

Investigating the microbiological profile of Motoho

INTRODUCTION

Fermentation has been used since ancient times as a preservation method for various foods and has become a part of the culture of many developing nations in Africa. Sorghum is the fifth most important cereal in the world. However it contains many anti-nutritional factors as well as a deficiency of fundamental amino acids. The fermentation of sorghum could improve its nutritional importance and improve its sensory qualities².

Motoho is a fermented sorghum beverage produced by the Basotho people of South Africa via spontaneous fermentation which can yield products with inconsistent quality.

The aim of this research was to assist a local producer of Motoho from South Africa to understand the association of microbes in the fermentation process used. This would enable the development of products with constant microbiological properties and quality.



Figure 1: Fermented slurry (A) , laboratory production of Motoho (B) and traditional production of Motoho

Fermentation medium

Sorghum flour and sugar were purchased at a local supermarket in Pretoria, South Africa.

Starter culture

An inoculum from the previous batch of fermentation was used as a starter culture.

Fermentation process

Motoho was produced with the assistance of the local producer in South Africa. Inoculum was prepared by backslopping and added to a 1:1 ratio of sorghum and water. The mixture was heated to 30°C and left to ferment for 12 hours. The fermented slurry was cooked at 90°C for 30 minutes, after which starch was added as a thickener. The product was cooked for a further 20 minutes and then allowed to cool. The product was then sieved and bottled. Three batches of Motoho were produced. The first batch was manufactured by the local producer. Batches 1 and 2 were produced using traditional production methods while batch 3 was produced using more aseptic techniques.

Isolation of microorganisms

Samples (5g) were aseptically collected from each process point during fermentation and homogenised in 45ml of Multiple Recovery Diluent (MRD). Serial dilutions were performed and 1ml of each dilution was pour plated in duplicate. Lactic acid bacteria were isolated using de Man Rogosa and Sharpe (MRS) agar which was incubated for 3 days at 30°C. Yeast and moulds were isolated using Potato Dextrose Agar (PDA) which was acidified using 10% Tartaric Acid and incubated for 5 days at 25°C. Counts were performed on plates containing 30 to 300 colonies.

Moodley, S.S.¹, Buys, E.M.¹ and Dlamini, N.R.²

¹ Department of Food Science, University of Pretoria ,Private Bag X20, Hatfield, Pretoria 0028, South Africa

