





## Influence of Environmental Pollutant Sediment on Processing Equipment and its Implications for the Nutritive Properties of *Detarium microcarpum* and *Brachystegia eurycoma* Seeds

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Abstract	Article History
<p>This study examined the impact of environmental pollutants' sediment on food processing equipment and its effects on <i>Detarium microcarpum</i> and <i>Brachystegia eurycoma</i> seeds processed using Attrition mill, wooden mortar and stone slab. The processed seed samples were examined for trace elements and heavy metals alike, using Agilent FS240AA Atomic Absorption Spectrophotometer. The result of the analysis showed Iodine and Zinc were the most predominant mineral elements and heavy metal observed with values at <math>74.22 \pm 3.43 \text{mg/kg}</math> and <math>1.46 \pm 0.07 \text{mg/kg}</math> for <i>D. microcarpum</i> (DM) and <i>B. eurycoma</i> (BE) processed with attrition mill. Chromium and Lead were higher in dust sediment with concentration of <math>15.76 \pm 0.57 \text{mg/kg}</math> and <math>9.29 \pm 0.12 \text{mg/kg}</math> from Attrition mill Equipment. The average daily dose (ADD) highest peak shows (Zinc, <math>0.400 \text{mg/kg}</math> and, <math>0.350 \text{mg/kg}</math> in DM, BE), Ingestion Dose (ID) highest peak (Zinc, <math>1.829 \text{mg/kg}</math> in DM, and <math>2.086 \text{mg/kg}</math>, in BE). Inhalation Dose (ID) highest peak (Zinc, <math>0.400 \text{mg/kg}</math>, BE, and <math>0.351 \text{mg/kg}</math>, DM). Hazard Quotient (HQ) (Pb, <math>28.943 \text{mg/kg}</math>, in both samples). Hazard index (HI) (<math>58.9364 \text{mg/kg}</math>, DM and <math>52.1229 \text{mg/kg}</math>, BE). Target Hazard Quotient (THQ) (Pb, <math>0.3965 \text{mg/kg}</math>, in both samples). Total Target Hazard Quotient (TTHQ) (<math>0.714 \text{mg/kg}</math>, BE and <math>0.807 \text{mg/kg}</math>, DM). Life Cancer Risk (LCR) (Cd, <math>0.0287 \text{mg/kg}</math>, BE and <math>0.0410 \text{mg/kg}</math>, DM) Investigation showed that attrition mill processing method raised concerns about long-term exposure to hazardous substances. This study highlights the urgent need for safer processing techniques to mitigate heavy metal contamination while preserving the quality of locally processed food.</p>	<p>Received: 09 Feb 2026 Accepted: 15 Mar 2026 Published: 25 Mar 2026</p>  <p>Scan QR code to view*</p>
<p><b>Keywords:</b> <i>Detarium microcarpum</i>, food, heavy metals, equipment.</p> <p><b>How to cite this paper:</b> Ohiri, R. C., Eze, U. B., Anacletus, F. C., Godwin, S. O., &amp; Nwikiri, B. (2026). Influence of environmental pollutant sediment on processing equipment and its implications for the nutritive properties of <i>Detarium microcarpum</i> and <i>Brachystegia eurycoma</i> seeds. <i>Journal of Pollution Monitoring, Evaluation Studies and Control</i>, 5(1), 209–215. <a href="https://doi.org/10.54117/7gc4xk18">https://doi.org/10.54117/7gc4xk18</a></p>	<p>License: CC BY 4.0*</p>  <p>Open Access article</p>

### INTRODUCTION

*Brachystegia eurycoma* (Achi) and *Detarium microcarpum* (Ofor) are essential soup thickeners in Nigerian cuisine, particularly valued for their nutritional benefits (Akhigbe *et al.*, 2024). They are rich in protein, carbohydrates, and essential minerals, contributing to overall dietary needs. It Contains 37.1% crude protein and 39% carbohydrates, indicating high nutritional value (Hasan *et al.*, 2025). They are useful plants that find applications in food, medicine and other commodities. In rural communities, the leaves and flowers are eaten as condiments or vegetables. The leaves are used to thatch roofs of houses while the fruits are eaten fresh or cooked. The fruit pulp is used as local sweetener or can be transformed into flour. The seeds are majorly used as soup thickener (Tull, 2013). Decoctions or infusions of different parts (root, stem, bark, fruit, leaves) of these plants are used traditionally for the treatment of varying kinds of diseases ranging from syphilis, dysentery, bronchitis, leprosy, sore throat to malaria and meningitis (Dougnon *et al.*, 2020).

