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Evaluation of the Microbiological Quality of Ground Nut Cake (Kuli kuli) Samples Sold in Markets in Ado-Ekiti Metropolis, Ekiti State Nigeria

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Groundnut cake (Kuli kuli) samples were purchased from sellers in five markets in Ado-Ekiti and taken to the laboratory for microbiological analyses. To isolate fungi, the samples were cultured on potatoe dextrose agar and sabouraud dextrose agar and the plates were cultured at 25°C for 5days. Bacteria were isolated by culturing the samples on nutrient agar. The plates were incubated at 37°C for 24 hours. The fungi isolated were *Rhizopus stolonifer, Mucor mucedo*, *Trichoderma viride*, *Aspergillus flavus. Penicillium italicum, Penicillium digitatum.* The most frequently occurring fungi was *Rhizopus stolonifer*(25%)while the least occurring was *Penicillium digitatum*(10%). The highest fungal count *was* $2.0X10^5$ recorded in market E while the least was $1.0x10^2$ in samples from market A. The bacteria isolated were *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Escherichia coli , Serratia marcescens.* The highest bacterial count *was* $4.0x10^6$ recorded in market E while the least was $2.3x10^4$ in samples from market A. It was concluded that kuli kuli sold in markets in Ado-Ekiti could be a source of transmission of microorganisms that could lead to intoxication and other health hazards. Sellers were therefore advised to ensure proper packaging of kuli kuli before display in market places to avoid microbial contamination.

Key words: Kuli kuli, Microorganisms, Fungi, Bacteria.

The peanut or groundnut (*Arachis hypogea*) is a species in the legume or bean family fabaceae so it is not a nut. It is an annual herbaceous plant growing 30 to 50 cm tall. The leaves are opposite, pinnate with four leaflets (two opposite pairs, no terminal leaflet) each leaflet 1to 7 cm long and 1 to 3 cm broad.

Peanuts are known by many local names: ground nut, earthnut, goober nut, monkey nut, pygmy nut and pignut.

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Kuli- kuli is a Hausa food that is primarily made from peanuts. It is a popular snack in West Africa especially Ghana and Nigeria. It is often eaten alone or with a mixture of garri, sugar and water which most people call 'garri soaking'. It is also eaten with Kooko, fura, kamu (which are all cereals porridges) and is sometimes ground and put into salad or even eaten with suya a meat kebab.

To make kuli kuli, peanuts are roasted and mixed with spices, salt and sometimes ground pepper. The paste is stripped of excess oil with water and made into desired shapes (round , cylindrical etc.). The oil removed in this process is then heated and used to fry the shaped peanut paste until it solidifies. It is then removed from the oil and allowed to cool down until ready to be eaten[1]. Kuli-kuli after production, is presented for

sale. These are retailed in open trays and basins in market places. The present work investigated the microorganisms associated with these retailed kuli kuli considering the fact that they are sold without wrappings.

MATERIALS AND METHODS

Collection of materials

Kuli kuli samples were purchased from sellers in five markets in Ado-Ekiti, Ekiti state, Nigeria and designated A,B,C,D and E. The samples were put into clean polyethylene bags immediately they were bought. The samples were transported to the laboratory immediately after purchase.

Isolation of microorganisms and identification of isolates

Fungi

The groundnut cakes were surface sterilized by first immersing in 70% ethanol for 2mins followed by immersion in 0.4% Sodium hypochlorite for 2mins[2] and rinsed in several changes of sterile distilled water, The surface sterilized ground nut cakes were ground and made into paste with a few drops of sterile distilled water. A little was taken from the paste with a sterile scalpel and put on the surface of Potato dextrose agar and Sabouraud dextrose to which 50mg/l chloramphenicol had been added[3]. All plates were incubated at 25°C for 5-7 day. Subcultures were made on sterile media plates and incubated appropriately.

The identification of the isolated fungi was done both macroscopically and microscopically. The gross morphology of the fungal growth including their colors on plates was studied. Later small portions of the fungal pure culture were teased and mounted in lactophenol in cotton blue dye on a clean slide, covered with a clean cover slip and observed under the microscope[4]. The identity of the fungi were certified using cultural characteristics as well as comparing them with confirmed representatives identified by means of key.

Bacteria

One gramme of kuli-kuli was crushed in a sterile porcelain mortar and made in to paste with little water. A sterile inoculating needle was dipped in the groundnut cake paste and steaked on the surface of nutrient agar plates. The plates were incubated at 37° C for 24 hours. The resultant colonies were confirmed using colonial characteristics and reaction to biochemical tests using methods described by[5].