Email: sanchia.moodley@gmail.com, Elna.Buys@up.ac.za

² CSIR, Biosciences, P.O. BOX 395, Pretoria 0001, South Africa

Email: NRDlamini@csir.co.za

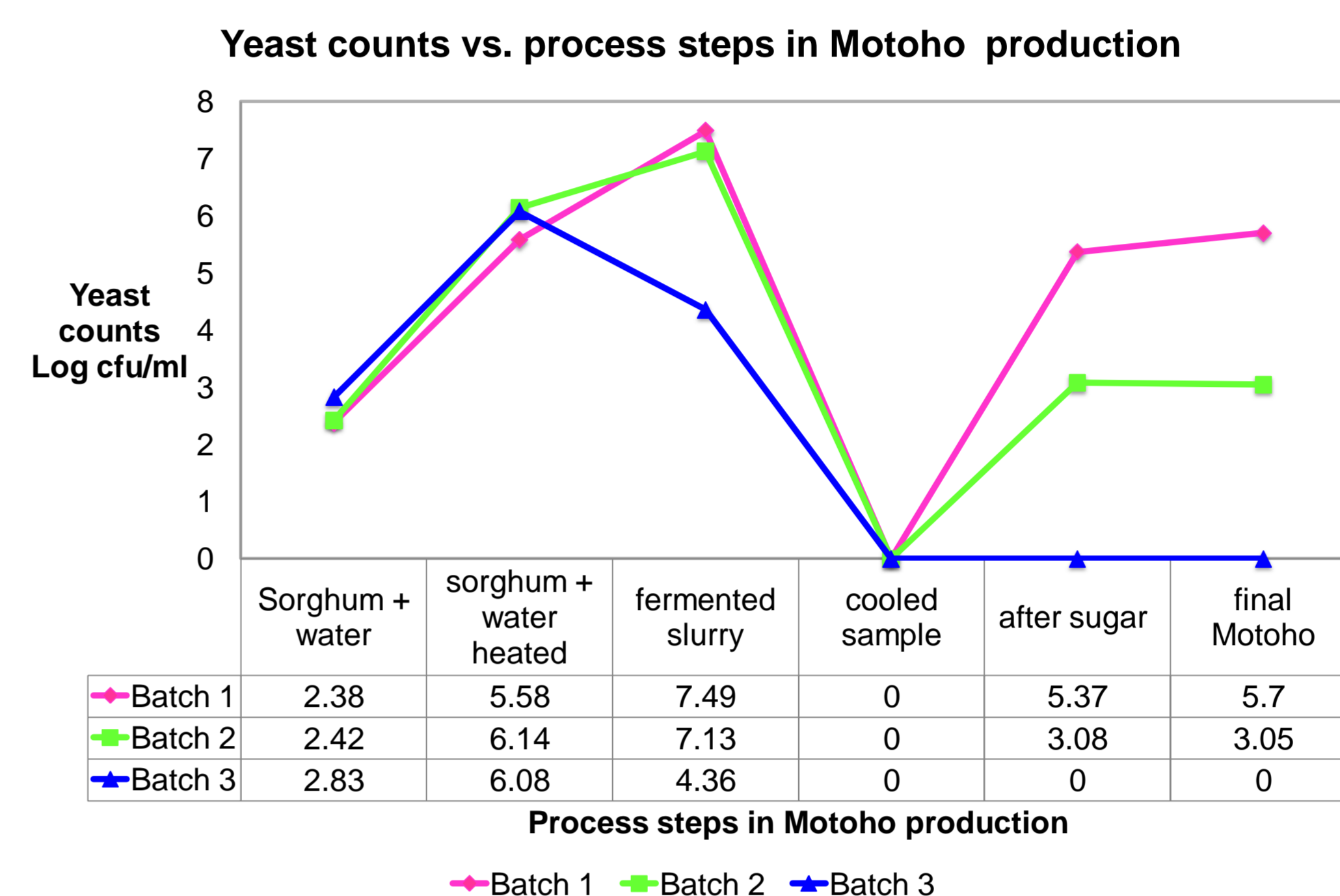


Figure 3: Graph of yeast counts in cfu/ml vs. various process steps in the manufacture of Motoho

RESULTS AND DISCUSSION

For batches 1 and 2, the lactic acid bacterial counts as well as the yeast counts decreased after cooking but increased after the batches were cooled to between 35°C and 45°C and sugar was added (Figs. 2 and 3). The lactic acid bacterial and yeast counts also decreased in batch 3 after the batch was cooked, however there was no increase in microbial counts after the batch was cooled and sugar was added.

Heat damage targets many bacterial cell components which include ribosomes, proteins, enzymes, DNA and the cell membrane. At temperatures above 65°C proteins and ribosomes denature, while DNA denatures at temperatures close to 90°C¹.

The decrease in lactic acid bacterial counts in all 3 batches could be attributed to the heat stress during cooking which resulted in the inactivation or killing of cells.

Heat stress in yeast can impede growth at the G1 phase of the cell division cycle. Gene transcription and rRNA synthesis are also inhibited.³ These inhibitions could have resulted in the decrease in yeast counts in batches 1 and 2. Sugar provided an energy source for both the lactic acid bacteria and yeast, which allowed them to repair the damage incurred and subsequently multiply.

A traditional production method was used for batches 1 and 2 while a sterile laboratory based method was used for batch 3. The production method used for batch 3 could also account for the < 10 log cfu/ml observed for both lactic acid bacteria and yeast after cooling and addition of sugar.

CONCLUSION

Lactic acid bacteria as well as yeast growth was observed in all 3 batches of Motoho production. This concurs with the microorganisms that are found in the traditional fermentation of sorghum. Slight variations in the production method of batches 1 and 2 versus batch 3 resulted in variations in the growth of both lactic acid bacteria and yeast populations between batches.

REFERENCES

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Lactic acid bacterial counts vs. process steps in Motoho production

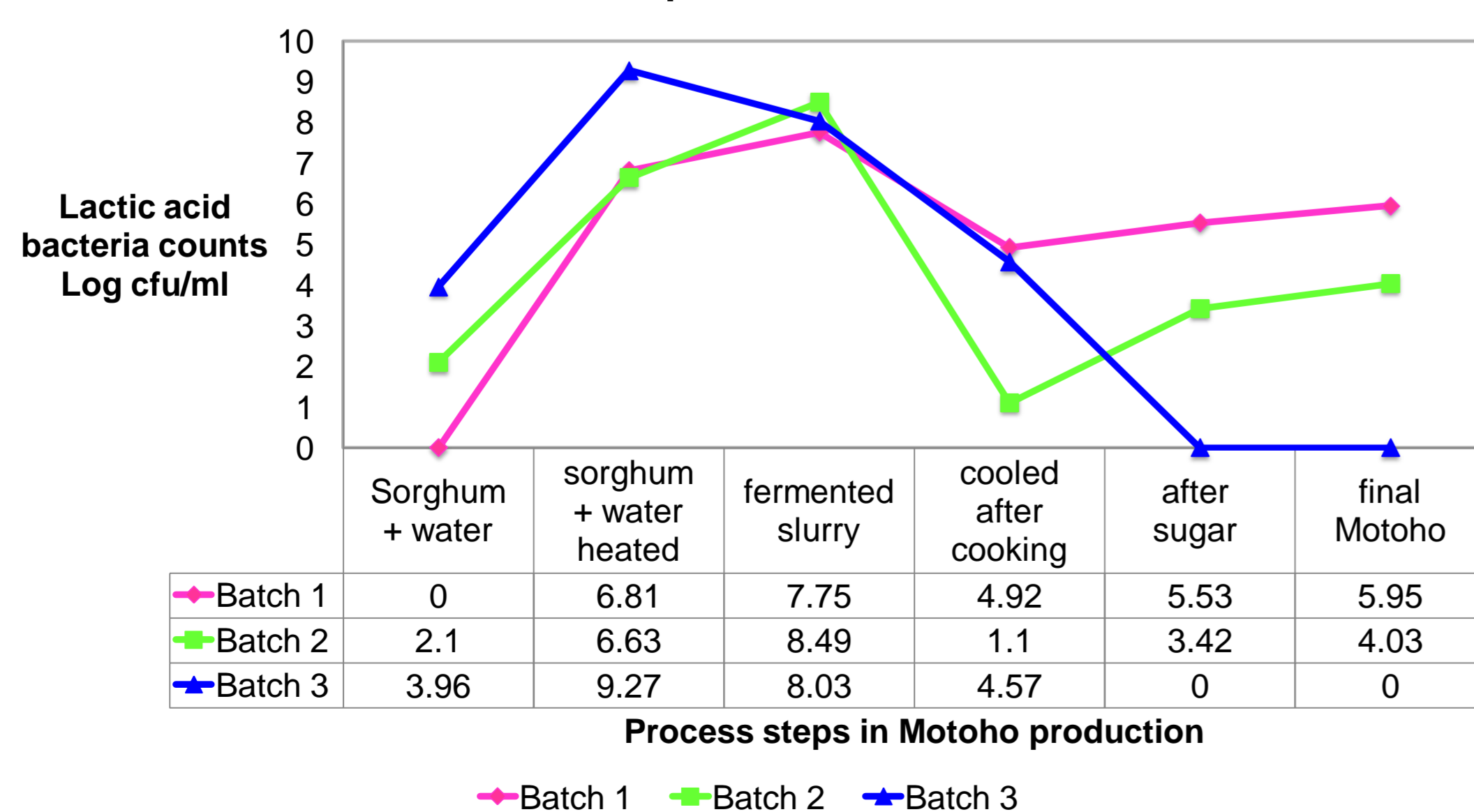


Figure 2: Graph of lactic acid bacteria counts in cfu/ml vs. various process steps in the manufacture of Motoho