

Quality Assessment of Cow Milk Sold in Some Major Towns of Yobe State

Lawan Bello and Musa Ibrahim Katuzu

Department of Science Laboratory Technology, School of Science and Technology, Federal Polytechnic Damaturu Yobe State.

Abstract

Conveying milk from villages and settlements to towns is a routine profitable business by the local inhabitants in Yobe State, and because majority of these people are not well informed or educated on proper way of milk handling, couple with the fact that milk is a rich medium for bacterial growth, it's therefore becoming necessary to protect consumers from food-borne diseases through contaminated milk. This necessitates to undertake the assessment of cow milk sold in some major towns in Yobe State, which was carried out between November 2022 and May 2023, to ascertain the level of milk contamination or hygiene in ten (10) selected towns comprising of Damaturu, Tarmuwa, Bursary, Geidam, Gashua, Jakusko, Buni-Yadi, Potiskum, Fika, and Fune, Milk samples were randomly collected and kept in icebox before transporting it to the laboratory under chilled conditions within 2 hours for analysis using Methylene blue dye reduction test method. The results revealed that more than 50% of the milk that were analyzed fall within the graded range of 'good and excellent', with milk samples from Bursary, Potiskum and Buni-Yadi appearing to be the safest milk having graded excellent and good milk respectively. This is because none of the milk samples from these towns were graded 'poor'. Other milk samples from Fune, Gashua, Geidam and Bursary have over 60% of their milk samples graded good and excellent, while the remaining milk samples were graded as fair milk. Interestingly none of the milk samples collected from all the 10 towns and locations were graded 'poor'. The research concludes base on the findings that, all the milk samples analyzed would not pose any health threat to the consumers, as the bacterial content are not significantly high to caused diseases. It is therefore recommended that periodic milk test should be done to improving the quality and check the viability of milk sold to consumers.

Keywords: Milk, Quality, Yobe, Methylene Blue, Consumers.

Introduction

Food-borne diseases can be minimized in towns and villages, within the local dairy industries to the final point of sale through adequate routine quality assessment of milk by veterinarians and any near-by institutions to ensuring public health of the communities is well protected. One of the objectives is to have healthy people with improved positive productivity and less cases of disease and mortality.

Milk is the nutrient rich liquid secreted by the mammary gland of mammals. It provides the primary sources of nutrition for newborns before they are able to digest other type of food (Sewgil *et al.*, 2018). Milk is the only food created by nature specifically for animal and human nutrition. (Van Winckel *et al.*, 2011). The term "milk" is exclusively referring to the

milk which comes from cows that is fresh and complete which has not been dehydrated or concentrated and does not contain additives such as sugar, vitamins, etc. (Van Winckel *et al.*, 2011).

Milking procedures like cleaning milking area, hand washing and drying, udder washing and drying before milking is highly recommended. Presence of mastitis brings about slight change in the chemical composition of milk and decreases its yield (Jamali *et al.*, 2018; Dalen *et al.*, 2019). However, the total bacterial count (TBC) and somatic cell count (SCC) are usually done in accredited laboratories and are expensive for milk producers and, moreover, the latter have to wait quite long for the results before they can improve the microbiological quality of their milk. The MBRT, has been reported to be simple and fast method that is effective and successful relative to the other test (Boor *et al.*, 2017).

Milk is a good medium for the growth of microorganisms. These active growing microorganisms reduce the oxidation reduction process potential of milk medium due to the exhausted oxygen by the microorganisms. Normally the milk is contaminated with organisms such as *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas* etc (Sewgil *et al.*, 2018). Contaminated milk is one of the important sources for transmission of diseases from animals to humans. The main reason for this contamination is the improper handling of milk. Normally milk is contaminated during the milking process by the microorganisms present in the exterior surface of the animals. Unsterilized dairy utensils such as milking machines, milk cans are also a good source of contamination by microorganisms. (Murphy and Boor, 2000). Since milk is nutritionally rich to support the growth of bacteria, improper milk handling is likely to contaminate the milk. Pathogenic bacteria in milk could pose a serious danger to public health, it constitutes about 90% of all dairy- related diseases among which include infections by *Salmonella* spp., *Listeria monocytogenes*, *Staphylococcus aureus*, *Escherichia coli* O157:H7 and *Campylobacter*, are the main microbiological hazards associated with raw milk consumption (Claeys *et al.*, 2013).

Literature Review

Yobe state is one of the 36 states in Nigeria that is severely affected with desertification leading to shortage of animal feeds which invariably affecting the health of herbivores with impact on quality of meat and milk (Hassan 2018). It covers land mass of 47,153 km² is Latitude 10.578-13.3770 N and Longitude 9.654-12.6890 E (YSG Report, 2010). The State had a population of 2,321,339 million people at the last census (NPC, 2006). And shares boundaries from the west with Jigawa and Bauchi States, Gombe and Borno States to the south-east and an international boundary of 323 km with the Niger Republic to the north (YSG Report, 2010).

