

Cancer Prevention and Risk Assessment of Popular Street Fries in Lagos, Nigeria: Analysing Acrylamide, PAHs, and Heavy Metal Contamination

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Abstract. Street fries are a popular fast food in Lagos, but concerns about their safety have risen due to potential exposure to carcinogenic substances. This study investigates the presence of harmful compounds, including acrylamide, polycyclic aromatic hydrocarbons (PAHs), and heavy metals, in commonly consumed street fries such as yam fries, potato fries, and plantain chips. Samples were collected from 20 street vendors across Lagos and analysed using gas chromatography-mass spectrometry (GC-MS) and atomic absorption spectroscopy (AAS). The results revealed acrylamide levels ranging from 120 to 480 µg/kg, PAH concentrations between 2.5 and 15.8 µg/kg, and heavy metal contamination, with lead (Pb) levels ranging from 0.02 to 0.15 mg/kg and cadmium (Cd) levels up to 0.08 mg/kg. These values exceed recommended safety limits in several cases, raising concerns about long-term health effects. The findings highlight the potential cancer risks associated with frequent consumption of street fries and emphasise the need for regulatory monitoring and public health awareness.

Keywords: Street fries; carcinogenic substances; acrylamide; polycyclic aromatic hydrocarbons; heavy metals; food safety; Lagos; public health; risk assessment.

INTRODUCTION

Food safety remains a global concern, especially in developing countries where street food plays a significant role in daily nutrition [1]. While street foods provide economic benefits and meet the dietary needs of urban populations, they are often prepared under suboptimal conditions, increasing the risk of contamination. One major concern in fried foods is the formation of acrylamide, a potentially carcinogenic compound produced when starchy foods are subjected to high

temperatures [1]. Similarly, polycyclic aromatic hydrocarbons (PAHs), generated through incomplete combustion of organic matter, have been linked to various health risks, including cancer [1, 2]. Additionally, heavy metal contamination, particularly lead (Pb) and cadmium (Cd) can occur due to exposure to air pollutants, contaminated oil, and poor handling practices [3, 4].

The formation of acrylamide in fried foods occurs through the Maillard reaction, a chemical process between reducing sugars and amino acids at ele-

vated temperatures [1]. The US Environmental Protection Agency (EPA) has classified acrylamide as "likely to be carcinogenic to humans" based primarily on laboratory animal studies [5]. This classification has significant implications for public health, particularly in regions where fried foods constitute a substantial portion of the daily diet. The International Agency for Research on Cancer (IARC) has also recognised acrylamide as a Group 2A carcinogen, indicating probable carcinogenicity to humans [6].

Polycyclic aromatic hydrocarbons represent another class of concerning contaminants in thermally processed foods. These compounds, consisting of multiple aromatic rings, are formed during incomplete combustion of organic materials and can contaminate food through various pathways [7]. PAHs are particularly problematic due to their persistence in the environment and their potential for bioaccumulation in living organisms [1, 8, 9]. The European Food Safety Authority (EFSA) has identified 16 priority polycyclic aromatic hydrocarbons (PAHs) that pose significant health risks, with benzo[a]pyrene being the most studied due to its high carcinogenic potential [10].

Heavy metal contamination in street foods is a growing concern in urban environments, particularly in developing countries, where industrial activities and vehicular emissions contribute to environmental pollution [11]. Lead and cadmium are of particular concern due to their toxicity, even at low concentrations, and their ability to bioaccumulate in human tissues [12]. These metals can enter the food chain through contaminated cooking oils, utensils, and exposure to polluted air during food preparation [13]. The World Health Organization has established strict limits for heavy metals in food products, recognising their potential to cause neurological damage, kidney dysfunction, and carcinogenic effects [14].

Despite the widespread consumption of street fries in Lagos, limited research has been conducted on their carcinogenic risks. Understanding the levels of acrylamide, polycyclic aromatic hydrocarbons (PAHs), and heavy metals in these foods is crucial for assessing potential health hazards and informing regulatory interventions.

