



**UNIVERSITI PUTRA MALAYSIA**

**SURVIVAL OF *LISTERIA MONOCYTOGENES*  
IN FROZEN BURGER PATTIES**

**WONG WOAN CHWEN**

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**SURVIVAL OF *LISTERIA MONOCYTOGENES*  
IN FROZEN BURGER PATTIES**

By

**WONG WOAN CHWEN**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra  
Malaysia, in Fulfillment of the Requirements for the Degree of Master of  
Science**

**June 2011**

The image features a large, light gray watermark of the UPM logo, which includes the letters 'UPM' in a red box, a stylized book icon, and a shield with geometric patterns. The watermark is oriented diagonally across the page.

**UPM**

**Dedicated to my beloved parents, siblings and friends for their endless  
love and support**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

**SURVIVAL OF *LISTERIA MONOCYTOGENES*  
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**June 2011**

**Chairman: Professor Son Radu, PhD**

**Faculty: Food Science and Technology**

*Listeria monocytogenes* is a foodborne pathogen which has caused outbreaks in several nations in which processed meats were the vehicle. The purpose of this study were to determine the prevalence of *L. monocytogenes* from frozen burger patties, assess the characteristics of the *L. monocytogenes* strains isolated from burger patties, and determine the effect of different cooking time in decontamination of *L. monocytogenes* in chicken burger patties.

A total of 220 samples were purchased from hypermarkets and retail shops in Malaysia from June to October 2009. Prevalence of *L. monocytogenes* in burger patties from this study was found to be 15.9%, in which the prevalence of *L. monocytogenes* in meat-based burger patties (22.3%) is

significantly higher than vegetarian burger patties (9.3%) at  $P < 0.05$ . *L. monocytogenes* was found to be most frequently detected in chicken patties (33.3%), followed by beef patties (22.9%), and fish patties (10.5%). By using MPN-PCR method, 15.9% of the samples were found to be positive for *L. monocytogenes*. MPN plating and direct plating method can only detected 7.7% and 7.3%, respectively. The density of *L. monocytogenes* detected in burger patties was ranged from 0 to 1,100 MPN/g.

Forty-one isolates of *L. monocytogenes* recovered from raw burger patties were characterized based on their antibiotic resistance and RAPD banding pattern. In particular, 31.7% of isolates were susceptible to 11 antibiotics tested. Result showed that, resistance to tetracycline was most common (46.3%), followed by erythromycin (36.6%), amikacin (31.7%), and SMZ-TMP (17.1%). All *L. monocytogenes* strains were sensitive towards imipenem and gentamicin. On the other hand, 31 out of 41 isolates in current study were typabled by RAPD-PCR with primer OPA 10. As observed from the dendrogram, these *L. monocytogenes* strains were classified into 3 clusters. These clusters were occupied by the strains recovered from all types of burger patties.

A simulation study was conducted to determine sufficient cooking time to reduce the number of *L. monocytogenes* present in chicken burger patties to

safe level which is fit for human consumption. Artificially contaminated burger patties were cooked for 0, 2, 4, 5, 8, and 10 min to determine survival of *L. monocytogenes*. Results demonstrated a linear correlation ( $R^2 = 0.87$ ) between mean log reduction of *L. monocytogenes* and cooking time. As a result from this study, it is suggested that a cooking time of 6 min or more is sufficient to decontaminate the burger patties, without control of temperatures of internal burger patties and cooking environment.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia  
sebagai memenuhi keperluan untuk ijazah Master Sains

**SURVIVAL *LISTERIA MONOCYTOGENES* DALAM DAGING BURGER  
SEJUKBEKU**

Oleh

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*Listeria monocytogenes* ialah patogen bawaan makanan yang telah menyebabkan wabak di beberapa negara, di mana daging terproses adalah medium untuk patogen ini. Matlamat kajian ini adalah untuk menentukan kekerapan *L. monocytogenes* dalam daging burger sejukbeku, mengenalpasti ciri-ciri pencilan *L. monocytogenes* yang dipencil dari daging burger, dan mengkaji kesan masa memasak yang berbeza terhadap penyahkontaminasi *L. monocytogenes* dalam daging burger ayam.

Sejumlah 220 sampel dibeli dari pasaraya dan kedai runcit di Malaysia dari Jun hingga Oktober 2009. Kekerapan *L. monocytogenes* dalam daging burger dari kajian ini adalah sebanyak 15.9%, di mana kekerapan *L. monocytogenes* dalam daging burger (22.3%) adalah lebih tinggi daripada burger

vegetarian (9.3%), signifikan pada tahap  $P < 0.05$ . *L. monocytogenes* didapati paling kerap dikesan dalam daging burger ayam (33.3%), diikuti dengan daging burger lembu (22.9%), dan daging burger ikan (10.5%). Dengan menggunakan kaedah MPN-PCR, sebanyak 15.9% sampel adalah positif bagi *L. monocytogenes*. Manakala, kaedah plating MPN dan plating langsung hanya dapat mengesan 7.7% dan 7.3%, masing-masing. Kepadatan *L. monocytogenes* yang dikesan dalam daging burger berada dalam julat 0 hingga 1,100 MPN/g.

Empat puluh satu pencilan *L. monocytogenes* yang dipencil dari daging burger mentah telah dicirikan berdasarkan kerintangan antibiotik dan pola pita RAPD. Khususnya, 31.7% pencilan *L. monocytogenes* adalah sensitif terhadap 11 antibiotik yang diuji. Keputusan kajian menunjukkan bahawa kerintangan *L. monocytogenes* terhadap tetrasiklin adalah paling umum (46.3%), diikuti eritromisin (36.6%), amikasin (31.7%), dan SMZ-TMP (17.1%). Kesemua pencilan *L. monocytogenes* adalah sensitif terhadap imipenem dan gentamisin. Sebaliknya, sebanyak 31 daripada 41 pencilan dalam kajian ini dapat ditaip dengan RAPD-PCR oleh primer OPA 10. Seperti yang diperhatikan dari dendrogram, pencilan-pencilan *L. monocytogenes* telah diklasifikasi kepada 3 kelompok. Kesemua kelompok telah dihuni oleh pencilan-pencilan yang dipencil dari semua jenis daging burger.



Suatu kajian simulasi turut dijalankan untuk menentukan masa memasak yang mencukupi untuk mengurangkan kuantiti *L. monocytogenes* yang hadir dalam daging burger ayam ke tahap yang selamat dan sesuai untuk dimakan oleh manusia. Daging burger yang dikontaminasi telah dimasak selama 0, 2, 4, 6, 8, 10 minit untuk menentukan kemandirian *L. monocytogenes* dan keputusan menunjukkan korelasi lurus ( $R^2 = 0.87$ ) di antara pengurangan purata log *L. monocytogenes* dan masa memasak. Keputusan kajian ini mencadangkan bahawa masa memasak 6 minit atau lebih adalah mencukupi untuk menyahkontaminasi daging burger, tanpa mengawal suhu dalaman daging burger dan suhu persekitaran memasak.

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I certify that a Thesis Examination Committee has met on 16<sup>th</sup> June 2011 to conduct the final examination of Wong Woan Chwen on her thesis entitled “Survival of *Listeria monocytogenes* in frozen burger patties” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the degree of Master of Science.

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## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is nor concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

WONG WOAN CHWEN

Date:



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