In West Africa, dietary patterns vary and are influenced by the vegetation belt. For example, in the Northern parts of Nigeria, cereals dominate, while in the South, legumes, nuts, seeds and starchy roots or tubers are the main food components (Hasan *et al.*, 2025). However, processing cereals and starch roots into a form of paste and eaten with soups is the general practice (Eke-Ejiofor *et al.*, 2019). Among the legumes used in soups (mainly for emulsification and stabilization of soups) are *Brachystegia eurycoma* (achi), *Detarium microcarpum* (ofor), *Mucuna pruriens* (Ukpo) and *Irvingia gabonensis* (Ogbono) (Asoiro *et al.*, 2020). Each of the soup thickeners differs in species from the others and so have their individual characteristic flavours, which they impart to soups. Often, choice depends on individuals, but *Brachystegia eurycoma* and *Detarium microcarpum* are favourite soup thickeners in Southeastern Nigeria (Agiriga and Siwela, 2017).

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Surampudi (2016) reported the lowering effect on blood glucose level and blood cholesterol content by dietary fibre; while Veronese *et al.* (2016) reported that the supplementation of the diets of diabetic patients or those with impaired glucose tolerance with fibre in the form of bran, or guar gum or the use of naturally high fibre foods such as whole grains cereals or dried legumes resulted in an improvement in blood glucose profiles, reduction in urinary glucose and a decrease in the mean serum cholesterol level.

Experiments have shown that hydrocolloids physiologically function as soluble fibre when ingested and as such are very effective in reducing blood cholesterol levels and moderating glucose response in diabetics (Giuntini *et al.*, 2022). Though hydrocolloids are good sources of soluble fibre, they have the ability to imitate and replace fat in processed food and so have been shown to be essential component in low fat and fat free products (Milani, & Maleki, 2012). Sources of hydrocolloids are mainly from plant materials. Two of such plants are *Brachystegia eurycoma* and *Detarium microcarpum* known locally in the Southeastern part of Nigeria as “Achi” and “Ofor”, respectively (Imam, 2021). *Brachystegia eurycoma* belongs to the family *caesalpiniaceae*, phylum *Spermatophyte* and order *Fabaceae*. It is a dicotyledonous plant, classified as legume and grows commonly along riverbanks. It flowers between April and May and fruits between September and January (Ahmed, 2019). The fruits are very conspicuous and persistently woody. The seed flour of *Brachystegia eurycoma* has gelation properties and imparts a gummy texture when used in soups, which is a desirable attribute necessary for the eating of garri, pounded yam, etc (Uhegbu *et al.*, 2009).

*Detarium microcarpum* belongs to the family *caesalpiniaceae*, phylum *Spermatophyte* and the order *Fabaceae*. It is particularly associated with dry savannah countries. It is known to flower throughout the wet season and fruits between November and January. The fruits are fleshy and quite edible (Keay *et al.*, 1964). The bark of *Detarium microcarpum* has diuretic and anti-inflammatory effects and reduces blood glucose levels in diabetic patients. The functional properties are quite similar to those of *Brachystegia eurycoma*, hence it is equally classified as food gum (Fatope *et al.*, 1993). The presence of phytochemicals alongside nutrients in plant materials is obvious. We thought it necessary to investigate the effect of processing methods on the trace elements and heavy metals of seeds of *Brachystegia eurycoma* and *Detarium microcarpum* and their probable effects on public health.

Studies have shown that the seeds of *D. microcarpum* and *B. eurycoma* can be dried, ground into flour and be used as emulsifying, flavoring and soup thickening agent (Kouyate and Damme, 2006). This is because the seeds have high content of water-soluble polysaccharides known as gums which solubilize in water to form a viscous gel (Dipiyoti and Bhattacharya, 2010). The gum of *D. microcarpum* and *B. eurycoma* have been shown to significantly lower shrinkage, increase water holding capacity and give better stability to raw beef burger than gum tragacanth (Onweluzo *et al.*, 2004). Gum from *D. microcarpum* and *B. eurycoma* can also be used

to increase water absorption and mix tolerance index of dough (Onweluzo *et al.*, 1999). Addition of this gum to fruit products also improved their stability during storage (Dipiyoti and Bhattacharya, 2010).

