Science and technological development of *Omashikwa*; Namibian traditional fermented butter milk

By

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DECLARATION

I declare that this thesis which I hereby submit for the degree of PhD at the University of Pretoria is my own work and has not previously been submitted by me for a degree at any other University or institution of higher education.

Peter George Bille
DEDICATION

This is dedicated to my family; Mrs. Monica Bille, daughters Marylyne and Gloria and sons Dennis and David for their support, prayers and encouragement during the five years I have been toiling, as a part time student, for the study.
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ABSTRACT

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In Namibia, Omashikwa traditional fermented buttermilk made with the root of Omunkunzi (Boscia albitrunca) tree by local farmers is one of the most important rural food products. It provides nutrition, jobs and generates income for food security for the community. As a traditional fermented product, it is unusual as it has a viscous consistency and low syneresis. However, the quality of Omashikwa is inconsistent and is characterized by high acid taste, low pH, rancid flavour, root taste and smell and contains filth.

In this research, the production process of Omashikwa, physico-chemical properties of the traditional and laboratory prepared Omashikwa and the role of the root of B. albitrunca tree in Omashikwa, viscosity, syneresis, microbiology and sensory properties were studied and compared in order to improve the quality of Omashikwa for wider community use and for poverty alleviation. Omashikwa was found to have a protein content of about 3.3%, fat 1.6%, moisture 90%, lactose 4.6%, ash 0.7%, total solids 8.7%, lactic acid 0.9% and a pH of 3.3
The quality of traditionally processed Omashikwa (TO) was compared with the laboratory processed Omashikwa (LO), which was made without the root. Traditional fermentation was carried out with raw milk and under rural conditions. After fermentation the milk was agitated vigorously to churn into butter, whereas LO was made with pasteurized (65°C/30 min) and filtered milk, and cream was scooped off after fermentation instead of churning. LO had a significantly (p < 0.05) higher pH (4.44) compared to traditional Omashikwa (pH 3.25), lower acidity (0.68%) compared to 0.92% of TO. Fat content was higher in LO (2.44% fat) compared to 1.56% fat in TO. LO was free from filth and had higher viscosity (2.98 Pa.s) compared to 2.54 Pa.s and lower syneresis (14.4ml/24 ml) compared to 19.6ml/24ml of TO.

It was found that extract from B. albitrunca root showed a low pH of 4.7 and exhibited bacterial inhibition properties on Total Plate Count Agar ring test. The root appear to specifically inhibit Escherichi coli, Staphylococcus aureus and Clostridium species. It also had a high content of soluble carbohydrates (hydrocolloids or gum) (19.4%).

Significant difference (p < 0.05) in total aerobic counts was observed in TO of 6.62 log cfu/g compared to 8.62 log cfu/g of LO and lower lactic acid bacterial counts, 6.58 log cfu/g compared to 7.87 log cfu/g of LO. Probably the most affected microorganisms in TO were the non acid formers, as lower pH of TO and inhibitory compounds in Omunkunzi root could have reduced them. Coliforms, yeasts and moulds counts were not significantly different (p<0.05). No pathogenic bacteria were found in either product. The lactic acid bacteria identified belonged to the genera Lactobacillus (Lb.) (Weissella), Leuconostoc (Leuc.), Lactococcus (Lact.) and Streptococcus (Str.) Twenty representative strains of LAB isolates were identified to species level; three belonged to the species Lb. delbrueckii subsp. lactis and two belonged to Lb. plantarum and two to Weissella confusa (former Lb. confuses). Three belonged to Str. salivarius thermophilus, three to Leuc. lactis, and two to Leuc. mesenteroides subsp. mesenteroides. Three belonged to Lact. lactis subsp. lactis and two belonged to Lact. lactis subsp. cremoris.

Significant differences (p < 0.05) in descriptive and consumer sensory attributes scores were observed between traditional and laboratory Omashikwa. Sensory attributes scores of TO on
the levels of syneresis was 3.4 compared to 2.9 for LO, filth 3.0 compared to 1.8 in LO, rancidity scores were 3.4 in TO compared to 1.8 in LO, and bitterness 4.2 in TO compared to 2.5 in LO. Aroma scores were 2.6 for TO and 4.2 for LO, viscosity 2.5 (TO) and 3.8 (LO) and texture 2.7 for TO compared to 4.2 for LO. There was an 80% preference score given to the laboratory Omashikwa by the young consumer panelists.

The results of this study indicate justification of using B. albitrunca root in the processing of Omashiwa by the rural community to improve the quality of Omashikwa in terms of flavour, smell and consistency compared to other traditional fermented milk products and in the absence of modern technology. However, application of good manufacturing practices on unit operations, particularly heat treatment of milk prior to fermentation, use of lactic acid starter cultures, maintenance of good hygiene and sanitation including packaging, seem to be the effective methods to improve and sustain the quality and safety of traditional fermented buttermilk (Omashikwa) for a wider market and better price.

Namibia Dairies Ltd, just like any other dairies in the region and elsewhere, manufactures buttermilk, a byproduct of butter that is fermented with mesophilic lactic acid cultures and branded as Omashikwa for the purpose of marketing. It has nothing to do with traditional Omashikwa as such; B. albitrunca root is not added and is processed by using modern industrial method. In addition, additives such as preservatives (potassium sorbate), stabilizers (pectin) and sugar are added and packed for distribution.

This research project therefore investigated the processing technology, physico-chemical, microbiological, viscosity and sensory quality of traditional Omashikwa. The remedial measures to curb inconsistency and poor quality experienced in Omashikwa processed in Namibia were also investigated and scientific measures were proposed for production of quality Omashikwa for marketing to a wider community.

Since laboratory processing method of Omashikwa gave a better quality product compared to traditional method in terms of microbiological quality, sensory attributes, viscosity, filth content, syneresis and general appearance, laboratory processing technique of processing Omashikwa is therefore recommended as an alternative and appropriate processing method for small scale production in the rural set up to improve the quality of Omashikwa.
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