

COMPARISON OF BACTERIA COUNTS IN "KINDIRMO" SOURCED WITHIN MINNA METROPOLIS, NIGER STATE, NIGERIA

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Abstract
A ten (10) week study was conducted to compare bacteria counts in kindirmo sourced within Minna metropolis. Weekly samples were obtained using a randomised sampling technique from Kure ultra-modern market, Chanchaga, Maikunkele and Kasuwan Gwari Markets for a period of 10 weeks. Serial dilution method was used in the laboratory analysis of kindirmo samples for determination of bacteria counts from week three of the experiment to the end, kindirmo from Kasuwan Gwari had a significantly ($P < 0.05$) higher bacteria counts than those from other locations. This was closely followed in the order of significance ($P < 0.05$); Chanchaga, Maikunkele and Kure ultra modern markets respectively. The result of biochemical characterization revealed the presence of *Escherichia coli*, *Bacillus subtilis*, *Micrococcus luteus*, *Streptococcus mutans*, *Klebsiella pneumoniae*, *Bacillus licheniformis*, *Streptococcus pneumoniae*, *Staphylococcus aureus* and *Staphylococcus epidermis*. A highest prevalence rate of 29.89% was obtained for *Bacillus subtilis* with a corresponding lowest prevalence rate of 3.45% obtained for *Staphylococcus epidermis*. The weekly mean bacterial counts obtained in the various locations of study shows values that were above recommended acceptable levels for raw milk. Therefore, it was recommended that sanitary education be provided to Fulani herdsmen within the study area so that the bacteria load of Kindirmo could be reduced to a barest level such that they would not constitute a health hazard to human life.

Keywords: Bacteria count, kindirmo, serial dilution, biochemical characterization and prevalence rate.

Introduction

According to Asaminew *et al.* (2011), local yoghurt ("kindirmo" as called in Hausa and Fulani languages) is obtained from healthy cow udder and often free of pathogens, but may pick many bacteria from the time it leaves the teat of the udder until it is used for processing. FAO (2001) reported that milk is a rich nutritious food and a good medium for microbial growth and that fresh milk easily deteriorates to become unsuitable for processing and human consumption.

Milk contamination may come from various sources; infection of udder, unsanitary milking utensils, sanitary status of cows and environment that surround the milking operation.

Rajagopal and Hotchkiss (2005) reported that milk produced under hygienic condition from healthy animals should not contain more than 5×10^5 cfu/ml bacteria. Although the roles of individual species in fresh milk production varies from region to region and within countries of the same region (Srairi *et al.*, 2010). The production of "kindirmo" in Nigeria

is without regard to quality control since it is mainly left in the hands of nomadic Fulani's. This local yoghurt belongs to the group of perishable commodities and it serves as an excellent medium for bacterial growth and other microbial organisms (McGee, 2004).

Therefore this study aims at determining the bacterial count of local yoghurt (Kindirmo) in various locations within Minna metropolis.

Materials and Methods

Collection of Samples

One hundred and twenty (120) different samples of "kindirmo" were collected from different markets within Minna Metropolis. The samples were collected using random sampling technique. The markets were: Chanchaga, Minna Central, Kasuwan Gwari, Kure ultra modern and Maikunkele markets respectively. Three (3) samples each were randomly collected from these locations every week for a period of ten (10) weeks. The samples were collected in clean sterile bottles and transported to the Department

of Microbiology Laboratory, Federal University of Technology, Minna, Niger State, for analysis.

Laboratory Analysis

Serial dilution was done so as to be able to count the bacterial organisms in the sample according to the procedure described by Manga and Oyeleke (2008). After serial dilution, the tubes were chosen randomly and inoculated into molten media in the petri dish and then mixed. It was allowed to solidify and incubated for total viable count.

The bacteria organisms isolated from the test samples were characterised based on microscopic appearance (gram positive or gram negative organisms), examination of colonies, morphological and biochemical tests (Cowan and Steel, 2010).

