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**Consumer Behaviour Concerning Food Safety in Brazil and New Zealand:
Modelling Food Safety Risk in the Home**

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

in

Food Technology (Food Safety)

at Massey University, Manawatu,

New Zealand.

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November – 2016

Abstract

Foodborne illnesses are among the most widespread public health issues, killing about 2.2 million people annually worldwide, and costing hundreds of billions of US dollars for governments, companies, families and consumers. In Brazil, foodborne illness in the home accounts for 44% of identified disease outbreaks and in New Zealand it represents 27% of notifiable disease outbreaks. Several studies have investigated aspects of consumer behaviour concerning food safety, but it remains a challenge to obtain a full picture of critical control points (CCPs) and key factors contributing to food contamination, pathogen growth or survival, when the food is under the consumer's responsibility. This study aimed to assess threats to food safety in the home in Brazil and New Zealand. From August 2011 to March 2012, survey questionnaires from 2,775 consumers most responsible for cooking in the home in Brazil were collected. From September 2012 to November 2012, 658 households in New Zealand responded to the same survey.

Both surveys found similar CCPs with the potential to threaten food safety in the domestic environment – food preparation, cooking and handling leftovers. Information from New Zealand suggests that choosing and purchasing food, and for Brazil food transportation, are also steps of concern. The age, marital status, gender, ethnicity, first-aid in response to illness and the way a person learned to cook had a significant influence in the risky practices of consumers in both countries, suggesting that similar consumer behaviour concerning food safety can be found in countries of substantially different degrees of economic development and culture. The young, the men, socio-economic minorities, people most susceptible to illness and ethnic groups were people of most concern, often ranked at-risk, demanding special attention of public health authorities in both countries. The CCPs of most concern and contributing factors identified in this study were officially reported in New Zealand, helping to validate the methodology used in this study and its possible use in other countries. Furthermore, food safety educational campaigns built on the steps of most concern and groups ranked at moderate or high risk, have the potential to be most effective in reducing food poisoning in the home.

List of publications and presentations

- **Motta S.P.O., Flint S.H., Perry P.E., Noble A. (2014):** Consumer contribution to food contamination in Brazil: modelling the food safety risk in the home. Brazilian Journal of Food Technology. Campinas, v. 17, n. 2, p. 154-165, abr./jun. 2014 (Appendix VIII).
- **Motta S.P.O., Flint S.H., Perry P.E., Noble A., Ramos I. (2015):** The Consumer Contribution to the Risk of Food Contamination in New Zealand: Modelling Food Safety Risk in the Home. EC Nutrition 1.4 (2015): 174-191 (Appendix VIII).

Acknowledgments

This study was conducted at the School of Food and Nutrition, Massey University, Palmerston North, New Zealand. I wish to thank Prof Richard Archer and the Emeritus Prof Ray Winger for their support in my Doctoral application at Massey University. I am very grateful to Prof Martins, a former Director-General of SENAI (my former employer in Brazil) for his enthusiasm and support to my research project.

I am deeply indebted to my supervisor, Prof Steve Flint, and co-supervisors, Prof Paul Perry, Dr Alasdair Noble and Dr Iloneide Ramos, for their dynamic contribution, tireless response and for sharing thoughts and knowledge regarding the fascinating field of food safety and scientific research. The countless debates and discussions that have taken place have helped me grow as a researcher as well as a person.

Many thanks to those who have supported this study with key pieces of information and advice, in particular Dr Roger Cook (MPI), Dr Donald Campbell (MPI), Lisa McPherson (MPI); their contributions were useful in improving the questionnaire design. Thanks to the Ministry for Primary Industry (MPI) for funding the New Zealand field survey and to Mr Emmanoel Monteiro for having developed the application for data gathering and processing, as well.

My sincere thanks to volunteers who participated in the field survey. I express my gratitude to colleagues and friends from Palmerston North, Wellington and Auckland, for their friendship and hospitality, especially to Daniel Conforte (in memory). They helped me to feel well settled in New Zealand.

I want to give thanks to God and my lovely children Amanda Motta and Alan Motta, who have accompanied me in this journey, so far. I also deeply thank Jordana Celli (my lovely partner) for having surrounded me with her support, love and affection.

Sergio Paulo Olinto da Motta – November 2016.

Significant contributions from others

- Database WEB application for computing the survey results, calculation of risk estimates, tabulation of outcomes and export to Microsoft Excel was developed by Mr. Emmanoel Monteiro, CIO of ATI-Tecnologia da Informação (ATI-Information Technology - <https://atijuridico.com.br/>).
- All the rest of the work was done by myself.

