

## BIOCHEMICAL CHARACTERIZATION OF MILK AND MILK PRODUCT SOLD IN JALINGO METROPOLIS, TARABA STATE, NIGERIA

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### ABSTRACT

A study was conducted to evaluate the biochemical characterization of milk and its product sold in Jalingo metropolis, Taraba State, Nigeria. A 100 samples of milk and milk product yoghurt were collected comprising 50 milk and 50 yoghurt samples each. The samples were analysed for microbial contamination. The culture media (MacConkey agar, SSA and EMA) were prepared according to manufacturers' instruction. The test samples were inoculated and preserved for 24 hours. Obtained isolate were subjected to biochemical tests. The results revealed that 20 (40.0%) of the 50 milk samples collected was contaminated with one or more microorganisms while non 0 (0%) of the milk product (yoghurt) was contaminated. Milk samples collected from Mayo-Dasa showed highest contamination of 70.0% among the collected samples. The results further showed that 45.0% of the organisms isolated were *Staphylococcus aureus*, 35.0% were *Escherichia coli*, 15.0% were *Salmonella* species and 5.0% were *Proteus* species, revealing that majority of milk contaminant in the study area were from *S. aureus*. However, from the results obtained it is recommended that good management practices and hygiene should be strictly adhered to in milk and milk product (yoghurt) to prevent contamination.

**Keywords:** Milk, Yoghurt, *S. aureus*, *E. coli* and *Salmonella*

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### INTRODUCTION

Nigeria like most developing countries has her dairy industry facing major problem of low demand for the fresh milk, partly due to public health concern over safety and quality of traditional dairy products such as fresh milk (Jorgensen *et al.*, 2005). Presently, it is difficult to ascertain the extent of risk posed by consumption of raw milk and milk products in the country, which is not documented. However, if efforts are made to practice good manufacturing practice, it would not only protect public health but also stimulate growth of dairy industry in Nigeria (Jorgensen *et al.*, 2005). In Nigeria, milk and its products are popular due to the nutritional, probiotic and organoleptic characteristics and can be contaminated by fungi which is able to modify organoleptic characteristics and be a risk of human health. Yoghurt can be easily subjected to fungi contamination. Aflatoxins are carcinogenic and toxic, which is a secondary metabolic product of some *Aspergillus spp.* (Issazadeh *et al.*, 2012). Fermented milk (yoghurt), like the fresh milk from which they are produced, is liable to contamination (Sofu and Ekinci, 2007). The pH values of yoghurt immediately after production range between 4.2 and 4.5 (Holec, 1990). *Escherichia coli* frequently contaminate food and is considered a good indicator of faecal pollution (Singh and Prakash, 2008). Its presence in milk products indicates presence of other pathogenic microorganisms which constitute public health hazard (Singh and Prakash, 2008). Moreover, these organisms are implicated in food poisoning outbreaks (Yabaya and Idris, 2012). *Staphylococcus aureus* in food article is an index of its contamination from personnel sharing in production and handling. Moreover, *Enterotoxigenic Staphylococcus aureus* strains may find opportunity to grow and multiply in the food leading to food poisoning among consumers (Abdel Hameed and El-Malt, 2009).

Yeasts are a major cause of spoilage of yoghurt and fermented milk in which the low pH provides a selective environment for their growth (Fleet, 1990). Yeasts and molds are the major contaminants in yoghurt (Nwagu and Amadi, 2010). Micotoxigenic fungi and pathogenic bacteria are able to grow at refrigeration temperature to numbers, which can result in an infection (Potter and Hotchkiss, 1995). Presence of yeasts and molds in milk and dairy products are undesirable even when found in few numbers as they result in objectionable changes that render the products of inferior quality (Abdel Hameed, 2011). Therefore, there is need to determine the microbial quality of milk and yoghurt sold in Jalingo metropolis which might pose danger to public health.

### MATERIALS AND METHODS

#### Study Area

The study was carried out in Jalingo metropolis in Taraba State, Nigeria. Jalingo Local Government Area is situated between the tropics and is located between Longitude 8° 89'N and Latitude 11° 36'E within a land mass of 54,472 sq km (TSD, 2023). Its climatic condition tallies with the two (dry and wet) seasons commonly experienced in the tropical region. The wet season covers up to seven months starting from April to October with

average annual rainfall range of 1,058mm – 1,300mm while the dry season covers about five months starting from November to March. Farming and livestock rearing are the major occupations of the people within the study area (TSD, 2023).

#### Sample Size and Samples Collection

Sampling units were randomly selected based on the availability and easy access of Milk (Nono) and Milk products (Yoghurt) within the Jalingo main market and its environs. The study area is within the Jalingo metropolis. Target sampling points include; Jalingo main market, both milk and milk products were purchased at selling points within Jalingo main market. A total of 100 different sample of milk and milk product (yoghurt) were collected comprising of 50 milk and 50 yoghurt samples each. The samples were placed in sterile container in ice packed cooler and taken to the government house laboratory clinic for analysis.

#### Sample Analysis

MacConkey agar which is recommended for isolation and differentiation of lactose fermenting organism from non-lactose fermenter and also use as selective medium was prepared by dissolving 48.5g of the medium in one liter of distilled water. Litter heat with frequent agitation was applied for one minute so as to completely dissolve the medium and was sterilized by autoclaving at 121°C for minute. Gram staining from freshly prepared culture a colony was pick and emulsified in sterile distilled water a thin preparation made on a slide and heat fixed smear was covered with crystal violet stain for two seconds, the stain was rapidly washed off with clean water. The sharp the water was tipped off and the smear was covered with lugoc iodine for two seconds. The iodine was washed off with clean water, the smear was covered with safranin stain for two seconds. The stain was washed off with clean water and air-dried morphology and gram reaction of the isolate were determined by the use of microscope using immersion object at 100x magnification to characterize the isolated organisms.

