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Assessment of Total Aflatoxins Level of Two Major Nuts Consumed in Gboko Benue State, Nigeria

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ABSTRACT

The aim of this study was to assess the total aflatoxin (TAT) contents of roasted, dehulled and hulled groundnuts (*Arachis hypogaea* L.) and of roasted cashew nuts (*Anacardium occidentale*), sold and consumed in some public areas of Gboko metropolis of Benue State, Nigeria. The items were sampled from 5 different locations based on human traffic densities and sellers of the product and then analysed for TAT contents using direct competitive Enzyme-linked Immunosorbent Assay (ELISA) method. In the roasted cashew nuts, TAT was only detected in samples collected at two of the sampling sites; Mechanic Site/Adekaa (>20.00 µg/kg) and Gboko Main Market (0.30 µg/kg) but not detected in samples collected at the three others (Gboko motor park, Abagu and Tipper Garage). Nevertheless, the detected levels at Gboko Main Market were below the maximum tolerable limits (MTL) of 4 µg/kg set by EU and 10.0 µg/kg set by CAC and NAFDAC, Nigeria for 'ready to eat' food substances unlike the situation at the Mechanic Site/Adekaa sampling location. In the roasted groundnuts, levels of TAT higher than the indicated MTL were documented in samples collected at Tipper Garage (12.20 µg/kg) and Abagu (5.70 µg/kg) only exceeded the EU MTL, while the results at Gboko motor parks (2.00 µg/kg), Gboko main market (1.30 µg/kg) and Mechanic site/Adekaa (0.50 µg/kg) were below the EU MTL. Samples of hulled groundnuts collected at Gboko main market recorded TAT levels of 0.10 µg/kg while at Mechanic site/Adekaa it was not detected. Dehulled groundnuts sampled at Gboko Main market (0.40 µg/kg) and Mechanic site/Adekaa (0.20 µg/kg) recorded TAT levels within CAC and NAFDAC MTLs. The dehulled groundnuts samples collected at the Tipper Garage sample location, which recorded a moisture level of 4.20 %; yet among the rest of all the other samples had moisture levels

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below the recommended maximum tolerable limits of 5.80 % for stored groundnuts and cashew nuts. The results of microbial counts revealed that total mesophilic bacteria ranged between < 1.0×10^1 to >1.0×10^2 CFU/L, fungi varied between < 1.0×10^1 to > 1.0×10^1 CFU/L while E.coli counts varied between 0.00 to 0.32 CFU/L. The microbial contagion was generally low. Nevertheless, prolonged feasting on the aflatoxin-contaminated nuts is possible in the study area due to the rising food insecurity of majority of the masses. The chronic and acute exposures therefore, presents health concern of aflatoxicosis.

***Keywords*:** Cashew Nuts, Groundnuts, Fungal / Bacteria Counts Total Aflatoxins, *Arachis hypogaea, Anacardium occidentale, Aspergillus parasiticus, Aspergillus flavus, Aspergillus nomius*

1. INTRODUCTION

Groundnuts and cashew nuts are among the commonest nuts that are consumed in public places. Cashew nuts are fried/roasted and are sold in sachets or in bottles. Groundnuts on the other hand, are fried/roasted and packaged in sachets, bottles, and also sold raw either hull or dehulled which are consumed.

It is a known fact that people buy and consume some processed food sold in public places without regard to the condition of these commodities whether they are safe for consumption or not. A good example of these processed food include, bread, fried cashew nuts, groundnuts, cakes, doughnuts, popcorn, and biscuits. But due to handling, processing and poor storage conditions, these food substances are exposed to moisture and attack by pests such as rodents, insects, fungi/moulds, bacteria which makes the food material a potential poison by the effects of activities of the afore mentioned pests. Since groundnut and cashew nuts are vulnerable to attack by moulds/fungi which are responsible for the production of aflatoxins among other mycotoxins, this work examine these natural toxins known as aflatoxin in fried cashew nuts, raw and fried groundnuts as sold in public places in Gboko and establishes the prevalence of whether or not they contain aflatoxin.

The most common and regularly encountered mycotoxins can be divided into six major categories: aflatoxins, zearalenone, trichothecenes, sterigmatocystins, ochratoxins, fumonisins and ergot alkaloids, which are produced by the moulds *Aspergillus flavus*, *A. paraciticus* and *A. nomius* [1-2].

