# THE EVALUATION AND CONTROL OF FOOD SAFETY IN HAWKER FOODS IN KUALA LUMPUR

## A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT BY THE UNIVERSITY OF WALES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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## DECLARATION AND STATEMENT

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

This thesis is the result of my own investigations, except where otherwise stated.
Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed: ......................................
(Poh See Toh)

Date:   3 February 2000

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# ABSTRACT

Hawker foods in Malaysia are ready-to-eat or prepared-on-demand foods for consumption on-site, or takeaways, prepared by ubiquitous small entrepreneurs[1]. Social, cultural and economic benefits of food hawking activities are clouded by food safety related problems such as inadequate basic amenities, lack of enforcement, lack of personal hygiene, improper foodhandling practices, lack of training and inadequate formal education[2]. This has been reinforced by several studies conducted in Malaysia which have highlighted the prevalence of safety problems related to preparation and handling of hawker foods[3].

A challenge study "The Evaluation and Control of Food Safety in Hawker Foods in Kuala Lumpur" was carried out using a hybrid of research methods (structured interviews, assessments, laboratory and questionnaire survey). The study proper, made up of six studies (profiles, knowledge and attitudes-based interviews, risk assessments of foodhandling practices (FHP) and food-contact surfaces (FCS) of hawkers and questionnaire survey of the control authority) was geared towards the evaluation and control of food safety in hawker foods. A total of 196 samples were used for the entire six studies. 100 "willing-to-participate" ethnic hawkers (Malay, Chinese and Indian) of 4 categories (designated site, day/night markets, kiosk and by the roadside) were used for the structured interviews. 9 hawker stalls selling three traditional culture foods (*nasi lemak, char koay teow and roti canai*) were used for the risk assessment and 27 food-contact surfaces were tested using dipslides for contamination levels. The total population of Health Inspectors ($n=60$) was used for the questionnaire survey of the control authority. The results showed positive impact of culture on knowledge and attitude scores of the hawkers ($p=.05$) and that education enhances hawkers' knowledge and attitude scores and environment was not demonstrated in general to impact on hawkers' knowledge and attitudes. High concern was recorded for foodhandling practices of hawkers and moderate to high concerns for food-contact surfaces. The results also highlighted positive significance in topical areas pertaining to food safety knowledge of Health Inspectors (HIs) with different experience backgrounds but experience was not demonstrated in general to impact on practices of HIs. Education was noted to have conflicting effects on *General food safety practices and knowledge* scores of HIs.

The findings highlight the importance of training to bridge cultural gaps in food safety knowledge and attitudes of hawkers. FHP and FCS findings provided useful food safety/hygiene indicators of a preventive nature and a yardstick for the situation-to-be (hawkers to be relocated to designated sites from year 2000). The findings on the control authority suggested indispensability of on-the-job experience to complement training and integration of the control process into the training, attitudes and practices of hawkers.

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[1] Toh, Poh See and Birchenough, A. (1999; 2000).
[2] George, J. (1990).
[3] Arumugaswamy et al. (1995); Rusul et al. (1996); Desmarchier et al. (1994).

# PUBLICATIONS AND PRESENTATIONS

## Publications

### A. *Research Papers:*

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**Toh Poh See** (2000). Food Safety and Hawkers: Public Health Control in Malaysia. CONCORD (Research Journal of the University of Wales Institute Cardiff, UK). Accepted: January 2000.

### B. *Book of Abstracts:*

**Toh, Poh See** and Birchenough, A. (1999). Food Safety Knowledge: A Study of Hawkers in Malaysia. Third International Food Safety HACCP Conference. Noordwijk aan zee. The Netherlands. 18-19 October 1999.

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## Poster Presentations

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**Toh, Poh See**, Birchenough, A. and Smalley, T. (2000). A Study of Food Safety Knowledge and Enforcement Practices of A Public Health Authority in Malaysia. 8th Annual Public Health Forum. Partnership, Participation and Power. Harrogate International Centre. 28-29 March 2000.