Nutritionally, *D. microcarpum* and *B. eurycoma* seeds contain carbohydrates, proteins, crude fibre, crude fat predominantly linoleic acid and essential minerals such as Na, K, Mg, Ca, S, P and Fe (Abreu *et al.*, 1998; Abreu and Relva, 2002). The seeds also contain some anti-nutrients such as saponins, phytates and cyanides (Anhwange *et al.*, 2004). The Proximate and functional properties of the ‘Ofor’ and Achi seed flour have been shown by Akpata and Miachi (2001). However, the traditional method of processing their seeds flour is not left without some challenges such as difficulty in removal of seed coat and grinding them into flour due to the hardness of the seeds. Because *D. microcarpum* and *B. eurycoma* seeds are usually boiled or roasted to aid seed coat removal, followed by soaking in water, usually overnight to soften the seeds prior to grinding, after which it is then sun-dried.

The preparation of Achi and Ofor involves various processing techniques that significantly influence their nutritional composition, safety, and overall quality. Traditional methods like drying can expose seeds to contaminants, while modern techniques enhance nutrient retention and reduce pathogens. Despite the benefits of modern processing, traditional methods remain prevalent in many communities, raising concerns about food safety and nutritional adequacy. Balancing traditional practices with modern techniques is crucial for optimizing the health benefits of these indigenous food items.

Environmental health assessment is vital for understanding how processing methods can introduce contaminants like heavy metals into food products, particularly in agricultural regions where chemicals are prevalent. The proximity of farms to processing centers increases the risk of contamination, necessitating a thorough evaluation of environmental factors affecting the safety and quality of food.

## MATERIALS AND METHODS

### Source of *Detarium microcarpum* and *Brachystegia eurycoma* seeds:

The mature dry seeds of *Detarium microcarpum* (Ofor) and *Brachystegia eurycoma* (Achi) were sourced in popular Eke-Aba Market, in Abakaliki.

**Pre-dehulling treatments:** The traditional methods of processing as described by Ene-Obong and Carnoalue (1982) were adopted in the treatment of the seeds. The dried seed plant sample was grounded into powder using Attrition mill, while the wet samples were processed using wooden mortar and stone slab respectively.

**Physical observation:** The attrition mill processed sample appeared gray, while the wooden mortar and stone slab processed sample appeared milk like.

## Methods for Elemental Analysis

Heavy metal analysis was conducted using Agilent FS240AA Atomic Absorption Spectrophotometer according to the method of APHA 1995 (American Public Health Association). 2g of each dried sample was weighed into a digestion flask, 20ml of an acid mixture (650ml of concentrated HNO<sub>3</sub>, 80ml of perchloric acid, and 20ml of concentrated H<sub>2</sub>SO<sub>4</sub>) was added, and the mixture was heated until a clear digest was achieved. Distilled water was added to the digest until it reached the 100 ml level. A series of standard metal solutions in the optimum concentration range are prepared; the reference solutions were prepared by diluting the single stock element solutions with water containing 1.5mL concentrated nitric acid/liter. A calibration blank was prepared using all the reagents except for the metal stock solutions

## Statistical Analysis

Data were presented as mean±standard deviation (SD). Statistical analysis was carried out using SPSS software (Version 23) (SPSS Inc., Chicago, IL) was used for descriptive data analysis. Differences between groups were analyzed by one-way analysis of variance (ANOVA) followed by Tukey's post hoc test for multiple comparisons. P values less than 0.05 (p<0.05) were considered statistically significant. Microsoft Excel 2016 was used for the data organization.