It has been seen that:

- Aflatoxin B_1 and B_2, are produced by *Aspergillus flavus* and *Aspergillus parasiticus*
- Aflatoxin G_1 and G_2, are produced by *Aspergillus parasiticus*
- Aflatoxin M_1, is a metabolite of aflatoxin B_1 in humans and animals (exposure in ηg levels can come from a mother's milk)
- Aflatoxin M_2, is a metabolite of aflatoxin B_2 in milk of cattle fed on contaminated foods [3].
- Aflatoxicol
- Aflatoxin Q_1 (AFQ_1), a major metabolite of AFB_1 in *in vitro* liver preparations of other higher vertebrates [4-5].

Aflatoxin is exceedingly resilient under most conditions of storage, handling and processing of foods. It is heat stable and will withstand temperatures up to boiling point of water. It is, therefore, impossible to eliminate them once the foodstuffs are contaminated [6].

Aflatoxins are naturally occurring mycotoxins that are produced by many species of *Aspergillus*, a fungus, the most prominent ones being *Aspergillus flavus* and *Aspergillus parasiticus*. Their name is coined from the word *Aspergillus flavus* toxins. These toxins are named from the fungus secreting them, e.g. "A" from the genus name *Aspergillus*, "fla" from the species name *flavus* added to toxin to give the name "aflatoxin". There are several different toxins in the aflatoxin group. Aflatoxins are toxic and among the most carcinogenic substances known. After entering the body, aflatoxins may be metabolized by the liver to a reactive epoxide intermediate or hydroxylated to become the less harmful aflatoxin M_1.

Since these nuts ground nuts and cashew nuts among other food stuff as consumed in Gboko town and environs are susceptible to attacks by aflatoxins because of the critical conditions of high temperature and humidity that are known to favour the growth of aflatoxin-producing moulds. The groundnuts and cashew nuts in particular, as well as their products are the most traded snacks by food vendors in Benue State and are widely consumed in all seasons by several persons (including travellers, students, traders, as well as people in public places; parks, markets, supermarkets, schools, work places including farms). This study was therefore, conducted with the objective of determining the total aflatoxin levels of roasted cashew nuts and the roasted, hulled and dehulled groundnuts traded in the commercial city of Gboko, Benue State.

2. MATERIALS AND METHOD

2. 1. Study Area

The study was carried out in Gboko, the Tiv Traditional Council of Benue State-Nigeria. The city is located at the North Eastern part of Benue State and lies on latitude 7º 30' N and longitude 83º 5' E, and an altitude of 104 m above sea level with about 300,377 dwellers. Gboko lies in the tropical guinea savannah zone of the Central Nigeria and has a typical climate with two distinct seasons: the dry season (often lasts from November to March) and rainy season (April to October). The area has a mean annual rainfall of 1000 mm and temperature fluctuates between a minimum of 27 ºC to 28 ºC and a maximum of 30 ºC to 34 ºC. Roasted and hulled Groundnuts as well as roasted cashew nuts are among the most traded snacks throughout the season in Gboko and the business is favoured by the high population and commercial activities of the town. However, the high temperature and humidity of the area are important climatic conditions for incidence of aflatoxin contaminations of poorly processed and handled foodstuff such nuts, corns, cakes that constitute high proportion of food vendors' commodities in the city.

2.2 Sample Collection and Pre-treatment

Five (5) sampling points were set aside in Gboko Town and environs: ten (10) samples were collected at random for each of the categories. These were the mapped sampling points: (1). Mechanic Site/Adekaa, (2). Gboko Main Market, (3). Gboko Motor Parks, (4). Abagu and (5). Tipper Garage. In each sampling stations, five substations were scientifically selected based on the high concentrations of human traffic and sellers of the roasted, hulled and dehulled groundnuts as well as roasted cashew nuts. For fried cashew nuts, ten (10) samples each were

collected from each of the sampling points. Fifty (50) samples were obtained and homogenised into five (5) composites for the fried cashew nut category, and this was the same for the fried groundnuts category. However, only twenty samples each of hull and dehulled groundnuts were collected from samples points (1 and 2).

