THE USE OF TRANSGLUTAMINASE IN THE MANUFACTURE OF SOME DAIRY PRODUCTS SUBSTITUTED BY SOYBEAN PROTEINS

By

NEAMA SAID ALI MOHAMED FARRAG

B.Sc. Agric. Sc. (Dairy Technology), Ain Shams University, 2005

M.Sc. (Dairy Technology), Ain Shams University, 2011

A Thesis Submitted in Partial Fulfillment

Of

the Requirements for the Degree of

DOCTOR OF PHYLOSOFY

in

Agricultural Sciences (Dairy Science and Technology)

Department of Food Science

Faculty of Agriculture

Ain Shams University

2018

Approval Sheet

THE USE OF TRANSGLUTAMINASE IN THE MANUFACTURE OF SOME DAIRY PRODUCTS SUBSTITUTED BY SOYBEAN PROTEINS

By

NEAMA SAID ALI MOHAMED FARRAG

B.Sc. Agric. Sc. (Dairy Technology), Ain Shams University, 2005

M.Sc. Agric. Sc (Dairy Technology), Ain Shams University, 2011

This thesis for Ph.D. degree has been approved by:

Dr. Eissa Abd-Elghaffar Hassan Emara .....

Prof. Emeritus of Dairy Science and Technology, Animal Production Research Institute, Agriculture Research Center.

Dr. Yossef Moursy Elkenany .....

Prof. Emeritus of Dairy Science and Technology, Faculty of Agriculture, Ain Shams University

Dr. Hamdy Farag Haggag .....

Prof. Emeritus of Dairy Science and Technology, Faculty of Agriculture, Ain Shams University

Date of Examination: 26/12/ 2018

THE USE OF TRANSGLUTAMINASE IN THE MANUFACTURE OF SOME DAIRY PRODUCTS SUBSTITUTED BY SOYBEAN PROTEINS

By

NEAMA SAID ALI MOHAMED FARRAG

B.Sc. Agric. Sc. (Dairy Technology), Ain Shams University, 2005

M.Sc. Agric. Sc (Dairy Technology), Ain Shams University, 2011

Under the supervision of:

Dr. Hamdy Farag Haggag

Prof. Emeritus of Dairy Science and Technology, Department of Food Science, Faculty of Agriculture, Ain Shams University (Principal Supervisor)

Dr. Samah Mohamed Shalaby

Associate Prof. of Dairy Science and Technology, Department of Food Science, Faculty of Agriculture, Ain Shams University

ABSTRACT

Neama Said Ali Mohamed Farrag: The use of transglutaminase in the manufacture of some dairy products substituted by soybean proteins. Unpublished Ph.D. Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2019.

Food consists of several components of a complex structure and different shapes to suit different tastes of consumers. A protein is considered the most important component of milk, in addition to its role in nutrition, it is a food component which works to improve the functional properties of the structure, stability and handling of dairy products.

Because of the higher milk protein price compared to other plant proteins, the study suggested that a portion of bovine milk protein could be replaced by a protein from a plant source. Previous studies show that soybean proteins are the most suitable type of proteins that can be used in the food industry in general and dairy industries in particular because of its good functional characteristics in addition to its nutritional and technological characteristics. Thus, the study focused on the use of soybean milk as a source of plant protein. Despite all the benefits of soy milk, the main problem is the appearance of some defects when used with some dairy products, especially yoghurt or soft cheese, especially when using whole-fat soy milk such as the appearance of off-flavour compounds which necessitated the need to modify the composition of both cow's or soy milk.

One of the best method of modification used is enzymes due to its high specialized role and no toxic substance residues in food. The most important enzyme used is the transglutaminase EC(2.3.2.13). The objective of this study was the production of some dairy products fortified by soy proteins and treated with transglutaminase. In addition, reduce or overcome some of the disadvantages in the traditional dairy products manufactured using fortified soy proteins that have already been studied.

This study was conducted in two parts. The summary of the results obtained are:

Part I: Manufacture of yoghurt

In this part transglutaminase was used by 0.5, 1 and 1.5 u / g protein in cow's milk, soy milk or mixture of both. The characteristics of resulted yoghurt affected by ratio of transglutaminase used and soy milk. Generally, the sensory evaluation of yoghurt made from 100% soy milk and 0.5 u of TGase was preferred compared with untreated soy milk yoghurt. Also, by increasing cow's milk in mixture or dose of TGase the colour, texture profile analysis and scanning electron microscope enhanced. By increasing soy milk in mixture used for yoghurt production and decreasing TGase dose didn't enhance the flavour or overall acceptability of yoghurt samples but was better than the mixture of 2:1 cow milk and soy milk in synersis.

In the case of the use of transglutaminase and soybean milk in the manufacture of yoghurt, one unit of enzyme should be used.

Part II: Cheese manufacture

In this part soft cheese was manufactured by cow's milk: soy milk 1:1, 1:2 or 2:1 and TGase dose 1, 5 and 10 u/ g protein. The results obtained showed that in case of the use of transglutaminase and soybean milk in the manufacture of soft cheese, lower doses of the enzyme should be used. It means that 1 or 5 units of enzyme enhance the colour, volatile profile compounds, texture profile, scanning electron microscope, and sensory evaluation of soft cheese made from soy milk or mixture of soy milk and cow's milk.

Key Words: Transglutaminase, Cow's milk, Soybean milk.

ACKNOWLEDGEMENT

I wish to extend my deepest appreciation and sincere gratitude to **Prof. Dr. Hamdy Farag Haggag,** Professor of Dairy Science and Technology, Food Science Department, Faculty of Agriculture, Ain Shams University, for the kind attention and greater help provided for the accomplishment of this work and for his efforts, supervising the research, writing the manuscript and encouraging me through this course. It is difficult to express in words my deep respect to him. He learnt me many things which I never have had the opportunity to learn.

I wish to find the word to express my gratefulness thanks to **Dr. Samah Mohamed Shalaby ,** Associate Professor of Dairy Chemistry and Technology, Food Science Department, Faculty of Agriculture, Ain Shams University, for her true efforts to complete this work and plentiful advices for me to complete this work.

Thanks are also extended for the institute of food technology, Anhalt University of Applied Sciences, Germany **(Prof. Dr. Thomas Heinschmidt)** for providing the transglutaminase enzyme.

I would like to thank all the stuff members of Food Science and Technology Department at Ain Shams University. Thanks also to everyone who provided help or advised me to achieve this manuscript.

CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES