STUDY OF MICROBIOLOGICAL HAZARDS IN RAW MILK CHEESE AND APPLICATION OF HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP) SYSTEM

By

MAHA FAWZY LOTFY MOHAMED
B.Sc. Agric. Sc. (Biotechnology), Ain Shams University, 2013

A Thesis Submitted in Partial Fulfillment
Of

The Requirements for the Degree of

MASTER OF SCIENCE
in

Agricultural Sciences
(Agricultural Microbiology)

Department of Agricultural Microbiology
Faculty of Agriculture
Ain Shams University

2017

Approval Sheet

STUDY OF MICROBIOLOGICAL HAZARDS IN RAW MILK CHEESE AND APPLICATION OF HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP) SYSTEM

By

MAHA FAWZY LOTFY MOHAMED

B.Sc. Agric. Sc. (Biotechnology), Ain Shams University, 2013

This thesis for M. Sc. degree has been approved by:

Dr. Rashed Abdel Fattah Zaghloul **……..……**
Prof. of Microbiology, Faculty of Agriculture, Benha University.

Dr. Mona Mansour Mahmoud Oraby **……..……**
Prof. of Microbiology, Faculty of Agriculture, Ain Shams University.

Dr. Enas Abdel El Tawab Hassan **……..……**
Prof. of Microbiology, Faculty of Agriculture, Ain Shams University.

Dr. Azhar Abdel Fattah EL Sayed **……..……**
Prof. Emeritus of Microbiology, Faculty of Agriculture, Ain Shams University.

Date of Examination: 10/ 10 / 2017

STUDY OF MICROBIOLOGICAL HAZARDS IN RAW MILK CHEESE AND APPLICATION OF HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP) SYSTEM

By

MAHA FAWZY LOTFY MOHAMED

B.Sc. Agric. Sc. (Biotechnology), Ain Shams University, 2013

Under the supervision of:

Dr. Azhar Abdel Fattah EL Sayed

Prof. Emeritus of Microbiology, Department of Agricultural Microbiology, Faculty of Agriculture, Ain Shams University (Principal Supervisor).

Dr. Enas Abdel El Tawab Hassan

Prof. of Microbiology, Department of Agricultural Microbiology, Faculty of Agriculture, Ain Shams University.

Dr. Osman Abdel Aleem Abdel Latif

Associate Prof. of Food Science, Department of Agriculture Food Science, Faculty of Agriculture, Ain Shams university.

ABSTRACT

Maha Fawzy Lotfy Mohamed. Study of Microbiological Hazards in Raw Milk Cheese and Application of Hazard Analysis Critical Control Points (HACCP) System. Unpublished M.Sc. Thesis, Department of Agricultural Microbiological, Faculty of Agriculture, Ain Shams University, 2017

Domaiti cheese is the most popular soft white pickled cheese in Egypt. The objective of this study asses and improve the microbiological hazards, physiochemical quality and safety of some raw milk Domiati cheese produced by small traditional dairy plants in Egypt through application of HACCP system. Different Domiati cheese varieties were sampled from Cairo retails. The cheese varieties (raw and pasteurized milk) included Double cream, Tallaga, Baramely, Istanbully and Feta cheeses. Results indicated that raw milk soft white cheese samples were highly contaminated, having microbial load exceeding the acceptable limits. Total lactic acid bacteria and fecal *E. coli* were high counts in Double cream cheese (12.9x 10^3 and 4.1 x10^2 cfu/g, respectively). Total bacterial count, *Staphylococcus* sp. and yeast & molds were high counts in Tallaga cheese (9.2 x10^5, 13.0 x10^4 and 9.0x10^3 cfu/g, respectively). Tallaga, Baramely and Double cream were contaminated with some pathogenic bacteria, while Istanbully cheese was free of pathogens. Also, results showed that pasteurized soft white cheeses were absence of lactic acid bacteria (LAB). Pasteurized cheeses were free of pathogens. Also, coliforms and fecal *E. coli* were not detected in pasteurized cheeses. The present study showed that the pasteurized cheeses were low contaminated of bacteria and yeast & molds compared to traditional cheeses. Moreover, results showed that fat content was high in pasteurized cheeses compared to traditional cheese samples. Protein content in pasteurized cheese were blow standard, these results are relatively low when compared to protein content in traditional cheese, which ranged from 9-12%. Total solid, ash, NaCl and EC were low compared to traditional cheeses, while acidity was

high in pasteurized cheeses compared to traditional cheeses. Results observed that some preservatives agents was found in pasteurized cheeses produced by modern dairy plants in Egypt. Nisin as a preservative agent used in modern dairy plant.

