



ASSESSMENT OF THE MICROBIOLOGICAL QUALITY OF SOME LOCALLY MADE CANDIES SOLD AT SOME PRIMARY SCHOOLS AT SHARADA

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ABSTRACT

*Candies are confectionaries which cover not only pure sugar concoctions but also include an array of tasty ingredients. Mostly sold at local primary schools with very high pupils population at very cheap price. The research was aimed at assessing the microbiological quality of some candies sold in selected primary schools because of their public health importance. Some locally-made candies comprising of Tsamigaye (Baobab fruit candy) and Alawar madara (Milk candy) collected from five primary schools within Kano Municipal L.G.A., coded site A, B, C, D and E were microbiologically examined for their bacterial and fungal loads respectively. It was observed that Tsamigaye from site C has the highest mean bacterial and coliform counts of 1.60×10^5 cfu/g and 1189 respectively and Alawar madara from site C also has the coliform count of 620 while site D has the highest mean bacterial count of 3.27×10^5 cfu/g. For the mean fungal count, it was observed that Tsamigaye from site E had the highest count of 7.27×10^4 cfu/g while Alawar madara from site C had the highest count of 4.51×10^5 cfu/g. The bacterial isolates identified from the samples were *Staphylococcus aureus*, *Escherichia coli*, *Salmonella* species and *Shigella* species, their occurrence may be due to contamination from the candy producers, vendors or the raw materials used. The fungal isolates identified from the sweet samples were *Rhizopus* species and *Aspergillus niger*, their occurrence may be due to the high sugar concentrations of the candies which favors the growth of the fungi. The presence of these microbes serves as potential health risk to the pupils and the general population at large.*

KEY WORDS: Candies, Bacteria, Fungi, Primary Schools and Pupils.

INTRODUCTION

The safety of food is an important parameters that determine general public health, more especially children, however only limited data is available about the microbiological quality of cheap and junk foods that are consumed more often by primary schoolchildren (e.g. local candies and chocolates) (Kim *et al.*, 2013). Locally processed foods such as candies and dried cakes are consumed frequently by children world over, especially in developing countries (Kim *et al.*, 2008). Children lack the appropriate decision-making capacities to differentiate between safe and unsafe food, basing their food purchasing decisions on bold colours, shapes, flavours and degree of sweetness, rather than food safety or nutritional value of the food (Han *et al.*, 2010). Majority of these food products are produced by local households or small manufacturing companies, under very poor sanitary conditions. The manufacturers in addition lack the necessary knowledge of food safety and hygiene (Seo *et al.*, 2009).

Children were found to be more susceptible to foodborne disease than adults for their organs are not fully developed (including intestines and stomach), coupled with their weak immune systems (Balbus and Malina, 2009; Kim *et al.*, 2011). Consequently, even a small quantity of foodborne pathogens could cause severe disease in children, which might otherwise not cause in adults. These cheap and junk foods including locally processed candies are ingested directly by the consumers without any form of pre-consumption treatment that might decrease the microbial load. Children are also found to be more engaged in hand-to-mouth habit, which causes the ingestion of microbes via the cross-contamination of containers, packages and the children's hands. Although a number of studies have assessed the same risk factors associated with foods such as colour additives (Sawaya *et al.*, 2008), artificial sweeteners (Han *et al.*, 2010), heavy metals (Dahiya *et al.*, 2005) and allergens (Tamay *et al.*, 2007), but only limited information studies were conducted on microbial quality of such foods (Kawo and Abdulmumin, 2009).

Numerous food products have been associated with food poisoning due to their poor quality, contaminated constituents and improper handling (Odeyemi, 1984). The two locally produced candies, Tsamigaye and Alawar Madara are produced locally from dried baobab fruit pulp and powdered milk respectively. The manufacture of these products is based on traditional method without any regard to the quality of the raw material used and/or the hygienic quality of the products. Under such conditions many microorganisms can find access to these finished products, which are subsequently consumed by children and adults. Thus the present study aimed at assessing the microbiological quality of some commonly produced local candies sold at some selected primary schools within Sharada, Kano, Nigeria.