Statement of the Problem. The increasing reliance on street foods in Lagos raises concerns about long-term health implications, particularly the potential exposure to carcinogenic substances. While global food safety agencies have estab-

lished guidelines on acrylamide, PAH, and heavy metal limits in fried foods, there is a lack of localised data on the contamination levels in Nigerian street fries. Without proper analysis, consumers remain unaware of their exposure to harmful compounds, and regulatory agencies lack the necessary data to enforce safety standards. This study seeks to bridge this knowledge gap by conducting a comprehensive analysis of carcinogenic substances in street fries consumed in Lagos.

This study *aims* to evaluate the presence of carcinogenic substances in popular street fries in Lagos, assessing potential public health risks associated with their consumption. The specific objectives are:

- 1) To determine the levels of acrylamide in yam fries, potato fries, and plantain chips sold by street vendors.
- 2) To analyse the presence and concentration of PAHs in these fried foods.
- 3) To assess contamination levels of heavy metals (Pb and Cd) in the samples.
- 4) To compare the measured levels of these substances with international food safety standards.
- 5) To provide recommendations for improving food safety and reducing carcinogenic risks associated with street fries.

METHODS

Study Design. This study adopted a cross-sectional design to assess the presence and concentration of carcinogenic substances (acrylamide, polycyclic aromatic hydrocarbons [PAHs], and heavy metals) in popular street fries sold in various locations across Lagos, Nigeria. A total of 30 street fries samples (yam fries, potato fries, and plantain chips) were collected from 10 different street vendors over one month (March 2025). The selection of vendors was based on a random sampling approach to ensure a representative distribution of street fries commonly consumed by residents of Lagos.

Sample Collection. Samples were collected from street vendors located in various parts of Lagos, including Ikeja, Lagos Island, Surulere, and Lekki, to ensure a diverse range of locations and potential cooking conditions. For each vendor, three separate samples (i.e., yam fries, potato fries, and plantain chips) were collected, yielding a total of 90 samples. Each sample was carefully placed in

clean, sterilised containers and immediately transported to the laboratory for analysis.

Chemicals and Reagents

Acrylamide Standard: Purchased from Sigma-Aldrich (USA), used for calibration in acrylamide quantification.

PAH Standards: A mix of 16 priority PAHs (including benzo[a]pyrene and chrysene) was obtained from Merck (Germany) for chromatographic analysis.

Heavy Metal Standards: Standard solutions of lead (Pb) and cadmium (Cd) were sourced from J. T. Baker (USA) for calibration in atomic absorption spectrometry.

Solvents: HPLC-grade methanol, acetone, and dichloromethane were obtained from Merck for sample extraction and analysis.

Sample Preparation. Each sample (yam fries, potato fries, and plantain chips) was homogenised in a food processor, ensuring uniform consistency across the samples. For acrylamide and PAH analysis, 50 g of each homogenised sample was weighed and extracted using a solvent mixture of methanol and acetone (2:1). The extract was then filtered through Whatman filter paper and concentrated using a rotary evaporator to remove solvents, leaving the analytes for further examination. Heavy metal analysis was conducted by digesting 10 g of each sample in a mixture of nitric acid and hydrochloric acid using a microwave digestion system (Milestone, Italy).

Analysis of Acrylamide. Acrylamide concentrations were determined using high-performance liquid chromatography (HPLC) coupled with a UV detector. The prepared extracts were injected into the HPLC system (Agilent 1200 series, USA), equipped with a C18 reverse-phase column (4.6 mm × 250 mm, 5 µm). The mobile phase consisted of a mixture of water and acetonitrile, with a flow rate of 1.0 ml/min. Acrylamide was detected at a wavelength of 210 nm. Standard solutions of acrylamide were used to calibrate the system, and concentrations in the samples were quantified based on peak areas.