Statistical Analysis

Data collected were subjected to one way analysis of variance using computer soft ware package SAS (2010). Significance was set at ($P < 0.05$).

Results

Table 1 shows mean total bacteria count (CFU/ml) $\times 10^5$ obtained at different locations within the study area. Significant differences ($P < 0.05$) were observed in the mean values in various locations of study throughout the ten (10) week period. At week one, mean total bacteria count were significantly ($P < 0.05$) higher in Chanchaga and Kure Ultra-modern markets as compared to Maikunkele and Kasuwan Gwari markets respectively. Whereas, in week two, Maikunkele market had a significantly ($P < 0.05$) higher mean total bacteria count than the other respective locations.

Table 1: Mean total bacteria count (cfu/ml) $\times 10^5$ obtained at different locations within the study area

Time (Weeks)	Locations			
	RC	RM	RK	RG
1.	77.67 \pm 7.75 ^c	14.33 \pm 1.76 ^a	65.67 \pm 2.33 ^c	3.33 \pm 4.91 ^b
2.	32.67 \pm 2.73 ^b	119.00 \pm 7.94 ^d	10.00 \pm 1.15 ^a	12.67 \pm 1.20 ^a
3.	5.67 \pm 1.20 ^a	9.00 \pm 1.16 ^a	5.33 \pm 1.5 ^a	620.67 \pm 27.48 ^b
4.	14.33 \pm 1.45 ^a	7.33 \pm 0.88 ^a	38.67 \pm 4.91 ^a	562.00 \pm 31.94 ^b
5.	85.33 \pm 6.6 ^b	104.67 \pm 4.4 ^b	8.00 \pm 1.73 ^a	303.00 \pm 15.87 ^c
6.	192.00 \pm 17.35 ^b	25.33 \pm 3.71 ^a	14.00 \pm 1.16 ^a	665.00 \pm 27.23 ^c
7.	313.00 \pm 13.61 ^c	22.00 \pm 2.52 ^a	6.67 \pm 1.45 ^a	115.00 \pm 6.43 ^b
8.	92.67 \pm 6.06 ^b	24.67 \pm 5.6 ^a	87.00 \pm 11.15 ^b	457.67 \pm 27.12 ^c
9.	94.33 \pm 5.04 ^b	27.33 \pm 2.96 ^a	24.67 \pm 3.18 ^a	537.67 \pm 25.73 ^c
10.	229.67 \pm 12.44 ^c	85.33 \pm 5.61 ^b	27.67 \pm 2.60 ^a	377.00 \pm 27.40 ^c

Within rows, means \pm SEM with different superscripts differ significantly at $P < 0.05$. SEM: Standard Error of mean.

Key: RC = Chanchaga Market, RG = Kasuwan Gwari Market, RK = Kure Ultra Modern Market, RM = Maikunkele Ma

However, from week three of the experiment to the end, Kasuwan Gwari had a significantly ($P < 0.05$) higher bacteria counts than the other locations. This was closely followed in the order of significance ($P < 0.05$); Chanchaga, Maikunkele and Kure ultra modern markets respectively.

Table 2 shows biochemical characterization of the various isolates obtained within the study area. The isolates obtained are: *Bacillus subtilis*, *Micrococcus luteus*, *Streptococcus mutans*, *Escherichia coli*, *Klebsiella pneumoniae*, *Bacillus licheniformis*, *Streptococcus pneumoniae*, *Staphylococcus aureus* and *Staphylococcus epidermis*.