These were composited into two (2) composites respectively, for the two categories. A total of fourteen (14) composites and four (4) categories were obtained from Gboko sampling station. At Gboko motor parks, Abagu and Tipper Garage sampling station, samples of hull and dehulled groundnuts were not obtainable at the time of collecting the samples; two samples of each item were collected at random from each sub-station, making a total of 10 roasted groundnuts, 10 hulled groundnuts, 10 dehulled groundnuts and 10 roasted cashew nuts respectively. The total samples of each nut per sampling station were pooled together into one composite and mixed thoroughly after which 3 representative samples were taken for each station and taken for laboratory preparation and analyses for the moisture contents, total aflatoxin levels, and fungi (mould)/bacteria counts. In all, the representative samples consisted of 10 roasted cashew nuts, 10 roasted groundnuts, 7 hulled groundnuts and 7 dehulled groundnuts. The hulled groundnuts were manually dehulled to obtain the nuts used for further processing and analysis.

2. 3. Determination of Moisture Content

A measured quantity (5.0 g) of each the typical sample was macerated using a Romer series II Miller. Then, 3.0 g of each pulverised sample was weighed into aluminium moisture plate and placed on the tray after which the lid was closed. Moisture content analyser, Sartorius, M100 certified according to ISO9001 was used. Running the analysis commenced when the button “Run analysis” was entered, and after waiting a while, alarm triggered, indicating the end of the analysis. The analysis was accomplished at the temperature of 105 °C and the results displayed on the digital screen in percentage (%) was recorded.

2. 4. Determination of Total Aflatoxin Levels

2. 4. 1. Samples Preparation

Twenty grams (20.0 g) of each composite sample was crushed using a Romer series II Miller and sieved through a 20-mesh screen. Then, 15.0 g of the sieved sample was weighed into a pre-cleaned jar followed by the addition of 100 mL of 70/30 (v/v) methanol-water extraction solution and the jar was sealed. A 1:5 (w:v) of the sample to extraction solution was mixed and shaken vigorously for 3 minutes and then allowed to settle. Thereafter, the supernatant was filtered through a whatman No. 1 filter paper and the filtrate collected [7-8].

2. 4. 2. Assay by the AgraQuant Total Aflatoxin Method

The filtrate was then mixed with enzyme-conjugated aflatoxins after which antibody-coated micro-well was also added. This allows the aflatoxins in the sample to compete with the enzyme-conjugated aflatoxins for the antibody binding sites [9]. After a washing step, an enzyme substrate was added and blue colour was seen. The concentration of aflatoxin in the sample was determined by observing the intensity of the colour (intensity of the colour is inversely proportional to the concentration of aflatoxin in the sample or standard) [20]. A “stop solution” was then added which changed the colour from blue to yellow.

The micro-wells were measured optically using a micro-well reader with an absorbance filter of optical density, 450 nm (OD_{450}), and a differential filter of 630 nm. The optical densities (ODs) of the samples were compared to the ODs of the standards and an interpretative result was determined [10].

2. 4. 3. Assay of the AgraQuant Total Aflatoxin Method

Sixteen blue/green–bordered dilution strips were positioned in a microwell strip holder. Separate dilution well was used for each standard (0.0, 2.0, 4.0, 10.0 and 20.0 ppb) and the sample. Then, an equal numbers of Antibody Coated Microwell strips were placed in the holder. Using an 8-channel pipettor, 2.0 mL of conjugate was dispensed into each blue/green-bordered dilution well. Further, using separate single channel pipettor, 1.0 mL of the substrate and standard were respectively dispensed into each corresponding microwell strip containing the conjugate. A fresh 8-channel pipettor was used to mix the sample by carefully pipetting it up and down three times and immediately, 1 ml of the mixture was transferred into the antibody coated microwell strips and incubated for 15 minutes at room temperature. The antibody coated microwell strips were then emptied and washed five times with deionised water. Maximum care was taken not to extricate the strips from the holder during the washing process [11]. Then, for each microwell strip, absorbent paper towels were folded into several layers, laid on a flat surface and the strip tapped onto the towels to absorb as much residual water as possible before drying the bottom with a dry-towel. Using the 8-channel pipettor, 1ml/strip portion of the substrate was put into the microwell strips and incubated for 5 minutes. Then, using a fresh 8-channel pipettor, 1.0 mL of "stop solution" was pipetted into each microwell strip and the colour changed from blue to yellow. Thereafter, the strips were read with a microwell reader using a 450 nm filter and a differential filter of 630 nm. The Optical Density (OD) readings were recorded for each micro-well.