MATERIALS AND METHODS

Sampling Sites and Sample collection

Five (5) schools were randomly selected in Sharada area of Gwale local government area of Kano State, Nigeria. The schools were Sabongida special primary school, Salanta special primary school, Ja'en special primary school, Al'amanat Nursery and primary school and Hayatudden Islamic primary school coded A, B, C, D and E respectively. A total of thirty (30) samples from each school were randomly collected and aseptically kept in a sterile cellophane bag that was previously sterilized with ethyl alcohol, adopting Food and Agricultural Organization (FAO, 1992) method. All samples were always taken to laboratory for analysis.

Microbiological analysis of the samples

Inoculation of samples

Sample inoculation was carried out using standard-plate count technique (FAO, 1992). Twenty five grams (25g) of the candy sample was aseptically weighed and introduced into 225 ml of sterilized buffered peptone water. The mixture was then shaken vigorously to make homogeneous solution of the candies. The homogenate was serially diluted (10^{-1} to 10^{-5}) and 1.0 ml of each of the homogenates was then inoculated into corresponding labelled

plates of nutrient (biotec) agar medium for bacteria and potato dextrose (LAB M) agar medium for fungi. The plates for bacterial counts were incubated at 37°C for 24 hours while those for fungal counts were incubated at room temperature ($27 \pm 1^\circ\text{C}$) for 5 days. Un-inoculated plates of nutrient agar and potato dextrose agar medium were incubated together with the inoculated plates to serve as control. The numbers of colony forming units were counted, recorded and expressed in colony forming units per gram (cfu/g). In addition, selective and differential media (Eosin methylene blue agar, MacConkey agar, Mannitol salt agar and peptone water) were also inoculated and incubated at 35°C for 18-24 hours accordingly.

Cultural, morphological and biochemical characterization of the isolates

Methods described by Cheesbrough (2006) were used for the identification of the bacterial isolates. Colony appearance was observed and recorded while Gram's reaction and spore staining were carried out to ascertain the morphology and Gram's reaction behavior of the bacterial isolates. In addition, biochemical tests such as indole, citrate utilization, catalase, methyl red-Voges proskauer and coagulase tests were carried out. Lactophenol cotton blue reagent was used for the fungal identification used and the stain examined microscopically using X10 and X40 objective lens (Beneke and Stevenson, 1977).

RESULTS AND DISCUSSION

The results of the microbiological assessment of the candy samples from the five selected primary schools in Sharada area of Gwale Local Government of Kano state are as presented in tables below. From Table 1, for Tsamigaye the highest bacterial and coliform counts were from site C and A respectively, with lowest counts found in site E and D. The highest and lowest bacterial and coliform counts for Alawar madara were from site D and E, and site C and A respectively. The highest and lowest mean fungal counts, were - for Tsamigaye from site E and C while for Alawar madara were site C and D (Table 2.0).

Table 1: Mean bacterial and coliform counts of the candy samples

Site Code	Tsamigaye		Alawar madara	
	Bacterial count (cfu/g)	Coliform count (cfu/g)	Bacterial count (cfu/g)	Coliform count (cfu/g)
A	7.11×10^4	1257	1.32×10^4	11
B	1.10×10^4	41	1.50×10^4	426
C	1.60×10^5	1189	6.83×10^4	620
D	2.10×10^4	17	3.27×10^5	30
E	9.23×10^3	23	1.29×10^4	42

Table 2: Mean fungal counts of the candy samples

Site Code	Tsamigaye Fungal counts(cfu/g)	Alawarmadara Fungal counts(cfu/g)
A	3.97×10^4	1.43×10^5
B	1.61×10^4	5.09×10^4
C	1.36×10^4	4.51×10^5
D	2.60×10^4	2.95×10^3
E	7.27×10^4	2.50×10^4

The results obtained from the present study, showed that the highest mean bacterial counts of the samples have exceeded the maximum recommended standards set by the International Commission on Microbiological Specification of Foods (ICMSF, 1986). This is for both the bacterial and fungal counts conducted, at corresponding sample size. According to this agency, the acceptable limit of aerobic mesophilic bacterial count in dried food products (diary and confectionery) should not exceed a maximum of 10^3 cfu/g.