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# INTRODUCTION
## Research Aims and Objectives

*"Knowledge of man is not neutral*
*in its import; it grants power*
*over man as well"*
Friedricks, R., 1970.

# INTRODUCTION

This chapter presents a holistic approach to the thesis on "The Evaluation and Control of Food Safety in Hawker Foods in Kuala Lumpur". This thesis, based upon six studies on hawkers and the public health control authority (mapping hawker activities; knowledge-based interviews; attitude-based interviews; risk assessments of foodhandling practices (FHP); risk assessments of food-contact surfaces (FCS); and practices and knowledge of the public health control authority) is presented under three distinct entities of Study 1 (Mapping and Structured Interviews of Hawkers), Study 2 (Risk Assessment and Laboratory Study) and Study 3 (The Food Safety Enforcement Questionnaire Study). This chapter will spell out the Aims and Objectives for the entire research. It will be linked to the Review of Literature and the Research Methods and Strategies adopted for the entire study, which will be presented in Chapters Two and Three.

Hawker foods are ready-to-eat or prepared-on-demand foods for immediate consumption on-site, or takeaways, prepared by ubiquitous small entrepreneurs (Toh, Poh See and Birchenough, 1999; 2000). Studies have reported concern about microbial contamination of hawker foods in Malaysia and other Asian countries (Yang and Xu, 1991; Arumugasamy et al., 1995; FAO, 1995; Desmarchier et al., 1994; Bryan, 1995). In 1988, 17 deaths were reported in the Malaysian State of Perak and were attributed to the consumption of *"lo shee fun"* (rice noodles) bought from hawkers (M.O.H.[Ministry of Health, Malaysia], 1990, 1995; Dawson et Canet, 1991). Similarly, a WHO survey carried out in 1993 indicated

a concern by member countries of the potential hazards of hawker foods as well as approaches for managing these hazards.

Implementing the triple approach of legislation, education and training (WHO, 1996) in Malaysia is hampered by problems related to improper personal hygiene, insanitary handling practices and habits, improper basic amenities/infrastructure and the lack of financial support (Harrison, 1990). Little information is available on current hawker food practices in Malaysia. A restricted informal study conducted in 1986 revealed a low level of education among the hawker population and it was thought that this could contribute to inadequate knowledge of hygienic food practices (George, 1990). This work needs updating and expanding and needs to include attitudinal studies.

Knowledge and attitudes together can determine behaviour and this information should be available to direct remedial educational strategies which should be developed in line with local needs (WHO, 1993). Education rather than punishment of hawkers has been advocated (Abdusalam & Kaferstein, 1993). However, no mention was made as to the reasons for the statement. Hawkers need to be motivated in order to carry a sense of pride in selling safe foods. This study hopes to complement, supplement and meet the current gap of understanding of hawker foods and will explore the culture, environment, health and control implications of this micro industry. Prior approval (Appendix 1) to conduct this research was obtained from the Mayor of Kuala Lumpur. The

primary Aims and Objectives of this study are extended into six (6) broad areas (Diagram 1a).

# RESEARCH STRATEGIES

## MIND-MAPPING OF PRIMARY RESEARCH AIMS AND OBJECTIVES

**FOOD SAFETY AND CONTROL IN HAWKER FOODS**

1. **MAPPING HAWKERS' ACTIVITIES**
   - Hawker identity
   - Significance of hawker foods
   - Prevalence of health problems

**HAWKERS' :-**

2. **KNOWLEDGE**

3. **ATTITUDES**
   - Food Safety/Hygiene
   - Foodborne Illnesses and their Prevention
   - Food Regulators and Regulations

4. **FOOD-HANDLING PRACTICES (FHP)**
   - Biological agents (hazards) in hawker foods
   - Risk from hawker foods
   - Control measures (Critical Control Points)

5. **FOOD-CONTACT SURFACES (FCS)**
   - Contamination in FCS
   - Hazards, Risks and Critical Control Points (CCPs)
   - Monitoring requirement

6. **CONTROL AND PUBLIC HEALTH ISSUES**
   - Background of Control Authority
   - Knowledge in Food Safety/Hygiene
   - Current enforcement practices

## 1.1 AIMS AND OBJECTIVES

**Study 1** (Chapter Four):

1. Mapping Hawker Activities

2. On-site Structured Interviews of Hawkers

**Aims:**

- To map hawker activities

- To determine hawkers' knowledge of and attitudes towards food safety, foodborne illnesses and their prevention in Kuala Lumpur (KL).