2. 4. 4. Interpretation of Results with the Romer AgraQuant Total Aflatoxin Assay Method

The OD values were each expressed as a percentage of the OD of the zero (0.0) standard and then a dose-response curve was constructed using the five standards. Since the amount of aflatoxin in each standard was known, the unknown was measured by interpolation from this standard curve. Results were further calculated using the Romer Log/Logit spreadsheet and the Log/Logit regression model was used for the results interpretation; the linearity coefficient (r^2) of the calibration curve was not less than 0.985 [11].

2. 4. 5. Isolation of Moulds and Microbial Counts

The procedure described below was followed for the isolation of moulds from each sample. Four pre-cleaned bottles were labelled with arbitrary letters u to x and the solutions they contained were respectively identified by the labels. Then, 5.0 g of each sample was pulverised and transferred into the bottle, 't' containing 45 mL of peptone water and shaken thoroughly to mix. With a sterile syringe, 2.0 mL of solution u was transferred into another bottle, 's' containing 18.0 mL peptone water and again shaken properly to mix. A 2.0 mL of solution v was transferred into another bottle, 'w', also containing 18.0 mL peptone water and mixed after which 1.0 mL of the solution w was transferred into a set of duplicate petri dishes labelled (1a, 1a'). Then, 2.0 mL of solution w was transferred into another bottle, 'w' containing

18.0 mL peptone water, mixed and 1.0 mL of solution w was transferred into another set of duplicate petri dishes (1b, 1b'). Then, 50 mL Durhan tubes were filled with 40 mL MacConkey Broth (MCB) by gently tilting, ensuring that no air bubble was trapped in the broth. When the molten Sabourand Dextrose Agar (SDA) cooled to about 54 °C, 10.0 mL of the molten Agar was transferred into each of the petri dishes and gently swirled to mix. Another 10.0 mL of the Agar was taken into a control petri dish (D), and allowed to set/gel. Then, the petri dishes were incubated in an incubator, set at 37 °C for 48 hrs after which the microbial growth were examined microscopically using Lacto-phenol Cotton Blue stain and classified by reporting the culture physiognomies at the face and reverse side of the inoculated Petri dishes [12]. The results were determined in units of colony-forming unit per millilitre (CFU/mL).

3. RESULTS AND DISCUSSION

3. 1. Moisture Content

The results of moisture contents (%) of the roasted cashew nuts, and the roasted, hulled and dehulled groundnuts sampled at five sample sites within Gboko metropolis are as presented in Table 1. Moisture levels of the roasted cashew nuts varied between 2.19 % to 2.82 % while roasted groundnuts chronicled moisture levels of 2.20 % to 4.20 %.

Table 1. Moisture content of roasted cashew nuts, roasted groundnuts, hull and dehulled groundnuts sold in Gboko Metropolis.

S/N	Sample Station	Moisture content %			
		Roasted Cashew Nuts	Groundnuts		
			Roasted	Hull	Dehulled
1.	Mechanic Site/Adekaa	2.82	2.78	4.02	4.80
2.	Gboko Main Market	2.23	3.01	3.78	4.45
3.	Gboko Motor Parks	2.19	2.20	-	-
4.	Abagu	2.38	3.80	-	-
5.	Tipper Garage	2.53	4.20	-	-

The results for the hulled and dehulled groundnuts rangeded between 3.78 % to 4.02 % and 4.45 % to 4.80 % respectively. The general levels of the results across the sampling points did not exceed the maximum recommended moisture limit of 5.80 % for safe storage of nuts [12]. Thus, this indicates that under proper conditions of storage and handling, the present moisture levels of the cashew nuts and groundnuts (roasted, hulled and dehulled) sold across the sampling stations in Gboko do not present favourable growth condition for moulds and hence, aflatoxin infestation.

