Bacterial Assessment and Quality Analysis of Raw Milk Sold in Gwagwalada Area Council of the Federal Capital Territory (FCT) Abuja, Nigeria

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ABSTRACT:
Analysis of raw milk from four different local farmers within Gwagwalada Area Council (FCT) Abuja, were assessed to determine the bacterial load of the milk. The experiment was assigned to four treatment based on farm location, namely: Adams Farm (T_1) (Control); Dagiri herd (T_2); Kutunku herd (T_3); and Dukpa herd (T_4). The treatments had three replicates (R_1-R_3) in a randomized block design (CDR). The result revealed that raw milk sampled contained various bacteria species which include species of *Bacillus subtillis*, *Escherichia coli, Staphylococcus aureus, Salmonella spp, Lactobacillus spp,Streptococcus spp*. The total viable bacteria counts ranged from 1.0 x10^6 -5.6x10^7 cfu/ml, while *Bacillus subtillis* has the highest frequency of occurrence (26.84%) followed by *Escherichia coli* (24.39%), *Staphylococcus aureus* (24.39%), *Salmonella spp*. (17.06%), *Lactobacillus spp*. (4.88%) and *Streptococcus spp* (2.44%). Bacteria count in treatment T_3 had the lowest count followed by T_4 and T_2 and highest for T_1. Treatment T_3 is therefore better in terms of bacteria load than others (T_1, T_2 and T_4).
Key Words: Raw milk, Gwagwalada Area Council, Microbial load.

1.0 INTORDUCTION

Milk is a translucent white liquid, produced by the mammary glands of mammals. It provides the primary source of nutrition for young mammal before they are able to digest other types of food.

According to Michael (1981), milk composes approximately 87.2 % water, 3.7 % fats, 3.5% protein, 4.9% lactose and 0.7% Ash and 6.8 % pH. The optimum range for most bacteria to flourish. Milk is the most nearly perfect food for infants as well as adult and an excellent growth medium for pathogenic microorganism (Fowole and Oso, 1988 and Olatunji, 2009), hence recognized safety measures are encouraged from the producer to the consumer.

This trial is to assess milk from local handlers within Gwagwalada and environs if they conform to health standard.

1.1 MATERIALS AND METHODS

A random field survey of Fulani herds in four different locations within Gwagwalada Area Council of the Federal Capital Territory was conducted. A representative animal size (3) was selected from each location for the purpose of this study.

The location, which was about 20km apart, were assigned treatments T_1, T_2, T_3 and T_4 for Adams Farm, Dagire herd, Kutunku herd and Dukpa herd respectively. The treatments were distributed in a completely randomized block design (CRD) (Table 1).

The management practices and feeding regime were purely the traditional Fulani husbandry types where animal graze from place to place in search of green pasture and towards the evening small quantity of maize bran is provided to supplement energy intake from forage. Also milk handling system conformed to the traditional system in that the calves is tied close to the dam to foster milk let down before milking, which is done by any member of the Family especially women and young once after the udder teat has being clean, using water from nearby stream.

Animals were milked early in the morning time (8.00hrs) and about 3 liters of milk per sample for the four different locations on the same day were made (making a total of twelve liters) and kept in a sterile container in an ice- chest and transported by vehicle to The Federal University of Technology Minna, Microbiology laboratory immediately for cultural evaluation. All the cows used were at various stages of lactation and post partum period.

Microbial Analysis.

The raw milk sampled from each location was assessed for bacteriological quality using the standard plate count. Total bacteria count, and coli form counts were carried out by inoculation serially diluted samples in Nutrient agar,

Milk agar, Tributyrin agar, De Man Rogosa Sharpe agar and MacConkey agar respectively and incubating them at 37^0 C for 48hours. The counts were expressed as colony forming units per milliliter of samples (cfu/ml).

Characterization and Identification of isolates.

Characterization of bacteria isolates was carried out using colonial morphology, microscopic techniques and biochemical tests including gram staining production of coagulase, oxidase, catalase and urease, methyl red-voqes proskauer test, starch and gelatin hydrolysis, spore stain, nitrate reduction and utilization of carbohydrates such as glucose, sucrose, mannitol, fructose, inositol, maltose and arabinose. The organisms were identified by comparing their characteristics with those of known taxa using the schemes of cowa (1974) and Cruickshank et al. (1975).

1.2 RESULTS

Total vialble count per milliter range from $1.0 \times 10^6 - 5.6 \times 10^7$ to $2.0 \times 10^6 - 1.5 \times 10^7$, Coliform count (cfu/ml) ranged from ND -3.8×10^4 to ND -1.4×10^4, Staphylococci count (cfu/ml) ranged from ND -7.0×10^3 to ND- 8.0×10^3 while Salmonella/Shigella count (cfu/ml) range from ND -3.6×10^4 to ND – 2.5×10^4 (Table 2).

The common microbial organisms encountered were, *Staphylococcus aureus, Salmonella spp.* Others were *Lactobacillus spp* and *Streptococcus spp* (Table 3).

The number of isolates in terms of microorganism varied significantly ($P<0.05$) with *Bacillus subtillis* having the highest number of isolate (11) followed by *Escherichia coli* and *Staphylococcus aureus* (10) respectively. While Salmonella spp, Lactobacillus spp and Streptococcus spp scored 7,2 and q respectively

1.3 DISCUSSIONS

The result revealed that all the raw milk sampled were contaminated with several species of microorganism including Bacillus, Staphylococcus, Salmonella, and Lactobacillus others were streptococcus and the Coliforms mainly *Escherichia coli.*

This observation confirms the finding of Frazeir and Westhoof (1998) that these micro organisms grow well in milk and hence endanger its keeping quality.

