

Microbes and Food Sustainability in Modern Era

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ABSTRACT

The Microbiological quality of wet and dry tiger nuts sold in five different locations within Calabar Metropolis was analyzed using Standard Microbiological and Bacteriological Techniques. *S. aureus*, *Bacillus* sp, *Streptococcus* sp, *E. coli*, *Pseudomonas*, *Enterococcus*, *Proteus* and *Klebsiella* species were microbial strains isolated from dry and wet tiger nut samples. *E. coli* was the most frequent isolates occurring 8(29.6) followed by *Bacillus* 6(22.2), *Streptococcus* and *Pseudomonas* occurred 3(11.1), *S. aureus*, *Proteus* and *Klebsiella* also had similar % occurrence of 2(7.41) while the least was *Enterococcus* with 1(3.70). The percentage occurrence of bacterial isolated from wet tiger nut was 14 (28.0) and 13 (26.0) from dry tiger nut. Four locations had similar 6(75.0) rate of isolates compare to Etim Edem Park with 2 (25.0). The general overview concludes that the microbial threshold in the wet tiger nut was higher 14 (28.0) than that of dry tiger nut with 13 (26.0). Association of microbial pathogens with food crops endangers human lives and are key agent to food scarcity.

INTRODUCTION

Cyperus esculentus L (tiger nuts), belongs to grass family *Cyperaceae*. They have different commercialized varieties such as yellowish brown, dark brown-black etc., and are sold in open containers as wet (with little amount of water) or dry nut (Ayeh-kumi *et al.*, 2014).

In Nigeria especially in Cross River State, it is widely consumed for its nutritional composition, some of which include; calcium, chromium, cobalt, iron, manganese, phosphorus, potassium, selenium, sodium, zinc, carbohydrate, protein, lipids and vitamins C, E etc. (Adjei – Duodu, 2014). Literature according to Ndubuisi, 2009 reported that the nut has the ability to prevent against heart attack, Thrombosis, absence of cholesterol among others. Despite the nutritional values, the nut is subject to scarcity in the nearest future due to susceptibility of the nut to bacterial contamination. Increase in the world population continues and availability of non-contaminated food to guarantee food safety is becoming more challenging. There is no balance in the growing population and Agricultural/food products especially in some rural areas where children are suffering from mal-nutrition. Thus, evaluating the microbial contamination of this tuber as well as comparing the microbial load in both wet and dry tiger nut was the outmost focus of this research.

Comment [U1]: explain the importance of this research

METHODOLOGY

20g weight of both Wet (wTNT) and Dry (dTNT) TNT were soaked in 80 mL of normal saline with vigorous shaking for 5 minutes to serve as a stock solution. 1 mL was taken from the stock solution to perform a ten-fold serial dilution down to 10^{-10} . Pour plating method was the culturing technique used in this study. Nutrient and MacConkey agar (Liofilchem® s.r.l., Italy) were media used. 1mL amount of 10^{-5} dilution of each suspension was placed in a clean sterile Petri dish; then, 20 mL of already molten Nutrient or MacConkey agar at about 44°C was added. The Petri dish was swirled gently until the contents were completely mix. The agar was allowed to set before incubation at 37°C for 24 hours in a humidified incubator.

After 24 hours of incubation, plates were examined for growth and the emergent colonies counted and recorded. Thereafter, discrete colonies were isolated after three successive sub-culturing and purification on Nutrient agar. Colonies were characterized by standard bacteriological techniques as

described by Cheesbrough., (2010). Gram negative oxidase positive rods were further identified using API-kit.

RESULTS AND DISCUSSION

Comment [U2]: first explain the introductory words about the data obtained, and discuss why the bacteria were obtained, the possible origin of the contamination as well

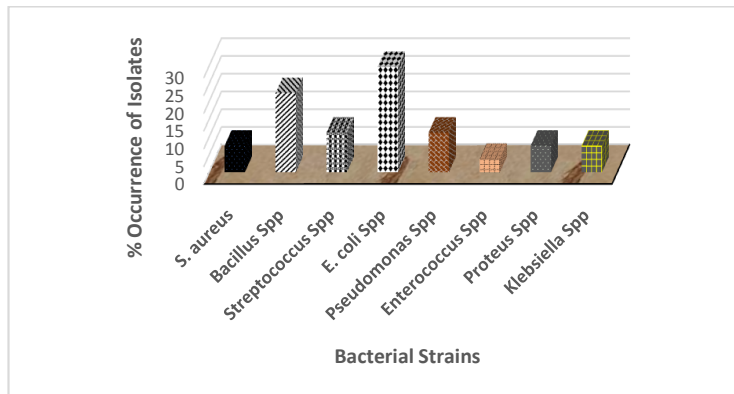


Fig. 1 shows the different strains of microorganisms isolated from tiger nut.