3. 2. Total Aflatoxin Level of the Roasted Cashew Nuts

Roasted, Hulled and Dehulled Groundnuts the results of the total aflatoxin (TAT) levels of the roasted cashew nuts, and the roasted, hulled and dehulled groundnuts sampled at five locations within Gboko metropolis are as presented in Table 2. The roasted cashew nuts recorded total aflatoxin contents of (>20.00 µg/kg and 0.30 µg/kg at only two sampling points Mechanic Site/Adekaa and Gboko Main Market, but not detected in samples collected at the three others (Gboko motor park, Abagu and Tipper Garage). Higher contagions of TAT was observed at Mechanic site/Adekaa (>20.00 µg/kg), which is above MPL. Although, the detected levels at Gboko Main Market were below the maximum tolerable limits (MTL) of 4 µg/kg set by EU and 10.0 µg/kg set by Codex Alimentarius Commission, (CAC) and NAFDAC, Nigeria for 'ready to eat' food substances unlike the condition at the Mechanic Site/Adekaa.

Table 2. Total aflatoxin concentrations in roasted cashew nuts, roasted, hulled and dehulled groundnuts sold in Gboko metropolis

S/N	Sample Station	Aflatoxin Concentration (ppb)			
		Roasted Cashew Nut	Groundnuts		
			Roasted	Hull	Dehulled
1.	Mechanic Site/Adekaa	>20.00	0.50	ND	0.20
2.	Gboko Main Market	0.30	1.30	0.10	0.40
3.	Gboko Motor Parks	ND	2.00	-	-
4.	Abagu	ND	5.70	-	-
5.	Tipper Garage	ND	12.20	-	-

These results mirror a good processing, handling and storage conditions of the roasted cashew nuts since the recorded moisture levels of 2.19 to 2.76 % do not represent a conducive growth condition for moulds that produce aflatoxins in stored foodstuffs.

Results of the TAT contents of the roasted groundnuts revealed that samples collected at Mechanic site/Adekaa had least levels 0.50 µg/kg, Gboko main market 1.30 µg/kg and Gboko motor parks 2.00 µg/kg below the MTLs. While Abagu location recorded 5.70 µg/kg which exceeded the EU maximum tolerable limit (MTL) of 4.0 µg/kg for nuts [13].

At the Tipper Garage, roasted groundnuts recorded TAT levels of 12.20 µg/kg, which exceeded the MPLs of both EU and 10.0 µg/kg set by Codex Alimentarius Commission, CAC, and the National Agency for Food and Drug Administration and Control, NAFDAC Nigeria for 'ready to eat' food substances.

These results propose poor processing and handling of the product at these locations, which has health consequences of aflatoxicosis for the consumers.

In the study area where food insecurity is a major concern, aflatoxin contaminated food poses a serious threat since greater part of the population is cadaverous by poverty and have little choice of the kind of food they consume. Many deaths occasioning from liver failure occur yearly in our hospitals and homes and these may be traced to the under-recognized and under-reported cases of acute aflatoxicosis [14]. Aflatoxins exposures have been reported to be responsible for the cause of deaths resulting from liver cancer in about 26,000 Africans living south of the Sahara annually. WHO's report also indicated that exposure of children to aflatoxins is a contributory element of stunted growth, underweight, neurological disorder, immuno-suppression and death. The capability of aflatoxins to cause immuno-suppression suggests that it could interact with HIV/AIDS. Furthermore, diseases caused by mycotoxins have been reported to reduce life expectancy in Africa where nutritional needs tend to surpass other concerns such as food safety [15].

3. 3. Microbial Counts of the Roasted Cashew Nuts, Roasted, Hull and Dehulled Groundnuts

The results presented in Tables 3 – 6 show the microbial contaminations of the roasted cashew nuts as well as roasted, hulled and dehulled groundnuts sold in Makurdi metropolis. In the roasted cashew nuts (Table 3), the results showed total mesophilic bacteria counts varying between $<1.0 \times 10^2$ to $> 1.0 \times 10^2$ CFU/L, fungal counts of $< 1.0 \times 10^1$ to $> 1.0 \times 10^1$ CFU/L, and *E. coli* counts of 0.00 to 0.32 CFU/L. The roasted groundnuts recorded total mesophilic bacteria counts ranging between $< 1.0 \times 10^1$ to $>1.0 \times 10^1$ CFU/L, fungal counts of $<1.0 \times 10^1$ to $> 1.0 \times 10^1$ CFU/L while the results of *E. coli* counts was 0.00 CFU/L. The results of the microbial counts obtained in the hulled groundnuts stood at $>1.0 \times 10^2$ CFU/L total mesophilic bacteria counts at $> 1.0 \times 10^1$ CFU/L fungi counts while *E. coli* was not seen. In the dehulled groundnuts, the results revealed that total mesophilic bacteria counts stood at $>1.0 \times 10^2$ CFU/L while fungi and *E. coli* counts recorded $>1.0 \times 10^1$ CFU/L and 0.00 CFU/L respectively. Generally, the roasted samples have reduced levels of microbial counts and this perhaps attributed to the effect of roasting and salting during processing which helped in preserving these nuts.