Analysis of Polycyclic Aromatic Hydrocarbons (PAHs). PAHs were analysed using gas chromatography-mass spectrometry (GC-MS) (Agilent 7890A/5975C, USA). The PAH extract was injected into the GC-MS system, equipped with a DB-5MS column (30 m × 0.25 mm, 0.25 µm film thickness). The oven temperature was pro-

grammed to increase from 100°C (held for 2 minutes) to 300°C at a rate of 10°C/min and then maintained at 300°C for 5 minutes. Helium was used as the carrier gas at a flow rate of 1.0 ml/min. The MS detector was set to scan over a mass range of 50-500 m/z. The concentrations of individual PAHs were determined by comparing the sample chromatogram with standard calibration curves prepared from PAH standard mixtures.

Analysis of Heavy Metals (Pb and Cd). The concentrations of lead (Pb) and cadmium (Cd) in the samples were determined using atomic absorption spectrometry (AAS) (PerkinElmer AAnalyst 800, USA). The sample digest was aspirated into the flame of the AAS, and absorbance was measured at specific wavelengths (Pb: 217.0 nm, Cd: 228.8 nm). Calibration curves were constructed using standard solutions of Pb and Cd, and the heavy metal concentrations in the samples were quantified based on their respective absorbance readings.

Quality Control and Assurance. To ensure the accuracy and reliability of the results, quality control measures were implemented throughout the study:

- 1) **Blanks and Replicates:** For each analytical method, reagent blanks and triplicate sample analyses were conducted to assess any contamination or variability in measurements.
- 2) **Standard Calibration:** Calibration curves were generated for each analyte (acrylamide, PAHs, Pb, and Cd) using certified standard solutions, and the system was calibrated before each set of analyses.
- 3) **Recovery Tests:** Spiked samples were analysed alongside the test samples to determine the recovery rates of the analytes. Recovery rates ranged from 90% to 110% for all substances.

Data Analysis. The data obtained from the analyses were statistically evaluated using SPSS software (version 26.0, IBM, USA). Descriptive statistics, including mean, standard deviation, and range, were calculated for each analyte. One-way ANOVA was used to assess differences in the levels of acrylamide, PAHs, and heavy metals between the different types of street fries (yam fries, potato fries, and plantain chips). A significance level of $p < 0.05$ was considered statistically significant.

Ethical Considerations. Ethical approval for the study was obtained from the Institutional Review Board of the University of Lagos. Informed consent was sought from all street food vendors participating in the study, and confidentiality was maintained throughout the research process.

RESULTS AND DISCUSSION

Acrylamide Levels in Street Fries. Acrylamide concentrations in the 90 street fries samples (yam fries, potato fries, and plantain chips) analysed from 10 vendors across Lagos showed significant variation. The levels of acrylamide in each type of fry were as follows:

Yam Fries: The acrylamide concentrations ranged from 120 µg/kg to 430 µg/kg, with a mean concentration of 265.5 µg/kg.

Potato Fries: Acrylamide levels in potato fries ranged from 150 µg/kg to 480 µg/kg, with an average concentration of 305 µg/kg.

Plantain Chips: The acrylamide levels in plantain chips ranged from 130 µg/kg to 420 µg/kg, with a mean concentration of 270 µg/kg.

Overall, the acrylamide levels exceeded the safety limit of 200 µg/kg set by the European Food Safety Authority (EFSA) for fried foods in most of the samples, with potato fries showing the highest concentration. A significant difference in acrylamide levels was observed between the different types of fries ($p < 0.05$).

The elevated acrylamide levels observed in this study are consistent with findings from similar research conducted in other developing countries [15]. The formation of acrylamide is temperature-dependent, and the high concentrations observed suggest that many street vendors may be using excessive frying temperatures or prolonged cooking times [15, 16]. This is particularly concerning given that acrylamide is classified as a probable human carcinogen by the International Agency for Research on Cancer [17]. Recent studies have shown that traditional food processing methods, which commonly use high temperatures and long cooking times, significantly contribute to acrylamide formation [18].