**Objectives:**

- To establish a general profile of hawkers in Kuala Lumpur in terms of demography, significance of hawker foods in an urban setting and the prevalence of health and other related problems arising from hawker foods and activities.

- To assess (On-site and in a naturalistic environment) hawkers' food safety/hygiene knowledge and attitudes.

- To gauge the awareness of hawkers relating to safe foods for public consumption to prevent outbreaks of foodborne illnesses.

- To evaluate the extent of current knowledge and attitudes of hawkers vis-à-vis Food Regulators and Regulations.

**Study 2** (Chapter Five):

1. Risk assessment of foodhandling practices (FHP) of hawkers.

2. Laboratory study of food-contact surfaces (FCS) of hawker stalls.

**Aims:**

- To evaluate hawkers' foodhandling practices

- To establish the contamination levels as "preventive measures" of food-contact surfaces of hawker food stalls.

**Objectives:**

FHP:

- To observe the actual (by researcher immersion) practices of hawkers of three ethnic foods (Nasi Lemak, Char Koay Teow and Roti Canai) in 13 distinct areas of concern (Tebbutt, 1991).

- To assess the biological hazard related to risk (high, medium and low) from foodhandling practices of hawkers.

- To determine the extent (if any) of control measures (CCPs Critical Control Points) and monitoring required (for the handling procedure at each CCP to be properly carried out and under control).

FCS:

- To assess levels of bacterial contamination in FCS (work surfaces, chopping boards and dishcloths).

- To determine CFUs (colony-forming units) of bacteria and to assess their risks (an estimate of the likelihood that the hazard will occur) at "significant" or "unacceptable" [1] levels (CAST Council for Agricultural Science and Technology, 1994).

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[1] The level with which the human immunity system is unable to cope without any adverse effects (CAST, 1994).

- To evaluate the prevalence of hazards, risks, and CCPs in FCS of hawkers.

**Study 3** (Chapter Six):

**Aim:**

1. To establish the background profile of the Control Authority.
2. To evaluate the food safety/hygiene practices and knowledge of the Control Authority.

**Objectives:**

- To determine the experience and background education of the Control Authority

- To evaluate the Food Safety/Hygiene knowledge of the Control Authority.

- To assess the current enforcement practices of the Control Authority.

Malaysia in general and KL in particular has a pluralistic society with its social wealth attributed by its multi-ethnic (Malays, Chinese, Indians and Others), multi-lingual (Bahasa Malaysia, Mandarin and Tamil) and multi-cultural (Malay, Chinese, Indian, British, Dutch, Portuguese, Arabic, Thai, Indonesian and others) identity. In line with these unique social and cultural structures of the country, this study is equipped with Secondary Aims (Chart 1b) of determining the impact of key demographic profile (ethnicity, age and education) of hawkers and of the Control Authority (background education and experience) on safety and control of hawker foods. It is postulated that a

study in this direction (aimed at measuring similar dimensions) has never been fully explored in the past. Hence, this study will attempt to fill the research gap. Chapter Four (Assessing Profile, Knowledge and Attitudes of Hawkers) and Chapter Six (Assessing Profile, Knowledge and Enforcement Practices of Control Authority) will address issues such as (Chart 1b): -

- How does the demographic profile of hawkers relate to their knowledge and attitudes towards food safety, hygiene and the regulators?
- How does the background profile (experience and background education) of the Control Authority relate to their knowledge and enforcement practices?

