

The Efficacy of the Mazzican for Milking, Transportation and Improving Bacteriological Quality of Milk in the Smallholder Dairy Value Chain in Tanzania



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Summary

Plastic milk containers commonly used in milk handling and transportation of raw milk by the majority of traditional farmers and milk traders contribute to the poor bacteriological quality of milk commonly observed in smallholder dairy value chains in Tanzania. These plastic containers are often not made from food grade plastic material or designed for milk handling but they are commonly used because they are more affordable than recommended metal containers. A new and more affordable food grade plastic container (the “Mazzican”) that was developed and shown to be an appropriate vessel for improving the hygiene of milk handling during milking and transportation to the market in other countries of East Africa was tested. This report presents results of field testing performed in Mvomero District in Morogoro Region in Tanzania to assess acceptability and validate the efficacy of the Mazzican for improving the bacteriological quality of milk when the vessel is used for handling and transportation of raw milk by agro-pastoralists and smallholder farmers in the area.

The field testing was done in Mvomero District in Tanzania among milk traders collecting milk from smallholder dairy farmers (SHDF) and from traditional cattle pastoralists’ herds. Fourteen farmers supplying milk to milk traders were provided with 15 Mazzicans to use in milking and to deliver milk to three traders. One trader in Manyinga village collected milk from five of the smallholder farmers while two traders at Wami Dakawa and Wami Sokoine purchased milk from traditional Maasai pastoralists.

Results showed that there was a dramatic reduction of 76.3% in the total plate count (TPC) in raw milk samples from the pastoralist farmers as a result of switching from jerry cans to the use of Mazzicans. The reduction in TPC in milk was also dramatic but slightly lower (69.5%) among the smallholder farmers. Total coliform counts (TCC) also reduced upon switching but the reduction was less dramatic (42.3%). compared to TPC.

The results confirm that the Mazzican is a much better container than plastic jerry cans for use in milking, transportation of raw milk and maintaining good bacteriological milk quality under smallholder and traditional cattle milk producer’s conditions in Tanzania.

Introduction

Unhygienic handling is a common problem leading to poor milk quality especially in dairy production and marketing systems without cold chains. Milk containers made from aluminium or stainless steel are usually recommended to address this problem because they are easy to clean and sanitize. However, these metal containers are expensive and unaffordable for many smallholders who often resort to using cheaper but less hygienic containers made from non-food-grade plastics that are also not easy to clean and sanitize.

Bacteria in raw milk may pose a human health risks besides rapid deterioration of milk quality. To encourage production of low bacteria count milk, farmers are advised to use good milk production practices. This includes good personal hygiene, udder health and use of sanitary milk vessels usually made from metal. Plastic jerry cans commonly used in milk handling and transportation of raw milk by the majority of traditional cattle keepers, smallholder dairy farmers and milk traders contribute to the poor bacteriological quality of milk. Keeping milk in unhygienic milk containers has been shown to be one of the main factors contributing to the high bacterial counts in marketed milk in East Africa in general and Tanzania in particular. Because recommended aluminium or stainless containers are expensive and unaffordable to small-scale farmers, there has been a need for developing high quality but affordable milk containers so as to ensure the milk quality is maintained.

During implementation of the first phase of the East African Dairy Development (EADDI) programme in Kenya, Uganda and Rwanda, a food grade plastic container with a wide opening known as Mazzican (<http://mazzican.com/>) was developed by [Global Good](#) with support from the Bill & Melinda Gates Foundation and shown to be an appropriate vessel for improving the hygiene of milk handling during milking and transportation to the market or milk collection centres. As an added innovation, a black funnel fitted to the can enables the milker to visualize the physical consistency of the milk and determine whether or not the cow's udder has sub-clinical mastitis or other physical abnormalities.

Tanzania desires to have this milk container officially introduced and used by dairy value chain actors in the country. This study was conducted to contribute to this process. The report presents results of field testing performed in Mvomero District in Morogoro Region to assess acceptability and validate the efficacy of using the Mazzican as vessel for handling and transportation of raw milk by smallholder farmers and agro-pastoralists from Turiani, Wami Dakawa and Wami Sokoine wards in the district.

Objectives

The objective of the research was to test the efficacy of the Mazzican as an appropriate hygienic milking and milk transport vessel for use by smallholder farmers in pastoral and dairy production systems in Tanzania.