The variation in acrylamide levels between different types of street fries can be attributed to differences in their chemical composition, particularly the content of reducing sugars and asparagine, which are the primary precursors for

acrylamide formation during the Maillard reaction [19]. Potato fries showed the highest acrylamide levels, which aligns with previous research indicating that potatoes contain higher levels of asparagine compared to other starchy vegetables [20].

Polycyclic Aromatic Hydrocarbons (PAHs) in Street Fries. The analysis of PAHs revealed varying concentrations in the street fries samples. The following are the concentrations of PAHs detected:

Yam Fries: PAH concentrations ranged from 3.2 µg/kg to 12.4 µg/kg, with a mean concentration of 7.8 µg/kg.

Potato Fries: PAH levels in potato fries ranged from 4.0 µg/kg to 15.8 µg/kg, with an average of 9.9 µg/kg.

Plantain Chips: PAH concentrations in plantain chips ranged from 2.5 µg/kg to 13.6 µg/kg, with a mean of 8.2 µg/kg.

The highest PAH levels were found in potato fries, followed by yam fries and plantain chips. Although the PAH levels in all samples were below the critical threshold of 50 µg/kg set by the Food and Drug Administration (FDA) for food safety, the variation in PAH levels indicates the need for improved cooking practices to minimise exposure to these toxic compounds.

The presence of PAHs in fried foods is primarily attributed to the thermal processing conditions and the type of fuel used for cooking [1]. PAHs are formed through pyrolysis and incomplete combustion of organic matter, including cooking oils and food components [2, 4]. The concentrations observed in this study are within the range reported for similar fried foods in other regions, but the cumulative exposure from regular consumption could pose health risks [21–23]. Studies have shown that PAHs can damage DNA and are associated with increased cancer risk, particularly for lung, skin, and digestive system cancers [24].

The variation in PAH levels between different types of street fries may be related to differences in oil absorption, cooking time, and the specific cooking conditions employed by different vendors [25]. The use of recycled cooking oil, which is common among street food vendors due to economic constraints, can lead to higher PAH formation as degraded oil components undergo further thermal decomposition [7].

Heavy Metal Contamination in Street Fries. Lead (Pb) and cadmium (Cd) contamination were detected in several of the street fries samples. The results are as follows:

1) Lead (Pb):

1.1) Yam Fries: Pb levels ranged from 0.02 mg/kg to 0.12 mg/kg, with a mean of 0.06 mg/kg.

1.2) Potato Fries: Pb concentrations ranged from 0.03 mg/kg to 0.15 mg/kg, with an average of 0.08 mg/kg.

1.3) Plantain Chips: Pb levels ranged from 0.02 mg/kg to 0.14 mg/kg, with a mean of 0.07 mg/kg.

2) Cadmium (Cd):

2.1) Yam Fries: Cd concentrations ranged from 0.01 mg/kg to 0.06 mg/kg, with a mean of 0.03 mg/kg.

2.2) Potato Fries: Cd levels ranged from 0.02 mg/kg to 0.08 mg/kg, with an average of 0.05 mg/kg.

2.3) Plantain Chips: Cd levels ranged from 0.01 mg/kg to 0.07 mg/kg, with a mean of 0.04 mg/kg.

Lead concentrations were below the Nigerian food safety limit of 0.1 mg/kg for Pb in foods. However, cadmium levels exceeded the safety threshold of 0.03 mg/kg set by the World Health Organization for cadmium in food [3], particularly in potato fries. This suggests a potential health risk from the long-term consumption of street fries, especially for vulnerable populations such as children and pregnant women.

The presence of heavy metals in street fries can be attributed to multiple sources of contamination. Environmental pollution from vehicular emissions, industrial activities, and improper waste disposal contributes to the contamination of raw materials and cooking environments [7]. Additionally, the use of low-quality cooking oils and contaminated water sources can introduce heavy metals into the food chain [8]. The bioaccumulation of heavy metals in the human body over time can lead to various health problems, including neurological disorders, kidney damage, and increased cancer risk [19].

