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Original Article

Isolation and phenotypic identification of some moulds isolated from Potato chips sold in Birnin Kebbi, Nigeria

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ABSTRACT

Potato chips are widely consumed ready-to-eat snacks and are prone to fungal contamination during processing, packaging, storage, and marketing. This study investigated the isolation and phenotypic identification of molds associated with potato chips sold in Birnin Kebbi, Nigeria. A total of fifty (50) potato chip samples were purchased from major markets and street vendors within Birnin Kebbi metropolis. Samples were analyzed using standard mycological techniques. Isolation was carried out on Sabouraud Dextrose Agar supplemented with chloramphenicol. Identification of isolates was based on macroscopic colony characteristics and microscopic morphology using lactophenol cotton blue staining. Results showed that 80% of the samples were contaminated with molds, while 20% showed no fungal growth. The predominant molds isolated belonged to the genus *Aspergillus*, with *Aspergillus niger* (60%) and *Aspergillus flavus* (40%) being identified. The presence of these molds, known for their spoilage potential and ability to produce mycotoxins, suggests possible public health risks associated with the consumption of contaminated potato chips. Improved hygienic practices during processing, storage, and marketing are therefore recommended.

Keywords: Potato chips, molds, *Aspergillus*, phenotypic identification, Birnin Kebbi

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INTRODUCTION

Potato chips are popular snack foods consumed by people of all age groups due to their convenience, palatability, and affordability [1,2]. They are usually produced by slicing potatoes, frying or baking them, and packaging for sale. Despite low moisture content, potato chips can still support the growth of molds, especially when exposed to poor hygienic handling, high humidity, and improper storage conditions. Molds are filamentous fungi commonly found in the environment, including air, soil, water, and food materials [3,4]. Their presence in food products can lead to spoilage, loss of quality, and production of mycotoxins that pose serious health risks on consumers. Species of the genus *Aspergillus* are among the most frequently isolated molds from processed foods and snacks, particularly

in tropical regions where temperature and humidity favour fungal growth [5,2]. Food contamination is a major problem, and contaminants vary with different food commodities. Despite the widespread consumption of potato chips in Birnin Kebbi, Nigeria, little attention has been given to their microbiological safety, particularly with respect to mould contamination. Potato chips sold in open markets and by street vendors are often exposed to environmental conditions such as dust, high temperature, humidity, and unhygienic handling practices, which may favour fungal growth. The presence of moulds, especially species of the genus *Aspergillus*, in ready-to-eat foods is of public health concern due to their potential to cause food spoilage and produce harmful mycotoxins [6]. However, there is a paucity of local data on the prevalence and types of molds contaminating potato chips sold in Birnin Kebbi. This study was therefore conducted to isolate and phenotypically identify moulds contaminating potato chips sold in Birnin Kebbi.

MATERIALS AND METHODS

Study Area

The study was carried out in Birnin Kebbi, the capital of Kebbi State, Northwestern Nigeria. It situated between latitudes 10^{o} 00' – 13^{o} 20'N and longitudes 3' 00 – 6^{o} 00'E. The area is characterized by high ambient temperatures and seasonal humidity, conditions that may favor fungal contamination of food products.

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Isolation and Purification of Mold Isolates

Distinct fungal colonies were selected based on morphological differences and

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Samples Collection

A total of fifty (50) potato chip samples were randomly purchased from different markets, shops, and street vendors across Birnin Kebbi metropolis, based on the market size and availability of the sample. Samples were aseptically collected into sterile polyethylene bags, properly labeled, and transported to the laboratory department of plant science and biotechnology, Abdullahi Fodio University of Science and Technology for analysis.

Preparation of Culture Media

Sabouraud Dextrose Agar (SDA) supplemented with chloramphenicol was prepared according to the manufacturer's instructions. The medium was sterilized by autoclaving at 121°C for 15 minutes, allowed to cool, and aseptically poured into sterile Petri dishes.

Preparation of Inoculum

Ten grams (10 g) of each potato chip sample were aseptically weighed and homogenized in 90 mL of sterile buffered peptone water to obtain a stock suspension. The suspension was allowed to stand at room temperature for 30 minutes to enhance microbial recovery.

Inoculation and Incubation

Aliquots of the prepared suspension were inoculated onto SDA plates using a sterile inoculating loop. The plates were incubated at 25–28°C for 3–5 days and observed daily for fungal growth

sub-cultured on fresh SDA plates to obtain pure isolates. Purified isolates were maintained on SDA slants at 4°C for further analysis

Macroscopic Identification of Isolates

Macroscopic identification was based on the observation of colony characteristics including color, texture, margin, surface appearance, growth rate, and reverse pigmentation on SDA plates.

Microscopic Identification of Isolates

Microscopic examination was carried out using lactophenol cotton blue staining. A small portion of each fungal colony was mounted on a clean glass slide, stained, covered with a coverslip, and examined under a light microscope at ×10 and ×40 magnifications. Identification was done using standard mycological identification keys.

Determination of Frequency of Occurrence

The frequency and percentage occurrence of each identified mold species were determined by counting the number of isolates belonging to each species relative to the total number of isolates obtained.

RESULTS

Prevalence of Molds in Potato Chips

Out of the 50 potato chip samples analyzed, 40 samples (80%) showed fungal growth, while 10 samples (20%) showed no mold contamination.