Table 3. Microbial counts (CFU/mL) of the roasted cashew nuts sold in Gboko metropolis.

S/N	Sample Station	Microbial Count (CFU/mL) for Fried Cashew nuts		
		Total aerobic mesophilic bacteria count	**Fungi count**	***E. coli* count**
1.	Mechanic Site/Adekaa	$<1.0 \times 10^2$	$<1.0 \times 10^1$	0.00
2.	Gboko Main Market	$<1.0 \times 10^2$	$<1.0 \times 10^1$	0.32
3.	Gboko Motor Parks	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00
4.	Abagu	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00
5.	Tipper Garage	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00

Table 4. The microbial/fungi count of the Fried Ground nuts sold in Gboko metropolis.

S/N	Sample Station	Microbial Count (CFU/mL) for Fried Groundnuts		
		Total aerobic mesophilic bacteria count	**Fungi count**	***E. coli* count**
1.	Mechanic Site/Adekaa	$<1.0 \times 10^1$	$<1.0 \times 10^1$	0.00
2.	Gboko Main Market	$>1.0 \times 10^1$	$>1.0 \times 10^1$	0.00
3.	Gboko Motor Parks	$>1.0 \times 10^1$	$>1.0 \times 10^1$	0.00
4.	Abagu	$>1.0 \times 10^1$	$>1.0 \times 10^1$	0.00
5.	Tipper Garage	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00

Table 5. The microbial/fungi count of the Hull Groundnuts sold in Gboko metropolis.

S/N	Sample Station	Microbial Count (CFU/mL) for Hull Groundnuts		
		Total aerobic mesophilic bacteria count	**Fungi count**	***E. coli count***
1.	Mechanic Site/Adekaa	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00
2.	Gboko Main Market	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00
3.	Gboko Motor Parks	-	-	-
4.	Abagu	-	-	-
5.	Tipper Garage	-	-	-

Table 6. The microbial/fungi count of the Dehulled Groundnuts sold in Gboko metropolis.

S/N	Sample Station	Microbial Count (CFU/mL) for Dehulled Groundnuts		
		Total aerobic mesophilic bacteria count	**Fungi count**	***E. coli* count**
1.	Mechanic Site/Adekaa	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00
2.	Gboko Main Market	$>1.0 \times 10^2$	$>1.0 \times 10^1$	0.00

3.	Gboko Motor Parks	-	-	-
4.	Abagu	-	-	-
5.	Tipper Garage	-	-	-

4. CONCLUSIONS

Results of this study revealed that, the cashew nuts consumed within Gboko metropolis documented high levels of total aflatoxin (TAF) above MPLs at Mechanic site/Adekaa sampling station and low at Gboko main Market but not detected in similar samples collected at the other locations. The detected levels were below the maximum permissible limits set by EU, CAC and NAFDAC, Nigeria for 'ready to eat' food substances. In the roasted groundnuts however, higher TAT levels than the permissible limits were chronicled in samples collected at Abagu and Tipper garage respectively. However, low record of TAT was obtained in the roasted groundnuts samples collected at Mechanic site/Adekaa, Gboko main Market and Gboko motor parks. Samples of hulled groundnuts collected at Gboko main Market recorded low levels of TAT while it was not detected in similar samples at the other location. Dehulled groundnuts recorded lower TAT levels within the MTLs at both Mechanic site/Adekaa and Gboko main Market. All samples recorded moisture levels below the recommended maximum limits of 5.80 %. The results of microbial counts showed low contamination levels of total mesophilic bacteria, fungi and *E. coli*. However, the nuts with higher aflatoxin contaminations above the health regulatory limits could present concern of aflatoxicosis to consumers following continued ingestion. Hence, it is important that producers and traders of these popular staple diets are sensitized on good manufacturing and handling practices of the nuts to curtail the contagion by aflatoxins, and other mycotoxins.

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