The higher cadmium levels observed in potato fries compared to other samples may be related to the natural ability of potatoes to accumulate cadmium from soil and water [5]. This finding is consistent with previous studies that have identified potatoes as a major dietary source of cadmium exposure in many populations [6, 7, 12]. The exceedance of WHO limits for cadmium in several samples highlights the urgent need for monitoring and regulation of heavy metal contamination in street foods.

Comparison of Carcinogenic Substance Levels in Different Types of Street Fries. A one-way ANOVA revealed significant differences ($p < 0.05$) in the levels of carcinogenic substances between the different types of street fries. The average concentrations of acrylamide, PAHs, and heavy metals were highest in potato fries, followed by yam fries and plantain chips. This variation could be attributed to differences in the frying temperatures, oil quality, and cooking practices employed by the vendors.

Table 1 – Descriptive Statistics of Carcinogenic Substances in Street Fries

| Sample Type | Acrylamide ($\mu\text{g}/\text{kg}$) | PAHs ($\mu\text{g}/\text{kg}$) | Lead (mg/kg) | Cadmium (mg/kg) |
|-----------------------|--|----------------------------------|-----------------|-----------------|
| Yam Fries | | | | |
| Mean \pm SD | 265.5 \pm 89.2 | 7.8 \pm 2.6 | 0.06 \pm 0.03 | 0.03 \pm 0.02 |
| Range | 120-430 | 3.2-12.4 | 0.02-0.12 | 0.01-0.06 |
| Median | 275.0 | 7.9 | 0.06 | 0.03 |
| Potato Fries | | | | |
| Mean \pm SD | 305.0 \pm 95.4 | 9.9 \pm 3.4 | 0.08 \pm 0.04 | 0.05 \pm 0.02 |
| Range | 150-480 | 4.0-15.8 | 0.03-0.15 | 0.02-0.08 |
| Median | 315.0 | 9.8 | 0.08 | 0.05 |
| Plantain Chips | | | | |
| Mean \pm SD | 270.0 \pm 84.1 | 8.2 \pm 3.2 | 0.07 \pm 0.04 | 0.04 \pm 0.02 |
| Range | 130-420 | 2.5-13.6 | 0.02-0.14 | 0.01-0.07 |
| Median | 265.0 | 8.1 | 0.07 | 0.04 |

Table 2 – Comparison with International Safety Standards

| Contaminant | Safety Limit | Regulatory Body | Yam Fries | Potato Fries | Plantain Chips | Samples Exceeding Limit |
|--|--------------|-----------------|-----------|--------------|----------------|-------------------------|
| Acrylamide ($\mu\text{g}/\text{kg}$) | 200 | EFSA | 265.5 | 305.0 | 270.0 | 28/30 (93.3%) |
| PAHs ($\mu\text{g}/\text{kg}$) | 50 | FDA | 7.8 | 9.9 | 8.2 | 0/30 (0%) |
| Lead (mg/kg) | 0.1 | Nigeria/FAO | 0.06 | 0.08 | 0.07 | 0/30 (0%) |
| Cadmium (mg/kg) | 0.03 | WHO | 0.03 | 0.05 | 0.04 | 18/30 (60%) |

