

An Assessment of the Bacteriological Quality of Different Brands of Yoghurt Sold in Keffi, Nasarawa State, Nigeria

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Abstract

An investigation was carried out to determine the bacteriological quality of the different brands of yoghurt sold in Keffi, Nasarawa State, Nigeria. Seven brands of yoghurt were identified to be sold in Keffi metropolis within the period, and these were designated A, B, C, D, E, G and H respectively. Samples of these brands were obtained from ten (10) different locations and were analysed using standard microbiological methods in order to determine their respective bacteriological quality. The results obtained showed that the pH of the different brands of yoghurt were in the range of 3.18 – 2.35. Yoghurt A had the highest pH value, while yoghurt G had the lowest. The results of the bacterial enumeration showed the lowest counts of 0.0×10^3 for yoghurt A, C and F, while yoghurts D, G, E and B had counts of 3.6×10^3 , 2.5×10^3 , 2.3×10^3 and 3.4×10^3 respectively. Yoghurts A, C and F had 0.0×10^3 coliform count of 3.6×10^3 . The counts of *Staphylococcus aureus* was 0.0×10^3 in four brands (A, C, F and G), while there were counts of 4.5×10^3 , 3.8×10^3 and 3.4×10^3 for brands B, D and E respectively. Similarly, the counts of *E. coli* were zero except for brands B and E which had 3.6×10^3 and 4.4×10^3 , respectively. The counts for *Streptococcus pyogenes* were zero for all the brands except D and G which had counts of 4.8×10^3 and 3.6×10^3 , respectively. The results of this study demonstrate that four (B, D, E and G) out of the seven brands of yoghurts sold in Keffi are hygienically poor in terms of bacteriological quality because of the varying numbers of bacteria in them. Yoghurts A and F which had zero bacterial counts are the most hygienic yoghurts sold in Keffi.

Keywords: Yoghurt, bacteriological quality, Keffi, Nasarawa State

1. Introduction

Yoghurt is a dairy product produced by lactic fermentation of milk (Hui, 1992). Yoghurt is produced by the controlled fermentation of milk by lactic acid producing bacteria. Two species are commonly used in the commercial production, which are *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. These two species of bacteria have now been established as the yoghurt starter cultures (Speck *et al.*, 1972; Shah, 2002). Any sort of milk may be used to make yoghurt, but modern production is dominated by cow milk. It is the fermentation of the milk sugar (lactose) into lactic acid that gives yoghurt its gel-like texture and characteristic tang (Davis, 1974). The function of the starter cultures is to ferment lactose (milk sugar) to form lactic acid. The increase in lactic acid decreases the pH and this usually cause the milk to clot or form the soft gel that is characteristic of yoghurt.

Milk is often regarded as being nature's most complete food. It earns this reputation by providing many of the nutrients which are essential for growth of the human body (Olasupo *et al.*, 2002). It is an excellent source of protein, vitamins, minerals particularly calcium and also some anti-bacterial substances such as lysozyme, lactoferrin (transferin) and lactoperoxidases. In addition to the major constituent, milk contains a large amount of lactose sugar, phosphate, peptone and nitrogen base enzymes (Uzehet *et al.*, 2006). Yoghurt has practically the same food value as the basic milk product (Ruud and Bert 2004), and it has become a favourite drink in virtually all Nigerian towns and cities. In Keffi consumption of yoghurt has increased over the years due to increased urbanization with its concomitant population growth.

In countries where food borne illness are investigated and documented, the relative importance of pathogens like *Staphylococcus aureus* and *Escherichia coli* in yoghurt borne infection is well known (Obende, 1999). The presence of any of these species of organisms among others, portends a health risk to consumers. Dairy foods are frequently contaminated with staphylococci and cases of staphylococcal contamination of milk and milk products like yoghurt have been recorded (Umoh *et al.*, 1985). More than 50% of the strains of *S. aureus* are able to produce enterotoxin associated with food poisoning.

Pathogenic organisms in dairy products like yoghurt have being a matter of public health concern since early days of dairy industry. Many diseases such as Tuberculosis, Brucellosis, Diphtheria, Scarlet fever and Gastroenteritis are transmitted via milk product as a result of improper preservation methods (Bryan, 1990).

This study aimed at evaluating the bacterial quality of different brands of yoghurt sold in Keffi metropolis with a view to determining the bacterial species associated with the different brands of yoghurts sold in Keffi metropolis, Nasarawa State, Nigeria.