Yobe State has 17 Local Government Areas (LGAs) distributed within three geographic regions (South, East and the North). The LGAs are Bade, Bursari, Damaturu, Fika, Fune,

Geidam, Gulani, Jakusko, Karasuwa, Nangere, Nguru, Potiskum, Tarmuwa, Yunusari, Gujba, Machina and Yusufari (source: Google, 2016).

Most rural milk production systems are not implementing the recommended practice except for hand washing before milking which is done with normal water and might contribute for high microbial contamination and quality deterioration (Yeserah *et al.*, 2020). Mastitis is a major reason for rising bacterial counts, as reported in numerous studies (Skeie, *et al.*, 2019). Microbiological status of raw milk may also be affected by several factors including a health status of the animal, farm management practices, environmental hygiene and poor temperature control (Food Standards 2009).

The frequent exposure of milk in highly populated area as is being done in the market could expose the milk to numerous contaminants. A study by Hassan *et al.*, (2020), on Camel milk in Yobe state, indicated that lack of environmental and personal hygiene could lead to accumulation of heavy metals in Camel Milk. The observed toxicity potentials of all the heavy metals revealed values that are less than 1.00 with the exception of Gaidam and Waro samples in which their corresponding chromium toxicity potentials are 1.00 in each case. Toxicity potentials that are greater than 1.00 are regarded as being out of specifications and hence unacceptable.

The risk of infection by milk borne disease is the reason for public health regulation, which discourages the informal milk markets that sell unpasteurized milk (Kang'ethe *et al.*, 2000). This is because of the risk it poses to human health. However, these regulations are never implemented in many developing countries including Nigeria. Over 70% of milk sales in Nigeria is in the hands of illiterate pastoral farmers who do not believe that milk could be a potential source of infection to humans and are not ready to subject their milk to any form of treatment. A study by Bertu, *et al.*, (2010), revealed that 15% of the 100 fresh milk samples from Fulani herds were positive for Brucella antibodies while 12% of the 100-milk collected from mobile milk sellers and those in designated sheds tested positive for Brucella antibodies. This gives an overall prevalence of 13.5%. Contaminated raw milk may act as a source of many harmful bacteria leading to various diseases, such as undulant fever, Salmonellosis, Dysentery and Tuberculosis. Raw milk with bacteria counts below a specified limit is known as "certified" milk and is considered healthy (Sewgil *et al.*, 2018)

Fresh milk is a pasteurized type of milk which is processed through exposure to high temperature for a short period of at least 73 °C for 15 s. Fresh milk shelf life cannot exceed five days (Csapó *et al.*, 2009). Pasteurization in milk destroys most pathogenic microorganisms. Fast method of Pasteurization is recommended to heat the milk to a high temperature for a short time, 73 °C for 15 s. The maximum criteria for TBC in cow's milk should not exceed $\leq 100\ 000$ cfu/ml (EC 853:2004). Bacterial contamination in milk was defined as total bacterial count (TBC) $> 1 \times 10^5$ (Berhe *et al.*, 2020). But when milk was pasteurized, it was reduced to 1.2×10^4 cfu/ml. Grade A milk has a count less than 1×10^5 cfu/ml (Rodrigues *et al.*, 2017).

To check the microbiological quality of raw milk, dairy producers commonly use the counts of total bacteria (TBC), somatic cell counts (SCC), and the methylene blue reduction test (MBRT), (Rodrigues *et al.*, 2017). However, when the data is large it is preferable to use methylene blue reduction test (MBRT). Methylene blue reduction test is based on the fact that the color imparted to milk by the addition of a dye, methylene blue will disappear more or less quickly as a result of the removal of the oxygen from milk and the formation of reducing substances during bacterial metabolism (Sudhasaravanan and Binukumari 2015).

Sample Collection

The initial proposed period for this research was from November, 2022 to October, 2023. However, the work was concluded in May, 2023. A total of 100 samples were collected from 10 major towns in Yobe State, comprising of 10 milk samples from each town. All the milk samples were kept in icebox and transported to the laboratory under chilled conditions within 2 hours for analysis using Methylene blue dye reduction test method as described by (Sewgil *et al.*, 2018).

Methods

Methylene Blue Reduction Test

All glassware and rubber stoppers were sterilized using autoclave. 1ml of the Methylene Blue Thiocyanate dye solution was added into a test tube followed by 10ml of milk sample. It was mixed by shaking the Methylene Blue Thiocyanate dye solution with milk in test tube. The test tube was placed in a water bath immediately for incubation so that temperature was maintained at 37°C. The initial time was noted down and the test tube was again examined after half an hour then subsequent readings was taken at hourly interval and results was interpreted as follows:

Classification of cow milk sample as described by (Sewgil *et al.*, 2018)

Class 1. Excellent, not decolorized in 8 hours.