Table 3 – Vendor-wise Distribution of Contaminant Levels

| Vendor Location | Sample Type | Acrylamide ($\mu\text{g}/\text{kg}$) | PAHs ($\mu\text{g}/\text{kg}$) | Lead (mg/kg) | Cadmium (mg/kg) |
|-----------------|--------------|--|----------------------------------|--------------------------------|-----------------------------------|
| Ikeja | Yam Fries | 245.2 \pm 15.3 | 6.8 \pm 1.2 | 0.05 \pm 0.01 | 0.025 \pm 0.008 |
| | Potato Fries | 295.8 \pm 22.1 | 8.9 \pm 2.1 | 0.07 \pm 0.02 | 0.048 \pm 0.012 |
| | Plantain | 252.6 \pm 18.9 | 7.5 \pm 1.8 | 0.06 \pm 0.02 | 0.038 \pm 0.010 |
| Lagos Island | Yam Fries | 285.1 \pm 25.4 | 8.9 \pm 2.8 | 0.07 \pm 0.03 | 0.035 \pm 0.015 |
| | Potato Fries | 325.4 \pm 31.2 | 11.2 \pm 3.5 | 0.09 \pm 0.04 | 0.052 \pm 0.018 |
| | Plantain | 288.3 \pm 29.1 | 9.1 \pm 2.9 | 0.08 \pm 0.03 | 0.042 \pm 0.016 |
| Surulere | Yam Fries | 275.8 \pm 20.6 | 8.2 \pm 2.1 | 0.06 \pm 0.02 | 0.032 \pm 0.012 |
| | Potato Fries | 310.6 \pm 28.9 | 10.1 \pm 3.2 | 0.08 \pm 0.03 | 0.050 \pm 0.015 |
| | Plantain | 275.2 \pm 24.8 | 8.5 \pm 2.6 | 0.07 \pm 0.03 | 0.041 \pm 0.014 |
| Lekki | Yam Fries | 235.4 \pm 18.2 | 6.2 \pm 1.5 | 0.04 \pm 0.01 | 0.022 \pm 0.009 |
| | Potato Fries | 278.9 \pm 25.6 | 8.4 \pm 2.8 | 0.06 \pm 0.02 | 0.045 \pm 0.013 |
| | Plantain | 243.1 \pm 21.3 | 7.1 \pm 2.2 | 0.05 \pm 0.02 | 0.035 \pm 0.011 |

Table 4 – Statistical Analysis Results (ANOVA)

| Contaminant | F-value | p-value | Significance | Post-hoc Comparison |
|-------------|---------|---------|--------------------|-------------------------|
| Acrylamide | 15.42 | <0.001 | Highly Significant | Potato > Plantain > Yam |
| PAHs | 8.73 | 0.003 | Significant | Potato > Plantain > Yam |
| Lead | 4.21 | 0.028 | Significant | Potato > Plantain > Yam |
| Cadmium | 12.85 | <0.001 | Highly Significant | Potato > Plantain > Yam |

Table 5 – Risk Assessment Based on Daily Consumption ($\mu\text{g}/\text{kg}$ bw/day)

| Consumption Level | Acrylamide Exposure | PAH Exposure | Lead Exposure | Cadmium Exposure | Risk Level |
|---------------------|---------------------|--------------|---------------|------------------|------------|
| Low (50 g/day) | 0.26 | 0.008 | 0.0007 | 0.0004 | Moderate |
| Moderate(100 g/day) | 0.51 | 0.016 | 0.0014 | 0.0008 | High |
| High (200 g/day) | 1.02 | 0.032 | 0.0028 | 0.0016 | Very High |

Table 6 – Seasonal Variation in Contaminant Levels

| Season | Sample Period | Acrylamide ($\mu\text{g}/\text{kg}$) | PAHs ($\mu\text{g}/\text{kg}$) | Lead (mg/kg) | Cadmium (mg/kg) | Temperature ($^{\circ}\text{C}$) |
|------------|---------------|--|----------------------------------|--------------------------------|-----------------------------------|------------------------------------|
| Dry Season | Nov-Feb | 285.4 \pm 32.1 | 8.7 \pm 2.4 | 0.065 \pm 0.025 | 0.038 \pm 0.015 | 32.5 \pm 3.2 |
| Wet Season | Mar-Oct | 298.2 \pm 28.9 | 9.2 \pm 2.8 | 0.071 \pm 0.032 | 0.042 \pm 0.018 | 28.1 \pm 2.8 |
| Harmattan | Dec-Jan | 275.8 \pm 29.5 | 8.1 \pm 2.2 | 0.058 \pm 0.021 | 0.035 \pm 0.012 | 27.8 \pm 2.1 |

The results of this study reveal the presence of carcinogenic substances, including acrylamide, polycyclic aromatic hydrocarbons (PAHs), and heavy metals (Pb and Cd), in street fries sampled from various locations in Lagos. These substances are commonly associated with the frying process, and their presence in food is a growing concern for public health.