## RESULTS AND DISCUSSION

The attrition mill processing of *Detarium microcarpum* and *Brachystegia eurycoma* seeds yield aqueous extracts with

notable concentrations of essential trace elements and one heavy metal as shown in Table 1. Iodine shows the highest levels (74.22 ± 3.43 mg/kg in *D. microcarpum* and 67.27 ± 3.11 mg/kg in *B. eurycoma*), followed by chloride (49.24 ± 2.27 mg/kg and 45.27 ± 2.09 mg/kg, respectively). Calcium is slightly higher in *B. eurycoma* (9.27 ± 0.43 mg/kg) than in *D. microcarpum* (8.68 ± 0.40 mg/kg), while phosphorus (8.18 ± 0.38 mg/kg and 7.47 ± 0.34 mg/kg) and magnesium (7.90 ± 0.36 mg/kg in *D. microcarpum* and 6.38 ± 0.29 mg/L in *B. eurycoma*) are also prominent. Lower but significant amounts include zinc (1.46 ± 0.07 mg/kg and 1.28 ± 0.06 mg/kg), iron (0.89 ± 0.04 mg/kg and 0.79 ± 0.04 mg/kg), and lead (0.37 ± 0.02 mg/kg in both). These elements play vital biochemical roles in biological systems, supporting thyroid hormone synthesis (iodine), electrolyte balance and digestion (chloride), bone health and signaling (calcium and phosphorus), enzyme activation and neuromuscular function (magnesium), immune response and DNA synthesis (zinc), and oxygen transport (iron). The seeds, commonly used as food thickeners in Nigerian cuisine, could thus contribute to nutritional needs in traditional diets (Orish *et al.*, 2012). However, the consistent presence of lead at 0.37 mg/kg raises concerns, as this non-essential heavy metal is toxic, potentially causing neurotoxicity, oxidative stress, and developmental issues with chronic exposure, even at low levels. Overall, while the processing method highlights beneficial mineral leaching, careful monitoring for contaminants like lead is recommended to ensure safe consumption.

**Table 1:** Composition of trace elements and heavy metals in Attrition mill, processed samples of *Brachystegia eurycoma* and *Detarium microcarpum* seed.

Parameters (mg/kg)	Attrition mill	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
Zinc	1.46±0.07	1.28±0.06
Iron	0.79±0.04	0.89±0.04
Lead	0.37±0.02	0.37±0.02
Cadmium	0.07±0.00	0.10±0.00
Chromium	0.03±0.00	0.02±0.00
Copper	0.36±0.02	0.59±0.03
Manganese	0.90±0.04	0.70±0.03
Nickel	0.01±0.00	0.02±0.00
Vanadium	0.01±0.00	0.01±0.00
Molybdenium	0.08±0.00	0.02±0.00
Silicon	0.36±0.02	0.27±0.01
Iodine	67.27±3.11	74.22±3.43
Phosphorus	8.18±0.38	7.47±0.34
Chloride	45.27±2.09	49.24±2.27
Calcium	9.27±0.43	8.68±0.40
Sulphur	1.09±0.05	1.08±0.05
Magnesium	6.38±0.29	7.90±0.36

Values are means ± Standard Error of the Mean (SEM). Values with different superscripts are statistically different at (p≤0.05).

## Risk Assessment

### The risk assessment of the heavy metals in *D. microcarpum* and *B. eurycoma*, seed processed using Attrition mill method.

The seeds of *Brachystegia eurycoma* and *Detarium microcarpum*, commonly used as soup thickeners in Nigerian cuisine, were processed using an attrition mill, resulting in measurable heavy metal exposure for adults. The Average

Daily Dose (ADD) represents chronic dietary exposure, while the Ingestion Dose (ID) indicates higher potential intake from consumption, with inhalation doses during processing remaining incomplete but typically lower. For zinc, ADD ranged from 0.350–0.400 mg/kg/day as shown in Table 2: and (ID) from 1.829–2.086 mg/kg/day across the two seeds as shown in Table 3. Nickel showed low ADD (0.003–0.005 mg/kg/day) in Table 2 and (ID) (0.014–0.029 mg/kg/day), as

shown in Table 3, chromium ADD (0.005–0.008 mg/kg/day) in Table 2. and (ID) (0.029–0.043 mg/kg/day), in Table 3, cadmium ADD (0.019–0.027 mg/kg/day) as seen in Table 2: and ID (0.100–0.143 mg/kg/day) in the Table 3. and Lead (Pb) identical values of ADD 0.101 mg/kg/day in Table 2. and ID 0.529 mg/kg/day for both species as shown in Table 3.