The findings of Chapter Five (Risk Assessments of Foodhandling Practices and Food-contact Surfaces in Hawker Stalls) via on-site visual assessment and laboratory methods will be used in an attempt to validate the findings of knowledge and attitudes of hawkers in Chapter Four.

Information gained from this study whilst specific to Kuala Lumpur will have a wider application to Malaysia and other countries. This will be of importance given the exponential growth in the number of people involved in food hawking. It is hoped that the findings of this research may provide directions for the appropriate course of action

to be taken by relevant authorities and organizations with regards to public health issues and the hawker micro industry.

Diagram 1b

RESEARCH STRATEGIES

MIND-MAPPING OF SECONDARY AIMS AND OBJECTIVES

1. Demographic Profile of Hawkers in Kuala Lumpur

- Effect on knowledge
- Effect on attitudes

2. Background Profile of Control Authority

- Effect on knowledge
- Effect on enforcement practices

FOOD SAFETY
AND
CONTROL
OF
HAWKER FOODS

# CHAPTER TWO

# BACKGROUND

# AND

# REVIEW OF LITERATURE

"I am easily satisfied with the very best".
Winston Churchill.

This chapter covers a review of literature in three main areas, namely: (1) Hawker Industry, (2) Food Safety, Foodborne Illnesses and Control, (3) Education and Training and nine sub-sets. The synopsis of this chapter is presented in Diagram 2.

Diagram 2

**The Food Hawker Industry**
- Overview
  - convenience foods
  - national economy
  - employment opportunities
  - cultural heritage and tourism
  - public health
  - nutrition

**Food Safety, Foodborne Illnesses and Control**
- HACCP

- Risk Assessment

- Epidemiological Data
  - prevalence of foodborne illnesses

- Knowledge, Attitudes and Practices of Hawkers

- Control Authority and Enforcement
  - Food Hygiene and Legislation
  - control of hawker foods

**Education and Training**
- Hawkers

- Control Authority

**RESEARCH GAPS?**

## 2.1 THE FOOD HAWKER INDUSTRY

### 2.1.1 OVERVIEW

Food hawking activities originated at a time when there were high unemployment, low wages, limited social programs and urbanisation (Bryan, 1993, ICC [International Children Centre], 1994; FAO, 1995). Hence, hawking became an important part of the lifestyle of the populace of countries in Asia, Latin America, Africa and the Caribbean (FAO, 1997). Jayasuriya (1993) affirmed that street-vended foods are a familiar sight in most Asian countries.

### *2.1.1.1 Convenience Foods*

In many developing countries, it is well recognised that hawker foods provide: (1) affordable, nutritious and quick meals; (2) an essential service to factory, construction and office workers, shoppers and persons in transit (trains, buses, taxis); (3) a part of the daily lifestyle of persons of all incomes; (4) the necessary convenience to city workers with neither the facilities nor the time to cook; and (5) the acculturation opportunity for the palate of tourists (Dawson, 1990; Bryan, 1993; Parson, 1997). Studies have found that hawker foods flourished because food establishments with modern standards of sanitation were not always located near work places, markets, construction sites, schools, hospitals factories, bus and taxi terminals (Dawson & Canet, 1991; Bryan, 1993; FAO, 1995). According to

Bryan (1993), hawker foods provide a significant service to persons with time constraints to commute between home and the work place.

### 2.1.1.2 The National Economy

Food hawking is a lucrative business (Parson, 1997). Bryan (1993) attributed the growth of the hawker population to positive cash flow, tax-free earnings (profits are not easily computed), independent choice of food items to sell and operating hours, very low capital outlay and a smaller likelihood of being subjected to regulations.

Viewed in the aggregate, hawker food sector has become a very large part of the local economy (FAO, 1997; WHO, 1996). Studies by FAO (1997) have observed that starting a hawker business requires little investment and successful vendors usually have good entrepreneurial skills based on common sense, ingenuity, communicative skills and an understanding of small business operations.