Table 2: Biochemical characteristics of the various isolates obtained within the study area

Gram stain	Cat	Cl T	Coug	S H	H ₂ S	MR	VP	IN D	L	CHO S	G	F	Bacteria organism present
_R	-	+	-	-	-	+	-	+	+	+	+	-	<i>Escherichia coli</i>
+C	-	-	-	-	-	-	-	-	-	+	-	+	<i>Streptococcus mutans</i>
_R	+	-	-	+	-	-	+	-	-	-	-	+	<i>Bacillus licheniformis</i>
+C	+	-	-	-	-	-	-	-	-	-	-	+	<i>Micrococcus luteus</i>
_R	+	+	-	-	+	-	+	-	+	+	+	-	<i>Klebsiella pneumoniae</i>
+R	+	+	-	+	-	-	+	-	-	-	-	+	<i>Bacillus subtilis</i>
+C	+	-	-	-	-	-	-	-	-	-	-	+	<i>Staphylococcus epidermis</i>
+C	+	-	+	-	-	-	-	-	+	+	+	+	<i>Staphylococcus aureus</i>
+C	-	-	-	-	-	-	-	-	-	+	+	+	<i>Streptococcus pneumonia</i>

Table 3 shows the prevalence of the various isolates obtained from the study area highest prevalence of 29.8% was obtained for *Bacillus subtilis* while the lowest (3.45%) was obtained for *Staphylococcus epidermis*.

Table 3: The various bacteria isolates identified and their prevalence within the study area

Bacteria	Frequency	Prevalence (%)
<i>Bocillus subtilis</i>	78	29.89
<i>Micrococcus luteus</i>	39	14.94
<i>Streptococcus mutans</i>	37	14.18
<i>Escherichia coli</i>	26	9.96
<i>Klebsiella Pneumoniae</i>	25	9.58
<i>Bacillus licheniformis</i>	20	7.66
<i>Streptococcus pneumonia</i>	15	5.75
<i>Staphylococcus aureus</i>	12	4.60
<i>Staphylococcus epidermis</i>	9	3.45
Total	261	100

Discussion

The results obtained from microbial analysis of "Kindirmo" within the study area showed that the products were contaminated with microorganisms of public health concern. This result has been reinforced by the report of (Rajagopal and Hotchkiss, 2005) that milk produced under hygienic condition from healthy animals should not contain more than 5×10^5 cfu/m. The high total bacteria counts may be as a result of the low level of hygiene maintained during the processing and sale of the products.

Higher bacterial counts encountered in Kasuwan Gwari market might be largely due to the fact that it is centrally located in the State Capital which allows for convergence of both the sellers and the buyers of the products. The sources of contamination includes: unsanitary milking utensils, personal and sanitary status of cows and environment that surround milking operations as highlighted by forecited authors (Aggad et al., 2009). Adam and Moss (1995) reported that the exposure of "Kindirmo" at various sale points in bowls can as well serve as source of contamination.

Results from bacteria analysis showed that *Bacillus subtilis* was the dominant contaminant. This could be attributed to the ubiquitous nature of the organism which agrees with the report of Kapronezai *et al.* (2005) that milk supports the growth of a variety of bacteria including pathogenic ones and that the presence of *Bacillus subtilis* can render the milk alkaline. Similarly, Asaminew *et al.* (2011) posited that "kindirmo" from healthy cows contains little bacteria but that it picks up many bacteria from the time it leaves the teat of the cow udder to the time of future processing. According to Murphy and Boor (2000), *Escherichia coli* presence in milk shows that the cow suffers from mastitis. Their presence could also be due to possible contamination derived from teats soiled with manure and other contaminants in the farm. The presence of pathogenic bacteria in kindirmo should be seriously taken into account because of their public health concern which is often associated with bloody diarrhea, severe anemia and kidney failure that can sometimes lead to death (Adam and Moss, 1993).

The presence of *Streptococci*, *Staphylococci*, Coliforms and other gram-negative bacteria isolated from the test samples supported the views of (Murphy and Boor, 2000) that microorganisms associated with bedding materials, manure, mud and feeds contaminate the surface of teats and udders.

In conclusion, the mean bacterial counts obtained in the various locations of study shows mean values that were above recommended acceptable levels for raw milk. The study showed that the presence of bacteria like *Bacillus subtilis* (29.89%), *Streptococcus mutans* (14.18%), *Escherichia coli* (9.9%) and *Streptococcus pneumonia* (7.66%) in Kindirmo indicates that Kindirmo which is widely consumed in the area could be source of food borne diseases with consequent effect on human health.

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