Zinc, an essential nutrient, poses risks of excess at these levels. The EPA oral RfD is 0.3 mg/kg/day, so ADD slightly exceeds this, while (ID) substantially surpasses it, potentially causing gastrointestinal issues, impaired copper/iron absorption, and immune effects with prolonged high intake. Nickel and chromium appear within safer bounds: nickel below the EPA RfD of 0.02 mg/kg/day, with low risks of dermatitis or kidney damage, and chromium (likely trivalent form) well under the RfD of 1.5 mg/kg/day for essential Cr III, though hexavalent forms warrant caution for carcinogenicity via inhalation. Cadmium and lead present the most serious concerns. Cadmium dose level exceeds the EPA

RfD (0.001 mg/kg/day) and WHO PTMI (-0.0008 mg/kg/day), risk kidney damage, bone weakening (e.g., osteoporosis), and cancer (IARC Group 1). Lead (Pb) far exceeds WHO PTWI (-0.0036 mg/kg/day) and current no-safe-level guidance, suggesting that this level may lead to neurotoxicity, hypertension, anemia, and organ damage, with bioaccumulation amplifying chronic effects. These findings align with vast studies on African seeds and plants, where heavy metal contamination varies by processing and environmental factors, sometimes showing low or undetectable levels in seeds but higher in other parts like bark. (Ehianeta *et al.*, 2013) Regular consumption of these processed seeds could contribute to cumulative exposure, particularly for Cadmium (Cd) and Lead (Pb) in regions with soil or water contamination. Vulnerable groups, including children and pregnant individuals, face heightened risks. Mitigation through, alternative milling, or limited intake is advisable, alongside monitoring local guidelines in Nigeria for food safety (Orish *et al.*, 2012).

Table 2: Average daily dose for adults of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition mill Average daily dose (ADD) (mg/kg/day)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
Zinc	0.400	0.350
Nickel	0.003	0.005
Chromium	0.008	0.005
Cadmium	0.019	0.027
Lead	0.101	0.101

Table 3: Ingestion dose for adults of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition mill ID (Ingestion Dose)(mg/kg/day) (Adults)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
Zinc	2.086	1.829
Nickel	0.014	0.029
Chromium	0.043	0.029
Cadmium	0.100	0.143
Lead	0.529	0.529

Table 4: Inhalation dose for adults of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition mill ID (Inhalation Dose)(mg/kg/day) (Adults)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
Zinc	0.400	0.351
Nickel	0.003	0.005
Chromium	0.008	0.005
Cadmium	0.019	0.027
Lead	0.101	0.101

Table 5: Hazard Quotient for Adult of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition mill HQ (Hazard Quotient) (Adults)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
Zinc	1.333	1.167
Nickel	0.014	0.027
Chromium	2.733	1.500
Cadmium	19.100	27.300
Lead	28.943	28.943

**Table 6:** Hazard Index for Adult of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition mill HI (Hazard Index) (Adults)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
	52.1229	58.9364

**Table 7:** Target Hazard Quotient for Adult of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition mill THQ (Target Hazard Quotient) (Adults)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
Zinc	0.0183	0.0160
Nickel	0.0002	0.0004
Chromium	0.0374	0.0205
Cadmium	0.2616	0.3740
Lead	0.3965	0.3965

**Table 8:** Total Target Hazard Quotient for Adult of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition Mill TTHQ (Total Target Hazard Quotient) (Adults)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
	0.714	0.807

**Table 9:** Life cancer Risk for Adult of heavy metal content of *D. microcarpum* and *B. eurycoma*, seed processed with Attrition mill method

Parameters	Attrition Mill LCR (Lifetime Cancer Risk) (Adults)	
	<i>Brachystegia eurycoma</i>	<i>Detarium microcarpum</i>
Chromium	0.0041	0.0023
Cadmium	0.0287	0.0410
Lead	0.0009	0.0009

**Heavy metal profile of Attrition Mill, Sediments Dust.**

From the study heavy metal concentrations in attrition mill sediment dust were Pb  $9.29 \pm 0.12$  mg/kg, Cd  $1.27 \pm 0.39$  mg/kg, Cr  $15.76 \pm 0.57$  mg/kg, Ni  $2.75 \pm 0.39$  mg/kg, and Fe  $7.31 \pm 0.30$  mg/kg, as shown in Table 10, representing relatively low to moderate levels compared to typical regulatory screening thresholds for dust/soil exposure. Non-carcinogenic risks via ingestion, measured by Total Hazard Quotient (THQ), were negligible for both adults and children (THQ < 1, with the highest values for children at Cr = 0.106 and Cd = 0.030), indicating no expected adverse effects such as neurotoxicity from Pb, kidney damage from Cd, or respiratory issues from Cr/Ni, as shown in Table 11 below. Carcinogenic risks, assessed as Total Lifetime Cancer Risk (TLCR), were low overall (Pb  $10^{-7}$ , Cr  $10^{-6}$  to  $10^{-5}$ , Cd  $10^{-5}$ ), generally within or near acceptable ranges (e.g.,  $\leq 10^{-6}$  low concern; up to  $10^{-4}$  tolerable per US EPA contexts), as shown

in Table 12, with Cd as the primary contributor but still implying minimal excess lifetime cancer probability from ingestion exposure.