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Abbreviations

Age – Age group
AGI – Acute gastroenteritis
ARPIF – At-risk persons living in the home
BSE – Bovine Spongiform Encephalopathy
CCPs – Critical control points
CDC – Center for Diseases Control and Prevention
CFICP – Factor influencing cooking practices and recipes
CPF – Choosing and purchasing food
Ed – Highest level of formal education
ESR – Environmental Scientific Research
Eth – Ethnic identity
FAO – Food and Agriculture Organization
FASS – First aid in response to some symptoms indicative of food poisoning
FDA – Food and Drug Administration
FHC – Family health status
FPC – Food preparation and cooking
FSK – Food Safety Knowledge and Concerns
FT – Food transportation
Gender – Gender
GP – General medical practitioners
HH – Influence of personal hygiene habits
HL – Handling of leftovers
Income – Total yearly income of everyone in household
KFA – Kitchen facilities and the use of kitchen appliances
KL – Kitchen layout
LHC – Learn how to cook
Marital – Marital status
MPI – Ministry for Primary Industries
Occ – Occupational status
PCBs – Polychlorinated biphenyls
PH – Personal hygiene
Region – Region of living (District Health Board–DHB)
Residence – Area of residence
RFF – Awareness of responsibility for food safety
RTE – Ready to eat foods
SPF – The storage and preservation of food
TPB – Theory of Planned Behaviour
WHO – World Health Organization

Preface - Focus of this research

This study is about consumer behaviour concerning food safety in Brazil and in New Zealand, two countries with quite different socio-economic and cultural backgrounds. Risks to food safety were measured by applying a model for estimating the risk of food contamination, pathogen growth or survival in eight steps of food handling in the home. In addition, the model allowed the identification of the steps of most concern, as well as variables that influence the risky behaviour of consumers and groups that have the greatest susceptibility to food poisoning in these two countries.

Overview of thesis chapters

There are seven chapters in this thesis. This chapter, **chapter 1**, provides an introduction to food safety issues worldwide. The risks to food safety across the food chain and the consequences to human health and foodborne illnesses in Brazil and in New Zealand, are discussed. **Chapter 2** provides a detailed literature review about food safety in the home covering: domestic food preparation and risks to food safety in the home, human behaviour and food safety culture, and a review of consumer food safety studies. **Chapter 3** details models used for food safety risk assessment, gaps in knowledge and the objectives of this study. **Chapter 4** contains the methodology used in this study, the design of the questionnaire, the risk estimate calculation, the sample characteristics of the field survey, and the limitations of the research.

Chapter 5 focuses on the survey results covering: the statistical analysis and food safety risks in the home in both countries, significant variables contributing to consumer behaviour, groups of most concern, as well as contributing factors to the risk estimate. **Chapter 6** discusses the survey findings, details the most critical steps in the preparation of a meal by the consumer, variables significantly influencing the consumer behaviour and groups of most concern, compares the results from both countries and suggests strategies to reduce the risk of food poisoning in the home in Brazil and New Zealand.

In the **Chapter 7**, the reader will find the main findings and conclusions of this thesis. Limitations and recommendations are also included.

Gaps in Knowledge

Although foodborne illness is preventable, millions worldwide become ill each year, creating high economic costs, loss of productivity and reduced quality of life. In New Zealand, it has been estimated that over 100,000 cases of acute gastrointestinal illness caused by foodborne pathogens occur each year (Cressey, 2012). In Brazil, approximately 147,000 cases of foodborne illness are reported as outbreaks each year, and sporadic cases will add to this incidence.

Earlier studies found that the home is an important location where foodborne outbreaks occur while at the same time many consumers do not believe the home to be a risky place for food poisoning (Redmond and Griffith, 2003). Furthermore, the identification of critical control points (CCPs) for food safety in the home and for groups of most concern may be useful for driving improvements in risk communication and educational campaigns concerning food safety (Worsfold and Griffith, 1994).

There remain some challenging questions about food safety in the home and in particular how applicable these are in different countries. These questions are: 1. What are the most important critical control points (CCPs) for food safety in the home? 2. What variables have the most influence on consumer behaviour related to food safety? 3. What groups of people are of most concern across CCPs? 4. What are the contributing factors and the risky practices of consumers across the CCPs? Answers to these questions could help in targeting food safety educational strategies to reduce the prevalence of foodborne illnesses in households.

Objectives of this study

The aim of the present study is to investigate threats to food safety by examining food safety knowledge, beliefs and concerns, personal hygiene and food handling practices among consumers. Brazil and New Zealand were chosen as countries for this study as they represent very different socio-economic and cultural backgrounds, therefore this study should show the similarities and differences in behaviour that can be attributed to two quite different countries.