However, Tsamigaye had the bacterial count within the acceptable limit from site E and Alawar madara from site D had the fungal count within ICMSF limit. Nevertheless, the counts are still considerably high since no microorganism should be recovered from any food meant for direct human consumption (FAO, 1992; WHO, 2003).

The generally observed high microbial counts in the present study could be ascribed to environmental factors, which were shown to play significant role in quality and safety of food products (Abdullahi *et al.*, 2005; Shamsuddeen and Ameh, 2008; Shamsuddeen *et al.*, 2008).

A total of four bacterial genera: *Staphylococcus aureus*, *Escherichia coli*, *Salmonella* species and *Shigella* species and two fungal genera: *Rhizopus* species and *Aspergillus niger* were identified.

The characterizations of the microbial isolates recovered from the candy samples analysed in this study indicated the presence of *Staphylococcus aureus*, *Escherichia coli*, *Shigella* and *Salmonella* species among the bacterial genera and *Rhizopus* species, *Aspergillus niger* among the fungal genera as the contaminants. Particularly important are the *E. coli* and *Salmonella* spp. These are known causative agents of food poisoning and intoxication (FAO, 1992; Adams and Moss, 1995). The presence of these bacteria may be due to the unhygienic environmental conditions and poor handling. Various studies, such as Abdullahi *et al.*, (2005), Aboloma, (2008) and Kawo and Abdulmumin, (2009) have reported that the presence of *S. aureus* in food is an indication of environmental and human contamination.

According to Wufem *et al.*, (2004), the presence of *S. aureus* might be ascribed to contamination of foods through air and respiratory openings of the handlers. Of significance is the ability of *S. aureus* to produce enterotoxins in foods, which are dangerous to human and other animal health (Okafor, 1987 and Wieneke *et al.*, 1993). The presence of *E. coli*, *Shigella* and *Salmonella* might be attributed to improper handling, which might be transferred directly by those processing or selling the candies. Both bacteria were reported to be dangerous to humans. *Escherichia coli* is found in the gastrointestinal tracts of animals, its presence might be indicative of fecal contamination. *Salmonella* are infectious pathogens that lead to serious clinical symptoms in humans. *Shigella* was also reported to be spread via contaminated food and drinks and young children from low socio-economic status as our study sites were reported to be the most frequently involved victims of *Shigella* infection. Food becomes contaminated by being exposed to *Shigella*-contaminated fecal material, usually on human hands (FAO, 1992).

Aspergillus species has been reported as one of the most prominent molds occurring in foods, with *A. niger* in particular known as opportunistic pathogen, thus making candies palatable substrate for their growth. The presence of *Aspergillus* species in the candy samples in the present study could result in the production of mycotoxins, which could lead to health hazards for the consumer (Weinzirl, 1992), especially for children because of their immune status. *Rhizopus* is also an opportunistic pathogen that can lead to fatal cases of zygomycosis, commonly inhibiting high organic contents substrate.

CONCLUSION AND RECOMMENDATION

From the present study, the average bacterial and coliform counts as well as the fungal counts of the candy samples assessed were generally above the maximum allowable limit for confectioneries, as such making them un-fit for human consumption, except for few samples as observed. These high microbial counts are suggestive of improper handling by the individuals involved.

The presence of the identified potential pathogens in the present study has suggested that these candies are a potential health risk for the children.

Based on the present study, it is recommended that only candies that are aseptically processed should be sold. Both parents and school

authorities should ensure that they enlighten these children on the dangers of consuming contaminated candies. Producers of such products should also be enlightened on proper and safe ways of processing these candies for direct human consumption.

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