These research aligns with standard health risk assessment methodologies, where THQ < 1 denotes negligible non-carcinogenic risk with TLCR values in the  $10^{-6}$  to  $10^{-4}$  range indicate minimal to acceptable carcinogenic risk, in accordant with United States for Environmental Protection Agency guidelines for metals in environmental media, (US EPA Regional Screening Levels, 2024; US EPA Framework for Metals Risk Assessment, 2007; US EPA IRIS database for toxicity values including RfD and slope factors for Pb, Cd, Cr, and Ni). Generally, the data obtained suggests low to negligible human health risks, though preventive measures are advisable for exposed population.

**Table 10:** Heavy metal profile of Attrition mill Sediments Dust.

Attrition Mill Sediment Dust				
Pb (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Ni (mg/kg)	Fe (mg/kg)
$9.29 \pm 0.12^a$	$1.27 \pm 0.39^a$	$15.76 \pm 0.57^a$	$2.75 \pm 0.39^a$	$7.31 \pm 0.30^a$

Values represent mean  $\pm$  SEM. Means in the same column with same superscript alphabet are not significantly different at ( $p \leq 0.05$ ).

**Table 11:** Total Hazard Quotient (THQ) Ingestion for Heavy Metal Contents of Attrition Mill Dust Sediments

Parameters	Attrition Mill Total Hazard Quotient (THQ)									
	Pb		Cd		Cr		Ni		Fe	
	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child
	0.0050	0.0468	0.0032	0.03E-02	6.79E-04	1.06E-01	1.96E-04	1.83E-03	1.49E-05	1.39E-04

**Table 12:** Total Life Cancer Risk (TLCR) of Heavy Metal Contents Attrition Mill Sediment Dust

Parameters	Attrition Mill Total Life Cancer Risk (TLCR)					
	Pb		Cd		Cr	
	Adult	Child	Adult	Child	Adult	Child
	1.86E-07	1.34E-07	2.55E-05	1.84E-05	1.08E-06	1.53E-05

**CONCLUSION**

The attrition mill processed *Detarium microcarpum* and *Brachystegia eurycoma* seeds, commonly used as soup thickeners in Nigerian cuisine, are rich in beneficial trace elements such as iodine, Calcium, chloride, magnesium and phosphorus, along with smaller amounts of iron, zinc, and others. These contribute mainly to nutritional needs, supporting bone health, thyroid function, enzyme activity, and overall biochemical processes in local diets. However, the presence of lead at (0.37 mg/L in both seed sample) and cadmium (0.07–0.10 mg/L) raises safety concerns.

Risk assessments show progressive Hazard Quotients (HQ) and Hazard Index (HI > 50) for non-carcinogenic effects, controlled primarily by Cadmium (Cd) and Lead (Pb) surpassing safe thresholds. Ingestion doses for these metals are high relatively to reference values, indicating potential for chronic toxicity including developmental issues, kidney damage, neurotoxicity, and increased cancer risks, particularly with significant Lifetime Cancer Risk from cadmium. In contrast, with the dust/sediment from the attrition mill showing low to negligible non-carcinogenic (THQ < 1) and carcinogenic risks total life cancer risk (TLCR) generally within acceptable range suggesting minimal exposure from processing dust. Whilst these seeds offer valuable nutritional benefits through essential minerals, the heavy metal contamination, particularly Lead (Pb) and Cadmium (Cd), in the processed seed samples of *D. microcarpum* and *B. eurycoma* poses considerable health risks with regular consumption. Safe utilization depends on mitigation efforts like source control, which prevents hazard at their origin, to meet both local and global safety standards, strategies, such as alternative processing techniques, consumption limits or regulatory oversight must be implemented to safeguard the vulnerable groups.

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