Table 1: Classification of Isolated Organisms Based on Gram Reaction

Bacterial Isolates	Gram Positive (+ve)	Gram negative (-ve)	Cocci	Rods
<i>S. aureus</i>	+	-	+	-
<i>Bacillus spp.</i>	+	-	-	+
<i>Streptococcus spp.</i>	+	-	+	-
<i>E. coli</i>	-	+	-	+
<i>Pseudomonas spp.</i>	-	+	-	+
<i>Enterococcus spp.</i>	+	-	+	-
<i>Proteus spp.</i>	-	+	-	+
<i>Klebsiella spp.</i>	-	+	-	+
Total	4	4	3	5

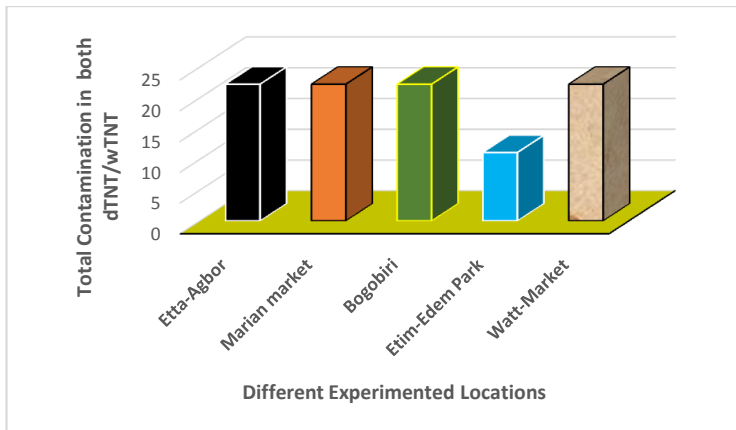


Fig. 2: The level of contamination of tiger nut was evaluated based on percentage occurrence of microbial isolates per experimented location. Etim Edem Park was the least contaminated location.

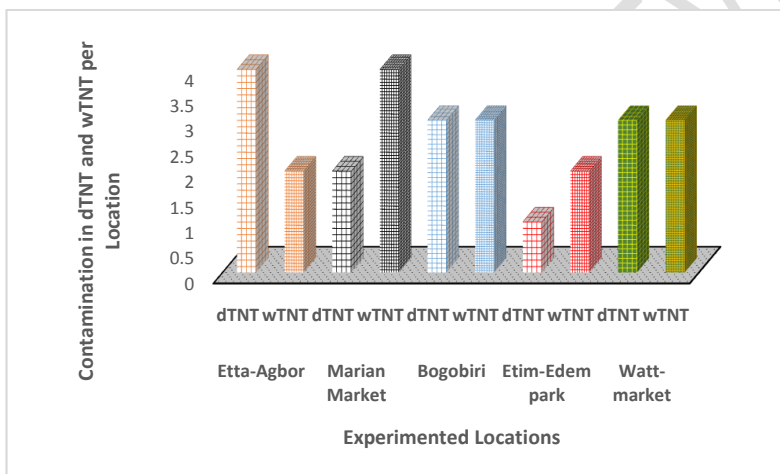


Fig. 3: There was no influence of water activity on level of contamination at Bogobiri and Watt market. However, some variations occurred for Etta-Agbor, Marian and Etim Edem Park. Dry tiger nut at Etta-Agbor and wet at Marian market had similar contamination level.

Table 2: Distribution of Isolates from Dry (dTNT) and Wet (wTNT) Tiger Nut Tuber Based on Locations

Bacterial Isolates	Etta-Agbor		Marian		Bogobiri		Etim Edem Park		Watt Market		Frequency of Occ.
	dTNT	wTNT	dTNT	wTNT	dTNT	wTNT	dTNT	wTNT	dTNT	wTNT	
<i>S. aureus</i>	-	-	-	-	+	-	-	-	+	-	2
<i>Bacillus</i> spp	-	+	+	-	-	+	-	+	+	+	6
<i>Streptococcus</i> sp	+	-	-	-	+	+	-	-	-	-	3
<i>E. coli</i>	-	+	+	+	+	-	+	+	+	+	8
<i>Pseudomonas</i> spp	+	-	-	+	-	+	-	-	-	-	3

<i>Enterococcus</i> spp	+	-	-	-	-	-	-	-	-	-	1
<i>Proteus</i>	+	-	-	+	-	-	-	-	-	-	2
<i>Klebsiella</i> spp	-	-	-	+	-	-	-	-	-	+	2
Total	4	2	2	4	3	3	1	2	3	3	27

High prevalence rate 8(29.6) of *E. coli* is a reliable proof of fecal contamination of the nut. *Bacillus* sp are known as environmental contaminants due to exposure of tiger nut tubers by Hawkers. These organisms can cause diarrhoea which may be mild, watery to severe and bloody stool, stomach cramps and or fever. *Bacillus* sp 6(22.2) may signify incomplete removal of soil particle that accompanied the nut during harvest. It may lead to food poisoning outbreak and its associated negative impact. The occurrence of *Streptococcus* and *Pseudomonas* in T. nut (ready to eat food) is not healthy for consumers as they have been reported among causative agent of food spoilage. Although the occurrence rate of *S. aureus*, *Proteus*, *Klebsiella* and *Enterococcus* were low, but should not be neglected in ready to eat food, however, according to Monica Chessbrough, (2010)., there is potency in any pathogen recover in 10^{-5} of any diluents. Kumi *et al.*, 2014 and Nyarko *et al.*, (2011) isolated and identified similar pathogens in TNT sold in different markets and vendors in Ghana city and Cape coast metropolis in Ghana.

The report of this study suggests that decontamination of irrigation water, cultivation of disease resistance nut and observation of personal hygiene during harvest and post-harvest are better remedial measures against tiger nut contamination as well as food sustainability.

CONCLUSION

The study report different microbial strains associated with ready to eat wet and dry T. nut tuber sold to the public at different locations within Calabar Metropolis, Cross River State, stating that this observation is unhealthy to the wellbeing of the citizens. Information on the microbial load of ready to eat tubers and nut within Calabar Metropolis is almost negligible. Possible health risk that may lead to food borne related illness or out breaks are not considered.

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Comment [U3]: explain the general condition of the rung where you took the sample, whether it is clean or not. If they are clean, what is the initial condition of the tiger nuts after harvest, also check the initial condition of the raw materials