Class 2. Good, decolorized in less than 8 hours but not less than 6 hours.

Class 3. Fair, decolorized in less than 6 hours but not less than 2 hours.

Class 4. Poor, decolorized in less than 2 hours.

Fresh milk will be pasteurized to serve as control milk sample.

Result

Table 1. Shows: The Results of the assessment of different milk qualities sold at various locations of Yobe State.

S/N	LOCATIONS	QUANTITY OF MILK	EXCELLENT	GOOD	FAIR	POOR
1	DAMATURU	10	3(30%)	5(50%)	2(20%)	0
2	TARMUWA	10	1(10%)	7(70%)	2(20%)	0

3	BURSARY	10	0	10(100%)	0	0
4	GEIDAM	10	0	6(60%)	4(40%)	0
5	GASHUA(Bade)	10	0	9(90%)	1(10%)	0
6	JAKUSKO	10	1(10%)	5(50%)	4(40%)	0
7	POTISKUM	10	0	10(100%)	0	0
8	NGURU	10	0	5(50%)	5(50%)	0
9	FUNE	10	0	8(80%)	2(20%)	0
10	BUNI-YADI	10	1(10%)	9(90%)	0	0
	(Gujba)					

Discussion

Table 1 shows results for the assessment of milk sold in ten different towns of Yobe state, using the methylene blue reduction test method. This work considered fair milk to be doubtful since is a midway between good and poor milk, while the remark- good and excellent milk is considered fit for consumption (Frazier and Westhof 2012: Sewgil *et al.*, 2018).

The results that were obtained from all the 10 towns revealed that more than 50% of the milk analysed were between the range good and excellent, thus fit for consumption. This group of milk samples contained less bacteria possibly due to recent pasteurization before its shelf-life of five days in the market (Csapó *et al.*, 2009). However, milk samples from Bursary, Potiskum and Buni-Yadi appeared to be the safest healthiest milk. This could possibly attain through thorough observations to avoiding milking infected caws but rather from mastitis free caws (Skeie, *et al.*, 2019). None of the milk samples from Bursary, Potiskum and Buni-Yadi was graded 'poor'. This is to show the level of adherence to environmental hygiene and health status of animal before milking in these three towns (Food Standards 2009). Other milk samples from Fune, Gashua, Geidam and Bursary have more than 60% of their milk samples graded good and excellent, while the remaining milk samples were graded as fair milk. These fair milk samples are considered doubtful because its falls between good and poor milk samples (Frazier and Westhof 2012: Sewgil *et al.*, 2018). Interestingly none of the milk samples collected from all the 10 towns and locations were graded 'poor milk.' This suggests less contamination and low microbial interference. This result is similar to a research by (Sewgil, *et al.*, 2018), who's work on kid's powdered milk revealed negative results to methylene blue reduction test. However, it contradicts with a study by Bertu, *et al.*, (2010), which revealed that fresh milk samples from Fulani herds were positive for Brucella antibodies with 13.5% prevalence. It has also been identified that there could be non-living contaminants (heavy metals, dust particles, droplets and dirt) in the milk as a result of prolong exposure in the market. (Hassan *et al.*, 2020).

Conclusion and Recommendations

The research work on the quality assessment of cow milk in ten major towns of Yobe State had revealed clearly that more than 50% of the milk analyzed were within the range of good and excellent, which shows no health threat to the consumers, thus fit for consumption.

It is there for recommended that:

- More emphasis should be given to Towns recorded fair milk samples as it is considered doubtful milk, and could harbor pathogenic bacteria.
- Other testing of milk testing should be used to determine the validity and extent of milk contamination in the study area
- Periodic milk test should be sustained to continue checking the viability of the milk sold to consumers.
- The milk handlers and sellers should improve personal and environmental hygiene especially through the use of clean water in the cleansing or washing of milk storage containers.
- Government should embark on public awareness campaign especially among milk sellers on the health risk of ingesting contaminated milk.