#### Statistical analysis

The data obtained from the study was analysed using simple descriptive statistics like percentage using SPSS 20 (2011).

### RESULTS

The results on the biochemical characterization and microbiological quality of milk and yoghurt in Jalingo showed that ten milk samples collected from Waru, shows 2(20.0%) assorted growth as presented in Table 1. Out of ten milk samples collected from Sabon – Gari, 3 (30.0%) showed assorted growth. The result also revealed that, 7 (70.0%) of the 10 milk samples collected from Mayo – Dasa showed assorted growth. Of the ten milk samples collected in ATC and CBN, 4(40.0%) each showed assorted growths.

**Table 1: Biochemical characterization and microbiological quality of milk and yoghurt according to the sources of collections**

Sources	No of milk and yoghurt samples collected	No of samples positive	Percentage (%)
<b>Milk</b>			
Waru	10	2	20.0
Sabon-gari	10	3	30.0
Mayo Dassa	10	7	70.0
ATC	10	4	40.0
CBN	10	4	40.0
<b>Sub-total</b>	<b>50</b>	<b>20</b>	<b>40.0</b>
<b>Yoghurt</b>			
Hollandia	10	0	0.0
Admiral	10	0	0.0
Nutrio-yo	10	0	0.0
Peak yohurt	10	0	0.0
Tito yoghurt	10	0	0.0
Sub-total	50	0	0.0
<b>Grand Total</b>	<b>100</b>	<b>20</b>	<b>20.0</b>

This shows that milk obtained from Mayo – Dassa were more contaminated with different microorganisms after 24 hours of incubation. Out of the total number of fifty milk samples collected and analyzed, 20 were contaminated with one or more microorganisms representing 40.0% respectively. The result also showed that fifty yoghurt samples from five different brands includes; Hollandia, Admiral, Nutri milk, Peak milk and Tito yoghurt were collected and analysed and no growth of any form of microorganisms was recorded respectively. According to the

distribution of the microorganisms isolated (Table 2) it was shown that 9 (45.0%) of the organisms isolated were *Staphylococcus aureus*, 7(35.0%) were *Escherichia coli*, 3 (15.0%) were *Salmonella* species and 1(5.0%) were *Proteus* species. This indicated that milk in the study area were more contaminated with *Staphylococcus aureus* when compared to the other three microorganisms isolated in this study.

**Table 2: Biochemical characterization and microbiological quality of milk and yoghurt based on the distribution of the microorganisms isolated**

Microorganisms isolated	Number	Percentage (%)
<i>Staphylococcus aureus</i>	9	45.0
<i>Escherichia coli</i>	7	35.0
<i>Salmonella</i> spp	3	15.0
<i>Proteus</i> Spp	1	5.0
<b>Total</b>	<b>20</b>	<b>100.0</b>

## DISCUSSION

The microbial load obtained in this study is an indication of the sanitary quality, safety and utility of the milk samples. It also reflects the conditions under which the product was manufactured such as the effectiveness of processing and the sanitary conditions of equipment and utensils at the point of processing. *Escherichia coli* were isolated in the milk, and it is a faecal organism. This agrees with another work carried out by Hamed *et al.* (2013). Cow milk is known to serve as a very good medium that supports the growth and multiplication of bacterial pathogens with undesirable consequences to human health. The presence of the coliform in milk samples indicates gross contamination (El – Bakri *et al.*, 2009). The presences of these bacteria in milk can result to detrimental effects on human health. This is in concordance with Ligathurai and Vellathurai (2010) who stated that the presence of bacteria in milk may cause milk – borne gastroenteritis. The most occurrences of *Staphylococcus aureus* in this study is not in line with the work of Bello *et al.* (2018) who reported *E. coli* as the most prevalent bacteria in fermented cow milk in Maiduguri, North East Nigeria. Three of the organisms isolated have been reported to cause food poisoning; *Salmonella*, *Staphylococcus aureus* and *Escherichia coli*. The presences of these organisms has been explained that processed milk product is a well – known food medium that support the growth of several microorganisms with resultant spoilage of product or infection in consumers and that microorganisms found in milk and its products mostly come from the water used in preparing the products or handling storage and processing property activities (Oliver *et al.*, 2005). Power supply is generally poor in Nigeria and Jalingo is not exempted. The growth of the microorganisms could therefore have been encouraged by improper storage of the samples as refrigeration is needed to maintain the quality of the samples and inhibit the growth of spoilage organisms (Shittu *et al.*, 2016). The milk samples contained more microorganisms than the yoghurt samples. This is expected due to the procedure and environment in which milk is being produced locally. The practice of adding steam water and milky white supernatants of soaked baobab seeds, to colour milk as reported by Shehu and Adesiyun, (1990). It has been reported that contamination might result from poor hygiene in processing, handling, preservation and storage by the Fulani women that prepare and handle milk (Olasupo *et al.*, 1996). These factors could also contribute to the high number of pathogenic microorganisms that were found in the milk samples in this study.

## CONCLUSION

It is therefore concluded that milk from the study area were contaminated with different type of microorganisms which may render it unacceptable for human consumption. The free contamination of yoghurt brands recorded in this study may result from the laboratory methods used and or the media. Further study needs to be carried out on the products (brands) using different method and media. Therefore, there is the need for instituting effective control measures to protect public health, monitor the sanitation facilities, treatment plants, and their impacts on the underground water for the animals within the study area.

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