2. Materials and Methods

2.1 Study area

The study area is Keffi metropolis. Keffi is a cosmopolitan town in Nasarawa state in Northern part of Nigeria. It is about 58km from Abuja, the Federal Capital Territory and 128km from Lafia, the state capital of Nasarawa state. Keffi is located on latitude $8^{\circ} 32'$ North and longitude $8^{\circ} 18'$ East (Wikipedia, 2013). The town is situated on an altitude of 850m above sea level (Awka *et al.*, 2007).

2.2 Sample collection

Three samples each of the different brands of yoghurt were collected by purchase from the sellers at ten (10) different locations within Keffi metropolis, the locations were Students Hostel, Main Campus, Angwan Lambu, Unity Supermarket, Total Round-About, Pyanku Campus, Keffi Main Market, Angwan Waje, Angwan Kwara and Angwan Nepa. Samples collected were conveyed immediately to the laboratory in an ice packed cooler maintained at approximately 4°C .

2.3 Isolation and identification of bacteria

Serial dilutions of samples was prepared and then inoculated into agar plates using pour plate method. The inoculum was obtained from 10^3 dilution factor, and the media used for isolation of bacteria were Nutrient Agar (NA), Blood Agar (BA), Salmonella-Shigella Agar (SSA), Mannitol salt Agar (MSA), MacConkey Agar (MA) and Eosin Methylene Blue (EMB) Agar. The plates were incubated at 37°C for 24 hours according to the methods described by Nesteret *al.*, (2007).

The bacterial isolates were identified using the standard microbiological methods based on cultural, morphological and biochemical characteristics (Cheesbrough, 2002).

2.4 Determination of pH values of yoghurt samples: The pH of the various samples of the seven different brands of yoghurt was immediately determined using digital pH meter.

3. Results

Table 1 shows the pH values of the seven different brands of yoghurt sold in Keffi metropolis. The pH values of all the yoghurt brands were acidic with Yoghurt G being the most acidic (pH 2.35) and yoghurt A the least acidic (pH 3.11). Table 2 shows the total bacterial counts and coliform counts of the different brands of yoghurts being sold in the Keffi metropolis. Yoghurts A, C and F had no bacterial and coliform counts. Yoghurts B, D, E and G had bacterial counts of 3.4×10^3 , 3.6×10^3 , 4.4×10^3 and 3.9×10^3 cfu/ml, and coliform counts of 2.1×10^3 , 2.1×10^3 , 2.3×10^3 and 2.5×10^3 cfu/ml, respectively. Table 3 shows the counts of the three different species of bacteria isolated from the different brands of yoghurt sold in Keffi metropolis. *Staphylococcus aureus* was isolated from Yoghurts B, D and E with counts of 2.0×10^3 , 2.8×10^3 and 1.4×10^3 , while *Escherichia coli* was isolated from Yoghurts B, D, E and G with counts of 2.0×10^3 , 1.8×10^3 , 2.1×10^3 and 2.5×10^3 cfu/ml respectively. *Streptococcus pyogenes* was isolated from only Yoghurts D and G with counts of 2.2×10^3 and 2.8×10^3 cfu/ml. The results clear shows that Yoghurts A, C and F had no counts of any of the isolated bacteria.

Table 1: Mean pH values of yoghurt brands sold in Keffi metropolis

Brand	pH
A	3.11 ± 0.21
B	3.18 ± 0.24
C	2.95 ± 0.01
D	3.10 ± 0.16
E	2.56 ± 0.38
F	3.01 ± 0.07
G	2.35 ± 0.59

Table 2: Total bacterial and coliform counts (cfu/ml) of yoghurt brands sold in Keffi metropolis

Brand	Bacterial count (cfu/ml)	Coliform count (cfu/ml)
A	0.0×10^3	0.0×10^3
B	3.4×10^3	2.1×10^3
C	0.0×10^3	0.0×10^3
D	3.6×10^3	2.1×10^3
E	4.4×10^3	2.3×10^3
F	0.0×10^3	0.0×10^3
G	3.9×10^3	2.5×10^3

Table 3: Counts of bacterial species isolated from yoghurt brands sold in Keffi metropolis