References

- Berhe G., Wasihum G.A., Kassaye E. Gebreselessie K. (2020). Mil-borne bacterial health-hazards in milk produced for commercial purpose in Tigray, Ethiopia. BMC public-health, 20 (1).
- Bertu, W.J., Dapar, M., Gusi, A. M., Ngulukun, S. S., Leo, S. and Jwander, L. D. (2010). Prevalence of brucella antibodies in marketed milk in Jos and environs. African Journal of Food Science, Vol. 4(2) pp. 062-064, February 2010 Available online <http://www.acadjournal.org/ajfs>
- Boor K.J, Wiedman M, Murphy S, Alcaine S, (2017) A 100 year review: Microbiology and Safety of milk handling journal of dairy science 100 (12): 9933-9957.
- Claeys W, Cardoen S, Daube G, De Block J, Dewettinck K, Dierick K. (2013) Raw or heated cow milk consumption: Review of risks and benefits. Food Control. 31:251e262.
- Csapó J., Salamon, S., Lóki, K., and Csapó -Kiss, Z. (2009) "Composition of Mare's Colostrum and Milk II. Protein Content, Amino Acid Composition and Contents of Macro- and Micro-elements." Acta Univ. Sapientiae, Alimentaria 2 (1): 133-48.
- Dalen G, Rachah A, Norstebo H, Schukken YH, Reksen O. (2019). The detection of intramammary infections using online somatic cell counts. Journal of Dairy Science.102 (6):5419–5429.
- Food Standards (2009) Australia New Zealand. Microbiological risk assessment of raw cow milk. Risk Assessment Microbiology Section 2009.
- Frazier W.C, Westhoff D.C (2012) food microbiology, fourth edition, Tata McGraw-Hill publishing company limited. India.*In raw milk. Dairy food environment sanitation 20: 606-611.*
- Hassan, G. A. (2018) Drought and Drought Mitigation in Yobe State, Nigeria. A thesis submitted in partial fulfilment of the requirements of the University of Wolverhampton for the degree of Doctor of Philosophy.
- Hassan, U.F., Hassan, H.F., Baba, Haruna, Madaki, A.A., Hassan, H.F., Ibrahim, Inusa, Hassan, A.F., Muhammed, Sagir. (2020). Evaluation of Toxicity Potentials of Heavy Metals in Camel Milk from Selected Farms in Yobe State, Nigeria. International Journal of Research and Innovation in Applied Science (IJRIAS) | Volume 5, Issue 7, Pp 112.

- Jamali H, Barkema HW, Jacques M, Lavallee-Bourget EM, Malouin F, Saini V, .(2018) Invited review: Incidence, risk factors, and effects of clinical mastitis recurrence in dairy cows. *Journal of Dairy Science*.101 (6):4729–4746.
- Kang'ethe EK, Arimi SM, Omoro AO, McDermod JJ, Nduhiu JG, Macharia JK, Githua A (2000). A paper prepared for oral presentation at the 3rd All Africa Conference on Animal Agriculture, 6-9th November.
- Murphy, SC and Boor, BJ (2000). Trouble shooting sources and of high bacteria
- NPC (2006) National Population Commission Official Result for 2006 House and Population Census Figures, Bureau for National Statistics Abuja, Nigeria. Online: <http://population.gov.ng/>(accessed on 06/12/2022).
- Ramanjaneyulu, G. and Vyas, S. H. (1985). Keeping quality of heat treated milk at room temperature. Gujarat. India Asian. J. of dairy pp 20-22.
- Rodrigues MX, Lima SF, Canniatti-Brazaca SG, Bicalho RC. (2017) The microbiome of bulk tank milk: Characterization and associations with somatic cell count and bacterial count. *Journal of Dairy Science*. 100(4):2536–2552. DOI: <https://doi.org/10.3168/jds.2016-11540>.
- Sewgil S. A, Sahar M.Z, Sarween A. RI, Ronar J. H, Iman J. A, Attia J. Q (2018) Detection of Kids milk Quality using Methylene Blue Reduction test. *International Journal of Environment, Agriculture and Biotechnology (IJEAB)* Vol-3, Issue-4, Page | 1450
- Skeie, S.B., Håland, M., Thorsen, I.M., Narvhus, J. & Porcellato, D. (2019). Bulk tank raw milk microbiota differs within and between farms: A moving goalpost challenging quality control. *Journal of Dairy Science*, 102 (3), 1959–1971. <https://doi.org/10.3168/jds.2017-14083>
- Sudhasaravanan R, and Binukumari S. (2015), Microbial Quality of Raw and Pasteurized Milk Samples Collected From Different Regions of Madurai District, (T.N) India. *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)*, 9: 7.
- Van Winckel, M., Vande Velde, S., De Bruyne, R., Van and Biervliet, S. (2011) "Clinical Practice: Vegetarian Infant and Child Nutrition." *European Journal of Pediatrics* 170: 1489-94.
- Yeserah B, Tassew T, Mazengia H (2020) Handling Practices of Raw Cow's Milk and Major Constraints of Clean Milk Production in and around Bahir Dar City, Ethiopia. *J Adv Dairy Res* 8: 234. doi: 10.35248/2329-888X.19.8.2.234
- Yobe State Government of Nigeria (2010) Position on the Proposed Construction of the Kafin Zaki Dam. Unpublished Report.