut oil, beniseed oil, palm kernel oil and coconut oil. Therefore, this study strongly recommended a continuous routine analysis of these edible oils from their retailer sources because of the inherent danger that is associated with the consumption of high concentration of aflatoxin in the edible oils.

Recommendation

In order to minimize the hazard health threat by the aflatoxin in edible oils the following should be applied, good preservative and storage means of grains and other crops should be employed so that it can be made free from fungi and other microorganisms that are responsible for producing these toxic compounds called mycotoxin. This can be done by storing properly dried grains in a very environment to avoid moisture.

Rid of fungi. Farmers should not be storing immature grains for storage, because immature grains are more susceptible to infection during storage.

Furthermore, aflatoxin contaminated food should be properly heated so that the aflatoxin level can be minimized. Although, aflatoxin are non-living matter and cannot die when heated but heating process will destroy the fungi and other microorganisms that are present in the food, it will also affect the configuration of aflatoxin and convert some fraction into less harmful compounds.

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