Data in hazard analysis and critical control points (HACCP) system in dairy plant at Damietta Governorate showed that the all materials were high microbial load and contaminated with some pathogens. The count of Lactic acid bacteria (LAB) in raw milk ($10.9x10^4$ cfu/ml), decrease during the different steps of cheese processing from salting to ripening ($8.30x10^2$ and $2.16x10^2$ cfu/g, respectively). The same trends were observed for total count with numbers ($9.5x10^6$ cfu/g in ripened cheese). Regarding the other hygiene indicator microorganisms (coliforms, fecal *E coli* and *Staphylococcus* sp.) decreased during cheese processing. Results obtained that all pathogens were not detected of ripened cheese. Unhygienic conditions for the air and contact surfaces for the chain production line. The physiochemical characteristics of raw materials, in process, final cheese and by product (whey) showed that total solids in raw milk was 12.40 %. Total solids increased during cheese process up to a maximum in ripened cheese (42.60 %). pH value in raw milk was 6.0, then decrease in fresh and ripened cheese (4.10 and 3.91, respectively) while, acidity increased in ripened cheese (0.98%). The salt content was (12.74%) in ripened cheese. Results showed four critical control points (CCPs) were found in the production in this cheese plant. They are receiving milk, heating and salting of milk, renneting, packaging and ripening (storage).

Validation of HACCP plan for production of Tallaga raw milk soft white cheese to improve the microbiological hazards, quality and safety of Tallaga cheese. HACCP plan was implemented to validate and control *Staphylococcus* sp., *Salmonella* sp. and *Listeria* sp. in Tallaga cheese manufactured with different salt levels (6, 8 to 10 % salt), mesophilic & thermophilic lactic acid bacteria and ripening for 90 day at 5°C. The

results indicate an increase in thermophilic and mesophilic LAB counts during the ripening storage, the counts were at maximum by the end of ripening period (90 day) in different salt levels. Also, results observed that both counts of *Staphylococcus* sp., coliform bacteria and yeast & molds were decreased in cheese manufactured made by LAB, 8% and 10 % salt compared to 6 % salt (with and without LAB) and control treatment during the ripening period for 90 day at 5°C. The fully reduction of *Listeria* sp. and *Salmonella* sp. in Tallaga cheese manufactured with salt levels (8%,10% salt), mesophilic and thermophilic LAB after repining period 90 day at 5°C comparing to without LAB and control treatment. Data show that, during ripening the pH decreased, both developed acidity and total solids increased in cheese with cultures, especially thermophilic culture. Also, the same parameters reached the maximum records by the end of the ripening period (90 day). The HACCP plan design shown in the results which include control measure for hazards in Tallaga soft white cheese. In concluded HACCP system is an effective way for systematic assessment of prevention and control of the probable hazards in raw milk soft white cheese in Egypt.

Key words: HACCP system, Soft white cheese, Domaiti cheese, Pathogenic bacteria, Microbiological hazards and food safety.

ACKNOWLEDGEMENT

The author wishes to express his great appreciation, sincere thanks, and deepest grateful to the supervisor **Prof. Dr. Azhar Abdel Fattah EL sayed** Emeritus Professor of Microbiology, Faculty of Agriculture, Ain Shams University for suggesting the problem, drawing the plan of the work, valuable help, advise, kind guidance and continuous encouragement during the courses and the preparation of the manuscript.

My sincere thanks and appreciation to **Dr. Enas Abdel Twab Hassan** Professor of Microbiology, Faculty of Agriculture, Ain Shams University and **Dr. Osman Abdel allem Aita,** Assistant Professor, Department of food science of Agriculture, Ain Shams University for their supervision and valuable help during the courses of this work.

The author would like to express his great appreciations to all staff members of microbiology Department, Faculty of Agriculture, Ain Shams University for their encouragement and valuable help during the courses of this work.

I am particularly grateful to **my family, my husband** and **my friends** for their help and continuous encouragement during my study period.

CONTENTS

LIST OF TABLES

LIST OF FIGURES