



**Application of the lactoperoxidase system to improve the  
quality and safety of goat milk and goat milk cheese**

**By**

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## **DECLARATION**

I declare that the 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.

A handwritten signature in black ink, appearing to be 'A. J. ...'.



## **DEDICATION**

This thesis is dedicated to my brother Derebe Nigatu who like any one of us had plans and aspirations for life but died at the age of thirty.

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## ABSTRACT

# Application of the lactoperoxidase system to improve the quality and safety of goat milk and goat milk cheese

By

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Promoters: Dr. E. M. Buys  
Professor E. F. Donkin  
Department: Food Science  
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The lactoperoxidase system is an endogenous antibacterial system present in milk and is used for preservation of raw milk especially under situations where it is not possible to cool the milk. In this thesis the inhibitory effect of the lactoperoxidase (LP) system against *Escherichia coli*, *Staphylococcus aureus*, *Listeria monocytogenes* and *Brucella melitensis* was investigated in Saanen and South African Indigenous goat milks. The effect of the LP system on the activity of mixed strain and single strain mesophilic cheese starter cultures was investigated in Saanen goat milk, and a starter culture that is resistant to the LP system was identified. The suitability of Saanen goat milk preserved by the LP system for the manufacture of Gouda cheese was determined.

The LP system exhibited a bactericidal effect against *L. monocytogenes* and *Br. melitensis* both in Saanen and Indigenous goat milks during a storage period of 6 h at 30 °C. The LP system showed a bactericidal effect against *S. aureus* in Saanen goat milk; however, it was bacteriostatic against *S. aureus* in Indigenous goat milk. On the other hand, the LP system only reduced the rate of multiplication of *E. coli* both in Saanen and Indigenous goat milks. The same pathogen showed different degrees of sensitivity to the LP system in the milk of the two goat breeds probably because of the difference in the LP system components in the milk of the two goat breeds. Saanen goat milk had a mean LP activity of  $0.79 \pm 0.18$  U/ml and a mean thiocyanate concentration of  $2.78 \pm 1.21$  ppm.

However, Indigenous goat milk had a mean LP activity of  $0.26 \pm 0.10$  U/ml and a mean thiocyanate concentration of  $4.58 \pm 1.92$  ppm.

Most of the mesophilic cheese starter cultures examined were found to be sensitive to the LP system, but varied in their susceptibility to inhibition. The activity of the mixed starter cultures CHN11, CHN22, CHN19, DCC240 and Flora Danica Normal was strongly inhibited by the LP system. However, the mixed starter culture LL 50C showed resistance to the LP system and could be used for cheesemaking from goat milk preserved by the LP system. The single strain culture *Lactococcus lactis* subsp. *lactis* NCDO 605 was inhibited by the LP system. However, the cultures *Lactococcus lactis* subsp. *diacetylactis* NCDO 176 and *Leuconostoc mesenteroides* subsp. *cremoris* ATCC 33313 were insensitive to the LP system.

Gouda cheese made from LP-activated Saanen goat milk had significantly ( $p < 0.05$ ) lower levels of coliform and coagulase positive staphylococci compared to cheese made from the untreated control milk. The LP-treatment did not affect the gross chemical composition of Gouda cheese made from Saanen goat milk. The level of proteolysis in cheeses made from LP-treated and control Saanen goat milks was comparable. However, the level of lipolysis in cheese made from LP-activated Saanen goat milk was significantly ( $p < 0.05$ ) lower than that made from the control goat milk at the end of the ripening period. The lower lipolytic activity of cheese made from LP-activated goat milk might be of significant importance in reducing the strong flavour associated with goat milk cheeses. Significant differences ( $p < 0.05$ ) in sensory attributes were observed between cheeses made from the LP-treated and the untreated control Saanen goat milk. Gouda cheeses made from LP-treated goat milk had a mild flavour as compared to the control. The results of this study indicate the potential of using the LP system to improve the quality and safety of goat milk and goat milk cheeses.

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