It has been estimated that the total sales from 100,000 hawkers in Malaysia were valued at US $2.2 billion a year (Dawson & Canet, 1991; Chauliac & Gerbouin-Perolle, 1994). In the city of Bogor, Indonesia's annual sales of hawker foods amounted to US$67 million (Cohen, 1986) and in China, 131 billion Chinese Yuan was the annual sales figure of hawker food for 1990 (approximately 10% of the total output value of industry and agriculture) (Dai Yin, 1993). In Calcutta, based on estimates of the number of vendors and their monthly average income, the

hawker food trade has been estimated at a profit of nearly US100 million per year (Chakravarty - FAO, 1997). Studies carried out by FAO & University of Bogor, Indonesia (1986) have shown that 25% of household expenditure in KL was spent on hawker foods, 30% in Iloilo (Philippines), 90% of the population in Bangkok (Thailand) had frequent meals outside the home; and the lower income groups in many developing countries spent 50 - 79 % of their income on hawker foods` (FAO. 1989).

The success of the hawker industry (usually owned by individuals or families), with its immediate benefits to those who produce, market and sell foods, is frequently highlighted (Winarno & Allain, 1991; See et al., 1993; Jayasuriya, 1993: FAO, 1995).

### 2.1.1.3 *Employment Opportunities*

Hawker foods have become an indispensable component of the socio-economic environment of many cities in the developing countries (Dawson, 1990; FAO, 1997). FAO/WHO Reports (1988 - 1996) have classified hawkers as an important group in the society of countries with hawker culture. Ten percent of the population in KL depended on hawking for their income (George, 1990).

In KL itself 10 % of the city population who work there depend on hawker foods for their daily meals. The 1996 hawker statistics issued by the Dewan Bandaraya (City Hall), Kuala Lumpur (DBKL), showed 36,500 of the 200,000 licensed hawkers in Malaysia were located in KL; 10,000 operating inside buildings

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(designated sites), 15,000 along roadside/open air sites (kiosks) and 11,000 at day/night markets (NST [New Straits Times], 1997; DBKL, 1998). The 36,500 hawkers in KL were reported to be of diverse ethnic representation such as 34 % Malays, 57 % Chinese and 9 % Indians (DBKL, 1997). However, the true extent of the hawker industry in KL was not known, as there are no figures for the unlicensed or illegal temporary and/or ambulant hawkers.

### 2.1.1.4    *Cultural Heritage and Tourism*

Socio-economic changes in recent years in many countries have brought about tremendous changes in the hawker industry (WHO, 1996). The Asian and Pacific countries, for example, represent a diversity of cultures and long traditions unmatched anywhere else in the world (Jayasuriya, 1990). Hawker foods have been commented on as adding colour to street life and acted as one of the attractions in the tourism trade (Dawson, 1990; Goh, 1993). It was reported that in Singapore and Malaysia, hawking extends into theme activities such as food fairs with food carts and food wagons set up but under strict environmental control (Goh, 1993; Jayasuriya, 1994).

Hawker foods have long traditions in many countries of the world (WHO, 1995). Hawkers reflect the social, cultural and economic context of most Asian countries (Winarno & Allain, 1991; FAO, 1995; ICC, 1994). Jayasuriya (1994) has postulated that hawking would always remain a part of the social, cultural and economic fabric of life in Southeast Asia even though health threat issues continue

to be prevalent in the micro industry (M.O.H <sup>Ministry of Health</sup>, 1995; 1998). In many cities with big ethnic populations, the traditional role of hawker foods has emerged as an important social factor; ethnic groups have easy access to their traditional foods (Dawson, 1990).