Variation in frequency of occurrence (Table 3) show levels of contamination in the raw milk analyzed. The microbes might have got into the milk through various sources including, the skin of animal, infected dirty udder, the milkers' hand, utensils and feaces. Olatunji (2009), stressed on hygienic handling of milk and milk products in other to prevent danger associated with microbial contamination.

The total viable count of all samples were very high (5.6 x 107 cfu/ml) with the highest recorded in Adams Farm. This exceed the standard limit (1×10^5 cru/ml) recommended by Bergdoll (1988). The author stressed that value above these limit are indication of serious faults in production hygiene. All the total viable count assessed had value higher than this limit (1 x 105 cfu/ml) (Table 2).

The low level of *Streptococcus spp* and *Lactobacillus spp* found in these samples denoted low level of free fermentable sugar in the raw milk sampled. These are the principal lactic acid producing bacteria in milk and are responsible for fermentation of carbohydrate to lactic acid. Thus these organisms are responsible for normal souring of milk (O' Connor and Tripathi, 1992).

All the microorganisms found in this work are either pathogenic or beneficial. The most predominant pathogenic bacteria found in the raw milk samples were Staphylococcus spp and *Escherichia coli* (24.39 %) respectively. (Table 2).

The *Staphylococcus aureus* is associated with mastitis; a predominant deadly farm animal disease confronting dairy industries. This disease (mastitis) is an inflammatory and generally highly communicable disease of the bovine udder (Bergdoll, 1988 and Olatunji 2009). Dalgeish (1995) stressed that in every four cows, there is about one suffering from mastitis.

Some strains of Staphylococcus aureus according to Adesanya et al. (1995) produce a potent exotoxin. Consumption of a product containing toxin producing strains may result in severe gastroenteritis. Most enteroxigenic strains of Staphylococcus are members of coagulase positive group (Adams and Moss, 1995). Thus only coagulase positive strains are considered potentially entero-toxigenic.

Milk containing appreciable number of these organisms must be regarded as unfit for human consumption (Bergdoll, 1988). As stipulated by the Standard Organization of Nigeria (SON) of 1984, raw milk containing up to a minimum of 500,000 colonies of microbes are unfit for human consumption.

Again the presence of Coliforms like *Escherichia coli* is an indication of poor level of hygiene of the milkers', utensils water and the milking environment. This agreed with Najib (2003) who observed that the source of *E. coli* found in raw milk include soil, manure, unsanitary equipment and human faeces.

A larger percentage of milk producer (Fulani) are illiterates who are not mindful of the possibility of contamination of milk from the kind of water, utensils and even from dung as well as from their own hand and/or transportation because many of the Fulani milk sellers transport this product to surrounding town daily by trekking long distances along dusty foot paths in the bush.

1.4 CONCLUSION AND RECOMMENDATION

The study revealed that milk put on sale in Gwagwalada Area Council of F. C. T. Abuja Nigeria are highly contaminated, especially more of the pathogenic once (*Staphylococcus aureus* and *Escherichia coli*: 24.39 % respectively) and less of the beneficial once (Streptococcus spp and *Lactobacillus spp* 2.44 % and 4.88 % respectively).

The presence of these organisms signifies poor hygiene level of the product (milk) and this implies that locally processes cow milk in Gwagwalada Area Council of FCT Abuja will be a source of disease infection to human's consumer of these products.

It is therefore recommended that regular enlightenment campaign by Gwagwalada Area Council Administrators should be embark on, on the need to handle milk and milk products with absolute hygienic measure and/or the establishment of bulk milk tanks and milk processing factories at strategic locations such that milk from Fulani could be purchase in bulk and process before it reaches the public.

1.5 ACKNOWLEDGEMENT

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Table 1: Bacteria count of raw milk obtained from Gwagwalada Area Council (cfu/ml)

Treatments	Total Viable Count	Coliform	Staphylococci	Salmonella/Shigella
T1	1.0×10^6 -5.6×10^7	ND – 3.8×10^4	ND – 7.0×10^3	ND – 3.6×10^4
T2	2.0×10^6 -4.7×10^7	ND – 4.0×10^4	ND – 8.0×10^3	ND – 3.2×10^5
T3	1.0×10^6 -1.2×10^7	ND – 3.1×10^4	ND – 9.0×10^3	ND – 2.3×10^4
T4	2.0×10^6 -1.5×10^7	ND – 1.4×10^4	ND – 8.0×10^3	ND – 2.5×10^4

ND= NON DETECTED

Table 2: Frequency of occurrence (%) of Bacteria Isolated in Raw milk Sample

Bacteria	Frequency of occurrence					
	T1	T2	T3	T4	No. of Isolates	% occurrence
Bacillus subtilis	3(7.32)	4(9.76)	2(4.88)	2(4.88)	11a	26.84
Escherichia coli	2(4.87)	2(4.88)	4(9.76)	2(4.88)	10ab	24.39
Staphylococcus aureus	2(4.88)	2(4.88)	5(12.19)	1(2.44)	10ab	24.39
Salmonella spp	2(4.88)	3(7.31)	1(2.44)	1(2.44)	7c	17.06
Lactobacillus spp	1(2.44)	1(2.44)	0(0)	0(0)	2d	4.88
Streptococcus spp	0(0)	0(0)	1(2.44)	0(0)	1d	2.44

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