A STUDY OF THE MICROBIOLOGICAL QUALITY OF BOTTLED WATER SOLD IN NEW ZEALAND

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PHILOSOPHY

"Forget lemonade. The real money's in bottled water."

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ABSTRACT

The aim of this study was to determine if retailed bottled water in New Zealand complied with the Australia and New Zealand Food Standards (ANZFS) Code (2002) and the New Zealand Microbiological Reference Criteria (1995).

The New Zealand Microbiological Reference Criteria for Packaged Waters include Total Coliforms, *Escherichia coli*, Enterococci (Group D streptococci) and *Pseudomonas aeruginosa*. Standard 1.6.1 of the ANZFS includes Total Coliforms, *Escherichia coli*, Enterococci (Group D streptococci), *Pseudomonas aeruginosa* and Total Viable Count (TVC).

In this study five samples of randomly selected 38 brands of different types of domestic and imported bottled waters were purchased from local retail stores in Wellington region. The samples were tested for Total Coliforms, *Escherichia coli*, Enterococci (Group D streptococci), *Pseudomonas aeruginosa*, TVC, Yeasts and Moulds and *Campylobacter spp.*

Three domestic brands did not comply with both of the above criteria for Total Coliforms.

Seventeen brands did not comply with TVC criteria of ANZFS Code (100 CFU/ml) with nine out of 17 being domestic New Zealand brands.

Twenty one brands displayed the growth of colonies on Sabouraud dextrose agar plates. Half of them displayed the growth of moulds.

Due to high incidence of campylobacteriosis in New Zealand composite samples of brands with TVC counts equal or higher than 100 CFU/ml were tested for *Campylobacter spp*. All samples were negative for *Campylobacter spp*. 
A survey questionnaire was used to assess the impact of manufacturing procedures on bottled water quality. The aim of the survey was to investigate possible significant public health links between the source water quality, type of abstraction, pipework materials, bottling process, staff training, policies and procedures. All four manufacturers, which responded to the questionnaire and represented 11 bottled water brands, bottled at least one brand that did not comply with the ANZFS Code for TVC.

Ten years after the initial study was performed by Hasell and Capill in 1999 microbiological contamination in bottled waters in New Zealand was still being detected. We demonstrated that monitoring bottled water microbiological quality was essential and that the presence of manufacturers’ procedures for ensuring satisfactory bottled water microbiological quality did not always guarantee it.
PREFACE

“Everything comes from water!
And everything is kept alive by water!”

J.W. von Goethe, Faust II, 1833

ACKNOWLEDGEMENTS

Assistance in statistical analysis of the data was provided by Ms Christine Roseveare, my previous colleague at the Regional Public Health, Hutt Valley District Health Board and Mr Brian Caughley, Senior Lecturer in Chemistry at Massey University in Wellington.
I would also like to thank Professor Philip Dickinson for his advice and guidance.
My thanks to the Wellington Massey University laboratory technicians Mrs Marilyn Mabon and Mrs Margaret Allison for their endless help.
Last, but not the least, I would like to thank my supervisors Associate Professor Rachel Page and Dr Robert Lau for their time, advice and guidance.

DEDICATION

I dedicate my work to everyone who believed in me.
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