Enumeration of organisms

A 1m laliquot of the resultant homogenate from ground nut cake ground in a sterile porcelain mortar was added to 9.0 ml of sterile distilled water in a test tube and serial dilutions were carried out to10^{-5}. A 0.1ml aliquot was taken from the10^{-3} dilution and plated onto the different media. The plates were incubated at 37°C for 24 h to obtain the total viable bacterial counts,

Determination of % occurrence of the fungal isolates

This was done to determine the incidence of occurrence of the different fungal and bacterial isolates. The total number of each isolate in all samples was obtained against the total number of all the isolates in all the samples screened. Frequency of occurrence was therefore determined using method described by[6].

$$\text{Percentage of frequency} = \frac{\text{No. of observations in which a species appeared}}{\text{Total no of observations}}$$

RESULTS

The fungi Isolated from kuli kuli were *Rhizopus stolonifer*, *Mucor mucedo*, *Trichoderma viride*, *Aspergillus flavus. Penicillium italicum, Penicillium digitatum.* The most frequently occurring fungi was *Rhizopus stolonifer* (25%) while the one with the least frequency was *Penicillium digitatum*(10%). These organisms and their frequencies of occurrence are shown in Table 1.

Samples from market B had the highest fungal counts of $3.0x10^5$ while samples from market A had the least count of $1.0x10^5$. Theseresults are shown in Table 2.

The bacteria isolated were *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Escherichia coli, Serratia marcescens* (Table 3).

The bacterial count was highest in sample from market E. ($4.0x10^6$). The least count was in samples from Market A $2.3x10^4$. (Table 4)

Table 1. Fungi isolated from Kuli kuli and their frequencies of occurrence

Fungi isolated from Kuli kuli	Frequency of Occurence of fungal isolates	% frequency of Occurrence of fungal isolates
Rhizopus stolonifer	20	25
Mucor mucedo	15	23.7
Aspergillus flavus	10	12.2
Penicillium italicum	15	23.7
Penicillium digitatum	08	10
Trichoderma viride	12	15

Table 2. Colony count of fungal isolates

Market code	Colony count of fungal isolates (sfu/g)
A	1.0×10^{2}
B	2.0×10^{5}
C	2.5×10^{3}
D	3.0×10^{3}
E	1.6×10^{4}

Table 3. Bacteria isolated from Kuli kuli and their frequencies of occurrence

Bacteria isolated from Kuli kuli	Frequency of Occurence of bacterial solates	% frequency of Occurrence of bacterial isolates
Rhizopus stolonifer	30	37.5
Mucor mucedo	15	18.7
Aspergillus flavus	20	25
Penicillium italicum	05	6.3
Penicillium digitatum	05	5.3
Trichoderma viride	10	12.5

Table 4. Colony count of bacterial isolates

Market code	Colony count of bacterial isolates (sfu/g)
A	2.3×10^{4}
B	2.5×10^{6}
C	2.8×10^{5}
D	3.0×10^{4}
E	4.0×10^{6}

DISCUSSION

The fungi and bacteria isolated are similar to those reported by[7] from‘street vended ready to eat fruits.

The fungi isolated are mostly field to store organisms or storage fungi. They could have come from the containers used in retailing the cakes or even from spore deposits in the air as the cakes are sold openly even in wheel barrows without proper packaging. The bacteria isolated from the samples are contaminants. *Staphyloccocus aureus*, and *Staphyloccocus epidermidis* are human pathogens which are could have got in to the food as a result of contamination during handling in market places and during processing[8]. Reported that ready to eat foods are contaminated by improper handling. *Pseudomonas* aeruginosa,

Bacillus subtilis and *Serratia marcensens* are associated with the soil so must have gotten to these cakes during processing as the cakes are prepared at ground level. These organisms may also have been carried in dust which eventually settles on the cakes during sales in the market places. The bacterial counts exceeded the limit of $1.0x10^2$. The presence of Escherichia coli is indicative of fecal contamination. This could have come from the water used in processing or even from handling in the market places as the producers are illiterate so may not observe good hygiene practices after visiting the toilets so their wares are contaminated with microorganisms of fecal origin. It was reported by[9] that *E .coli* contamination of Tsire-suya a Nigerian meat product was due to poor hygiene practices.

CONCLUSION

The Microorganisms isolated from kuli-kuli samples sold in Ado-Ekiti are those associated with careless handling and could be prevented with good hygiene practices as use of gloves during processing and proper packaging of products before display in market places. These microorganisms are of public health concern as they can lead to health problems if unchecked in kuli kuli which is more or less a staple food in the study area. It is therefore recommended that retailed kuli-kuli should be properly packaged and the use of wheel barrows in selling kuli-kuli in the open should be discouraged.

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