Acrylamide is formed during the frying process, especially at high temperatures. In this study, potato fries exhibited the highest acrylamide concentration (305.0 µg/kg), surpassing the European Food Safety Authority's (EFSA) safety threshold of 200 µg/kg. Although yam fries and plantain chips contained lower levels of acrylamide (265.5 µg/kg and 270.0 µg/kg, respectively), these levels still pose a health risk, especially with frequent consumption of fried foods.

The presence of PAHs is indicative of incomplete combustion during the frying process, where organic material, such as the oil, undergoes pyrolysis. Potato fries again exhibited the highest PAH concentration (9.9 µg/kg), though all samples were below the threshold of 50 µg/kg set by the U.S. Food and Drug Administration. Despite this, the variation in PAH levels emphasises the need for better cooking practices to reduce exposure to these carcinogens.

Regarding heavy metals, lead (Pb) and cadmium (Cd) contamination was observed in all samples. Lead concentrations ranged from 0.06 mg/kg in yam fries to 0.08 mg/kg in potato fries, which are within the permissible limit of 0.1 mg/kg for Pb. However, the cadmium levels exceeded the World Health Organization's recommended limit of 0.03 mg/kg, particularly in potato fries (0.05 mg/kg). This suggests that the use of contaminated oils or the frying process itself could contribute to the accumulation of heavy metals in the food.

The cumulative effect of exposure to multiple carcinogenic substances simultaneously represents a significant concern for public health [2]. While individual contaminant levels may be within acceptable limits, the combined exposure to acrylamide, PAHs, and heavy metals could result in additive or synergistic toxic effects [24, 25]. This is particularly relevant for populations that consume street fries regularly, as chronic exposure to low levels of carcinogens can increase the risk of developing cancer over time [4].

The findings of this study align with growing concerns about the safety of street foods in developing countries, where regulatory oversight is often limited, and food safety standards are not consistently enforced [1, 5]. The presence of multiple contaminants in street fries highlights the need for comprehensive food safety programs that address not only microbiological hazards but also chemical contaminants [6]. The data presented in Tables 1-6 demonstrate significant variations in contaminant levels across different parameters. The comprehensive statistical analysis reveals that potato fries consistently showed the highest concentrations of all measured carcinogenic substances, with mean acrylamide levels exceeding international safety standards by 52.5%.

CONCLUSIONS

The analysis of street fries in Lagos reveals that acrylamide, PAHs, and heavy metals (Pb and Cd) are present at varying levels in the different types of fries analysed. Potato fries contained the highest concentrations of all carcinogenic substances, particularly acrylamide and cadmium. Although the levels of PAHs and lead were within safe limits, the study suggests that frequent consumption of these street fries could pose potential health risks due to the accumulation of these toxic substances.

The exceedance of international safety standards for acrylamide and cadmium in multiple samples indicates an urgent need for intervention. Regular monitoring of carcinogenic substances in street foods should be implemented as part of a comprehensive food safety surveillance program. This monitoring should include not only the contaminants investigated in this study but also other potential hazards such as mycotoxins, pesticide residues, and additional heavy metals.

The findings underscore the importance of adopting improved frying practices and implementing effective regulatory oversight to ensure food safety during the preparation of street fries. Training programs for street food vendors should be developed to educate them about safe cooking practices, including optimal frying temperatures, proper oil management, and the importance of using quality ingredients. Additionally, public health awareness campaigns should be conducted to inform consumers about the potential risks associated with frequent consumption

of street fries and promote dietary diversification.

Future research should focus on developing cost-effective mitigation strategies to reduce the formation of carcinogenic substances during food preparation. This could include the use of natural antioxidants, optimisation of cooking parameters,

and the development of safer cooking technologies suitable for street food preparation. Furthermore, longitudinal studies should be conducted to assess the long-term health effects of consuming street fries with documented levels of carcinogenic substances.

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