UNIVERSITI TEKNOLOGI MARA

OPTIMISING TREATMENT PARAMETERS FOR THE REDUCTION OF TOTAL FAT, SATURATED FAT AND CHOLESTEROL IN SQUID AND PRAWN BY *LACTOBACILLUS ACIDOPHILUS* YOGHURT USING RESPONSE SURFACE METHODOLOGY

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MSc

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

The purpose of this study was to optimise the total fat, saturated fat and cholesterol reduction in squid and prawn by *L. acidophilus* yoghurt using response surface method (RSM) of MINITAB software (version 13). Experimental design was created by RSM whereby test variables such as pH of sample, amount of *L. acidophilus* yoghurt, incubation temperature and incubation time were used. *L. acidophilus* yoghurt was prepared and compared to commercial yoghurt through sensory evaluation and rheological test. There were no significant difference ($p>0.05$) for both yoghurts in terms of aroma, appearance and viscosity. Squid or prawn with different pH was mixed thoroughly in *L. acidophilus* yoghurt and treated differently in terms of incubation temperatures and incubation times as suggested by the experimental design of RSM. The optimum centrifugal speed was investigated and RCF of 1,000 x g at the temperature of 2°C for 10 minutes showed the best performance. This speed was able to give 64.71% and 57.74%, reduction in total fat content of squid and prawn respectively. This centrifugation condition was used to determine the optimum amount of saturated fat and cholesterol reduced in treated squid and prawn. It was found that at optimum condition, the optimum reduction of saturated fat in squid were stearic acid (74.2%) followed by myristic acid (64.8%) and palmitic acid (62.8%). For prawn, the highest optimum amounts of saturated fat reduced were stearic acid (38.05%) followed by myristic acid (30.9%) and palmitic acid (14.99%). The optimum condition for optimum removal of myristic acid in squid was at pH 5.0, with 10.4% *L. acidophilus* yoghurt, incubated at 44.5°C for 97 minutes. For palmitic acid in squid, the optimum condition was at pH of 6.4, with 10% yoghurt, incubated at 45°C for 150 minutes. For stearic acid in squid, the optimum condition was at pH of 6.0, with 47.5% yoghurt, incubated at 29.9°C for 30 minutes. For myristic, palmitic and stearic acids in prawn, optimum removal condition was at pH of 7.0, with 33.1% *L. acidophilus* yoghurt, incubated at 45°C for 96.8 minutes. Cholesterol content in prawn was reduced (57.67%) more than in squid (46.39%). Prawn, when treated at the optimum condition; pH of 6.9, 50% yoghurt, incubation temperature of 45°C and time of 54.9 minutes, could reduce its cholesterol by 57.67%. Removal of 46.39% cholesterol in squid was achieved when treated with 10% yoghurt at pH of 6.5, incubated at 45°C for 150 minutes. In addition, the significant regression equations or models at 5% level of confidence were also established for the estimation of the percentage reduction of saturated fat and cholesterol in squid and prawn treated with *L. acidophilus* yoghurt. This indicates that *L. acidophilus* yoghurt is a potential candidate to be employed to reduce total fat, saturated fat and cholesterol in squid and prawn.

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CHAPTER 1

INTRODUCTION

1.1 Background

Coronary heart disease (CHD) is the most frequent cause of morbidity and mortality at the global level (Bertolami & Farnworth, 2003). In 2004, heart disease and disease of pulmonary circulation constitute 14.52% of the total certified deaths in government hospitals throughout the country, which represent 5,544 deaths and placing CHD as the second principal cause of death in Malaysia (Ministry of Health Malaysia, 2005).

It has been established that total fat (Mustad *et al.*, 1997), saturated fat (Baggio & Bragagnolo, 2006), cholesterol (Kimoto *et al.*, 2002; Kim *et al.*, 1994; Buck & Gilliland, 1994) and cholesterol oxides (Staprans *et al.*, 2003; Steinberg, 1997; Staprans *et al.*, 1996) in food are related to the development of CHD, which are responsible for the greatest number of natural deaths in many countries. Even though drug treatments have been used extensively, dietary change is still the basic therapy in most patients with hypercholesterolemia (Marieb, 1998).

According to Mustad *et al.* (1997), dietary changes by reducing intake of total fat and saturated fat, will lower serum cholesterol and Low Density Lipoprotein (LDL) level. The latter is believed to reduce the risk of arteriosclerosis, a condition caused by accumulation of plaques in the arteries wall, which can lead to the development of heart attack, stroke, circulation problems, and ends with death. A previous study had linked the intake of dietary cholesterol with coronary heart disease (Ulberth & Reich, 1992).