The specific objectives were:

- i. Test the detection rate of abnormal and mastitic milk by smallholder farmers during hand milking using the Mazzican
- ii. Evaluate the bacteriological quality of milk handled using the conventional milk handling vessels during milking and delivery to milk traders
- iii. Evaluate the improvement in the bacteriological quality of milk handled using the Mazzican during milking and delivery to milk traders

Methodology

Study sites and selection of milk traders

Two milk traders who source milk from traditional cattle pastoralists were identified in Wami Dakawa and Wami Sokoine. Ten Mazzicans were loaned to pastoralists supplying milk to the two traders. One Trader who purchases milk from smallholder dairy farmers was identified at Manyinga village near Turiani. Five Mazzicans were loaned to smallholder dairy farmers supplying milk to the Manyinga milk trader. The farmers were trained on how to use Mazzicans. Farmers in Turiani were observed and their reactions noted during milking using the Mazzicans. Pastoralists supplied with Mazzicans could not be observed during milking as they had moved their cows far away from the Wami Dakawa/Wami Sokoine area.

Milk sampling and preparation

Individual farmer milk samples were collected from the three milk traders at the three villages in Mvomero District namely Manyinga, Wami Dakawa and Wami Sokoine in August and September 2016. Sterilised falcon tubes were used in collection of milk samples.

A total of 38 jerry can and 45 Mezzican milk samples were taken from farmers who sell their milk to the identified traders. Milk samples from the 14 farmers were collected for two weeks each before (Jerry cans) and after being provided with Mazzicans. During the preliminary period milk samples were taken directly from jerry cans and farmers were asked to report observed cases of cows with signs of abnormal milk. The number and type of samples collected is shown in Table 1.

Table 1: Sampling frame for Mazzican Testing in Mvomero District, Tanzania

Site	Wami Dakawa/Wami Sokoine		Manyinga -Turiani	
No. Traders	2		1	
Farmer type	Traditional		Smallholder dairy	
Number of farmers	9		5	
Vessel type	Jerry can	Mazzican	Jerry can	Mazzican
No. Samples taken	18	30	20	15

The preliminary period was followed by a Mazzican testing period involving direct observations in the case of some farmers in Turiani and milk sampling. Samples were collected three times directly from the Mazzican upon arrival at the traders' location by pouring directly (approx. 50 mls) into pre-sterilised falcon tubes. Farmers were similarly asked to indicate any observations on mastitis cases during milking.

Results

Observations on the use of Mazzicans by farmers

Some farmers were able to milk directly into the Mazzican. Some farmers found it difficult to hold the Mazzican in one hand and do the milking. They preferred using plastic jugs in milking then transfer the milk to the Mazzican container, the main reason being that the containers are too big to be held with one hand while milking (Plate 1). Another reason given by the traditional pastoralists was that zebu cattle are not as calm during milking which makes it difficult to place the milking vessel on the ground or in the milker's lap



There were farmers, especially those in Manyinga that own improved dairy cattle, who managed direct milking into the Mezzican (Plate 2).

Another important observation by farmers was that once filled with milk, using the side handle during transportation of milk to milk collection centres was a bit problematic.

They suggested:

- a) Provision be made to have a flexible handle at the top.
- b) Another suggestion by farmers was to design a 1-2 litres milking Mazzican as separate vessel to the transport vessel.



Despite instructions to clean and dry the containers beforehand, some farmers were observed to be cleaning the milking vessel with plain water just before milking. None of the Standard procedures like the use of hot water, disinfectants and detergents in washing and cleaning milking vessels before milking were observed to be performed by smallholders in Manyinga village.

Also farmers were not able to report any observed cases of clinical mastitis both during the preliminary and the test period.

Some farmers reported leakage of milk from the Mazzican during transportation on rough roads.

Bacteriological quality of the raw milk

Results of the bacteriological quality of milk during the preliminary period (jerry can) and during Mazzican testing are shown in Table 2 and Figure 1. Results show very high TPC and TCC in milk samples delivered to traders by small scale dairy farmers than samples by pastoralists using the two types of vessels.



Table 2: Bacteriological quality of raw milk delivered by smallholder dairy and traditional cattle to milk traders in selected villages in Mvomero District Morogoro using two types of vessels.

	Traditional cattle		Smallholder dairy	
	Jerry can (n=18)	Mazzican (n=30)	Jerry can (n=20)	Mazzican (n=15)
Total Plate Count (c.f.u./ml)ml	3.90E+05	9.23E+04	1.19E+06	3.62E+05
Total coliform (c.f.u/ml)	1.02E+03	2.28E+02	7.68E+03	4.42E+03
% Reduction, TPC		76.33		69.48
% Reduction, TCC		77.62		42.3

A higher total plate count was observed in milk samples taken from the smallholder dairy farmers' jerry cans (1.19×10^6 cfu/ml) than traditional pastoralists jerry cans (4×10^5 cfu/ml), and Mazzican for smallholder farmer (3.6×10^5 cfu/ml). A similar trend was observed when farmers used Mazzicans. This implies that traditional farmers generally produced milk of better bacteriological quality than smallholder dairy farmers in the study areas. Similar results have been reported in Tanga (Kurwijila, 2013 and Kurwijila 2015).

The effect of changing from use of jerry cans is shown in Figure 2. In both categories of farmers, the bacteriological quality of milk measured by TPC /ml and TCC/ml improved considerably compared to the preliminary period when jerry cans were used. This shows that with all factors remaining the same, introduction of the Mazzican had a positive impact on the improving the milk quality of both category of farmers.

There was a 76.3% reduction in the TPC of raw milk from the pastoralist farmers as a result of switching to the use of Mazzicans. The improvement in the total plate count of milk was lower (69.5%) among the smallholder farmers but much less (42.3%) with respect to TCC/ml. The lower TPC and coliform count in pastoralist milk may be due to the use of calabash (*vibuyu*) in milking which have a very narrow opening hence less contamination of milk with faecal and other extraneous materials.

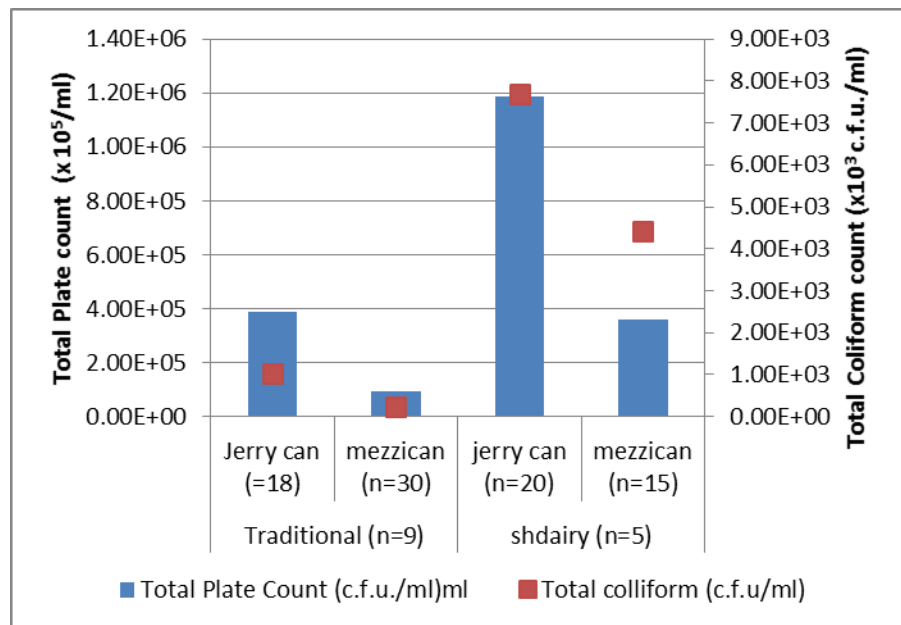


Fig 2. Bacteriological quality of milk handled by use of jerry cans and

mezzicans. The improvement in the total plate count of milk was lower (69.5%) among the smallholder farmers but much less (42.3%) with respect to TCC/ml. The lower TPC and coliform count in pastoralist milk may be due to the use of calabash (*vibuyu*) in milking which have a very narrow opening hence less contamination of milk with faecal and other extraneous materials.

Conclusions

From the milk bacteriological quality perspective, the results confirm that the Mazzican is a much better container than plastic jerry cans for use in milking, transportation of raw milk and maintaining good bacteriological milk quality under smallholder and traditional cattle milk producer's conditions in Tanzania.

Recommendations

1. The Mazzican is a suitable food grade replacement for the conventional plastic jerry cans widely used in milk handling in Tanzania. Therefore, agencies responsible for regulation and promotion of improved milk quality marketed in Tanzania should consider facilitating its introduction and wide use by value chain actors
2. The manufacturers should consider putting a flexible handle at the top of the Mazzican for ease of transportation
3. Design 1-2 litres Mazzican for use in hand milking of traditional cattle
4. Mazzican cover could not be well tightened which led to leakage of milk when transporting them. It is recommended to redesign the gasket to a more flexible one that produces an air tight seal between the cover and the vessel.

References

Kurwijila, L.R 2013. A study on the microbiological status of raw milk at Tanga Fresh milk collection centres in Tanga and Morogoro. Consultancy study for Tanga Fresh Ltd.

Kurwijila L.R, 2015. Milk quality improvement strategy for Tanga Fresh Ltd. An IFAD consultancy report for Tanga Fresh Ltd.

Appendix: Limitations of the study

We did not manage to take milk samples from all the farmers that were indicated per trader as most of them had moved in search of pasture and water for their animals far away from their residence.

We didn't manage to get hold of the fourth trader (Simon Okeshu from Parakuyo village) due to unavailability and poor communication.