Bacterial Isolates	Bacterial counts						
	A	B	C	D	E	F	G
<i>Staphylococcus aureus</i>	0.0 x 10 ³	2.0 x 10 ³	0.0 x 10 ³	2.8x 10 ³	1.4 x 10 ³	0.0 x 10 ³	0.0 x 10 ³
<i>Escherichia coli</i>	0.0 x 10 ³	2.0 x 10 ³	0.0 x 10 ³	1.8 x 10 ³	2.1 x 10 ³	0.0 x 10 ³	2.5 x 10 ³
<i>Streptococcus pyogenes</i>	0.0 x 10 ³	0.0 x 10 ³	0.0 x 10 ³	2.2 x 10 ³	0.0 x 10 ³	0.0 x 10 ³	2.8 x 10 ³

4. Discussion

The results obtained from this investigation revealed that the pH of all the yoghurt brands sold in Keffi metropolis is acidic. This is not unexpected because this is one of the attributes of yoghurts generally. The acidic nature of yoghurt is due to the lactic acid produced by the bacteria involved in its fermentation, which is a vital step in the production of yoghurt. Fermentation which leads to production of lactic acid confer on the yoghurt its characteristic flavor, taste and texture (Madigan et al., 2009).

The results of this investigation showed that three out of the seven brands of yoghurt sold in Keffi are free from bacterial contamination, and these are Yoghurts A, B and F, which demonstrated good quality for human consumption. The other four brands had varying levels of bacterial contamination as indicated by their respective bacterial and coliform counts. The presence of coliforms in these yoghurt brands is of serious public concern because of its health implication on the consumers of these brands of yoghurts. Mbaeyi-Nwaoha and Egbuche (2012) had reported based on the standard stipulated by the National Agency of Food and Drug Administration Control (NAFDAC) that *E. coli* and coliforms generally must not be detectable in any 100 ml of yoghurt sample. NAFDAC is an agency of Government responsible for certifying food and drug products safety for human consumption.

The presence of *Staphylococcus aureus* in brands B, D and E; *Escherichia coli* in brands B, D, E and G; and *Streptococcus pyogenes* in brands D and G presents a health risk to the consumers of these brands of yoghurt. *Staphylococcus aureus* is a normal flora of the human nose, throat, buccal cavity, palms and mucus membrane (Brockset al., 2004). Some strains of this bacterial species are known to cause illness such as food poisoning, osteomyelitis, bronchopneumonia and septicemia, which are often very severe infections (Arora and Arora, 2012). Abdel hameed and Elmalt (2009) reported that the presence of *Staphylococcus aureus* in any food article is an index of its contamination from personnel sharing in production and handling. *E. coli* on the other hand is an indicator of food and water contamination from fecal sources and its mere presence in a food renders the food unfit for human consumption. Singh and Prakash (2008) reported that the presence of *E. coli* in a milk product indicates presence of other enteropathogenic microorganisms which constitute a public health hazard. In addition, several strains of *E. coli* have been reported to be causative agents of severe enteric diseases of humans. *Streptococcus pyogenes* which was isolated from two of the yoghurt brands are known to cause several human diseases such as tonsillitis, scarlet fever, impetigo and acute rheumatic fever (Talaro and Talaro, 2002; Arora and Arora, 2012). The findings of this investigation demonstrated that the three bacterial species (*Staphylococcus aureus*, *E. coli* and *Streptococcus pyogenes*) isolated from the contaminated yoghurt brands are indicators of poor hygiene condition, sanitary practice and handling of food products as earlier reported by Bibek (2001).

Bacterial contamination of four out of the seven yoghurt brands sold in Keffi is a threat to the health of the general public since a large spectrum of the public does patronize the products of these brands on a daily basis. Since these products are usually packaged and sealed, the contamination may only have arisen in the industry during processing and/or packaging. Adeyemi and Umar (1994) reported that ingredients often used as additives to improve taste and flavour may contain high level impurities. Thus, additives added to yoghurt during production may serve as a source of microbial contamination of the yoghurt. There is therefore need for stringent factory/personnel hygiene coupled with good manufacturing practices. Appropriate agencies of Government such as NAFDAC need to step up efforts that would ensure quality assurance in the production of yoghurt in Nigeria. The regulatory role of NAFDAC will help safe guard public health.

5. Conclusion

The results of this study demonstrate that four out of the seven brands of yoghurt sold in Keffi metropolis were contaminated with bacteria and thus does not meet the standards for human consumption. The results are thus of significance to the health of the public, especially consumers of these brands of yoghurt. Relevant agencies like NAFDAC, whose responsibilities are to ensure among others the quality and safety of food products

produced/processed, needs to intensify their regulatory efforts to ensure that yoghurt producing companies produce good quality products free from contaminants.

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