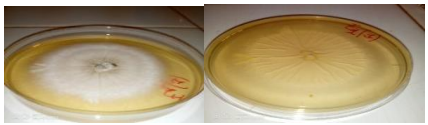
Table 1: Prevalence of Mold Contamination in Potato Chips Sold in Birnin Kebbi

Samples	Number of Samples (n = 50)	Percentage (%)
Samples with mold growth	40	80
Samples without mold growth	10	20
Total	50	100

Macroscopic Characteristics of Isolates

The fungal colonies observed were predominantly fast-growing with cottony to powdery textures. Colonies initially appeared whitish colors. Reverse pigmentation ranged from colorless to pale yellow.

Table 2: Macroscopic Characteristics of Mold Isolates from Potato Chips

Colony Colour (Surface)	Texture	Reverse Pigmentation	Mould colonies observed on Petri dish
Whitish colors	Cottony	Colourless to pale yellow	 *Aspergillus niger*
Whitish colonies	Rounded and cottony appearance	Yellow pigment	 *Aspergillus flavus*

Microscopic Characteristics of Isolates

Microscopic examination revealed septate hyphae with characteristic conidial heads typical of the genus *Aspergillus*. Two distinct species were identified based on morphological features and microscopic examination confirmed that the isolates belonged to the genus *Aspergillus* as seen in Fig. 1.

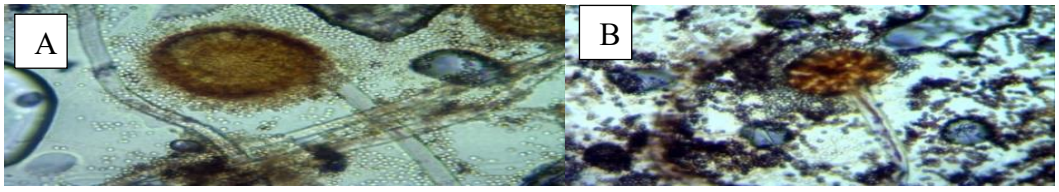


Fig. 1: *Aspergillus niger* (A) and *Aspergillus flavus* (B) observed under an optical microscope

Distribution of Identified Molds

A total of 25 representative isolates were identified. *Aspergillus niger* accounted for 15 isolates (60%), while *Aspergillus flavus* accounted for 10 isolates (40%) as indicated in Table 2.

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Table 3: Distribution of Mold Species Isolated from Potato Chips

Mold Species	Number of Isolates	Percentage (%)
Aspergillus niger	15	60
Aspergillus flavus	10	40
Total	25	100

DISCUSSION

The findings of this study indicate a high prevalence (80%) of mold contamination in potato chips sold in Birnin Kebbi. This is consistent with reports on fungal contamination of low-moisture ready-to-eat foods in Nigeria and other tropical regions [2,7]. According to Ezekiel [2], whom observed high fungal contamination rates in low-moisture snacks sold in Nigerian markets, attributing this largely to environmental exposure and inadequate post-processing handling. Similarly, Onyeke [4], reported that informal marketing and storage conditions significantly contributed to mold occurrence in street-vended foods.

The predominance of *Aspergillus* species obtained in the presence study aligns with well-established patterns in food mycology. The genus *Aspergillus* is widely recognized as a common contaminant of processed foods in tropical climates due to its ability to tolerate low water activity and variable environmental conditions [3,5] In particular, *A. niger* and *A. flavus* were recorded as the major species, with *A. niger* being more frequent (60%) than *A. flavus* (40%). This distribution pattern mirrors several studies on snack foods and cereals as [8] documented similar dominance of *A. niger* in samples of processed foods, emphasizing its adaptability and high spore production. However, some studies have found variations in species distribution. An investigation into potato chips intended for children's consumption revealed *Penicillium* spp. as a more prominent isolate followed by *A. flavus* [9]. These differences may be attributed to variation in substrate composition, moisture content, and storage conditions inherent to different food types. Potato chips, with comparatively lower moisture content but open display practices, may favor the robust growth and sporulation of *A. niger* over other species.

The macroscopic and microscopic characteristics observed in this study such as septate hyphae, conidial heads, and distinctive colony pigmentation parallel with standardized identification descriptions reported in mycological keys and recent food microbiology research [10,5]. These morphological traits remain crucial for phenotypic

classification despite advances in molecular diagnostics.

The presence of *A. flavus* raises concerns about potential aflatoxin contamination. This is particularly relevant given that aflatoxins are among the most potent naturally occurring carcinogens known to contaminate food supplies, especially in tropical regions with high humidity and inadequate storage infrastructure [11]. Although this study did not directly quantify mycotoxin levels, the frequent isolation of *A. flavus* suggests a potential risk that warrants further analytical investigation. *Aspergillus niger* and *Aspergillus flavus* are well-known for their spoilage potential and ability to produce mycotoxins, including aflatoxins in the case of *A. flavus* [7,11]. Consumption of foods contaminated with such molds may pose health risks ranging from allergic reactions to chronic toxicity. The presence of these molds in a ready-to-eat snack such as potato chips is of public health concern, especially considering that consumers rarely subject the product to further heat treatment before consumption in some countries (12,,11].

CONCLUSION

This study revealed significant contamination of potato chips sold in Birnin Kebbi with mold species, predominantly *Aspergillus niger* and *Aspergillus flavus*. The findings highlight the need for improved food safety practices during production, packaging, storage, and marketing of potato chips. Producers and vendors should adhere strictly to good manufacturing and hygienic practices.

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