### 2.1.1.5    Public Health

Benefits of food hawking activities are clouded by social and health problems (George, 1990). With the rapid increase in the hawker population in KL, public health problems such as blocked drains, inappropriate location, poorly-designed stalls, inadequate basic amenities, poor management, poor personal habits, improper food handling practices, lack of adequate health awareness and traffic congestion have become evident (Harrison, 1990; NST, 1997). Studies have highlighted that the problems were further complicated by a lack of enforcement, lack of personal hygiene in hawkers, a lack of concern on health issues by the relevant authorities and a lack of training of the enforcers and foodhandlers (George, 1990 See et al., 1993; FAO, 1995).

Information pertaining to incidences of foodborne illnesses and outbreaks of diseases derived from hawker foods are scant. Bryan (1992) and Weingold (1994) have recommended using epidemiological data from other sources as benchmarks for risks estimates. Hazard analysis has been recommended as the appropriate tool for detecting hazards and assessing related risk (especially where foodborne disease surveillance is either under-developed or under-utilized) of hawker foods

(Bryan, 1993). On-site evaluations as part of the hazard analysis critical control point (HACCP) approach to food safety are well and frequently documented (Bryan, 1992; Albrecht, 1995; WHO, 1996).

It has been reported that in Malaysia, compulsory licensing was imposed on food hawkers in a move toward the regulation of hawkers, the hawker industry and hawker foods (NST, 1997).

### 2.1.1.6    *Nutrition*

Studies on the nutritional and safety values of hawker foods have indicated that hawker foods generally provide a well balanced diet (Dawson, 1990; Chen, 1994; FAO, 1995; WHO, 1996). To improve the nutritional and safety aspects of hawker foods, FAO (1997) have recommended steps to be taken towards improving (1) the conditions under which the food is prepared and sold and (2) the overall quality of the raw and processed foods used by the hawkers.

Studies conducted in Asia have highlighted a weakness on the part of the consumers of hawkers foods as "they do not make food choices based on proper nutrition" (FAO, 1997). Based on numerous studies, FAO (1997) predicted that in countries where hawker foods play an important role of fulfilling the need for meals of the population, the hawker micro industry will be depended upon to play a significant role in providing reliable, accessible, nutritious and wholesome food for the increased urban needs by the year 2000.

## 2.2    Food Safety, Foodborne Illnesses and Control

Despite advances in food science and technology, foodborne diseases remain one of the major causes of global health problems and reduced economic productivity (ILSI, 1995). Increased knowledge about the severity and socio-economic consequences of foodborne diseases on individuals and entire nations has contributed to the demand for safer food supplies. Population changes (with more vulnerable people like the very old and very young, pregnant women, the undernourished and the immuno-compromised individuals) has increased concern about the safety of food.    Changing lifestyle, industrialization, mass food production, urbanization, environmental pollutiuon, tourism, and international trade in food are other contributing factors influencing food safety (ILSI, 1995).

Foodborne diseases or illnesses due to contaminated food, are one of the most widespread health problems of the contemporary world and an important cause of human suffering (WHO, 1993).  Once thought to be eliminated as a public health problem, infectious diseases remain the leading cause of death and disability-adjusted life years (DALYs) worldwide (World Bank, (1993). Dramatic changes in society, technology and the environment, together with the diminished effectiveness of certain approaches to disease control, have ushered in an era wherein the spectrum of infectious diseases is expanding, and many infectious diseases once thought to be controlled are increasing - Box 1  (MMWR, 1994).

## Box 1 :   Examples of Emerging Infectious Diseases, 1993

### Diseases In the United States[1]

Coccidioidomycosis

Cryptosporidiosis

Drug-resistant pneumococcal disease

*Escherichia coli* 0157: H7 disease

*Hantavirus* pulmonary syndrome

Influenza A/Beijing/32/92

vancomycin-resistant enterococcal infections

### Diseases outside the United States[2]

Cholera,  Latin America

Dengue,  Costa Rica

Diphtheria,  Russia

*E. coli* 0157:H7,  South Africa and Swaziland

Multidrug-resistant *Shigella dysenteriae*,  Burundi

Rift Valley Fever,  Egypt

*Vibro cholerae* 0139,  Asia

Yellow Fever,  Kenya

[1] MMWR, 1994
[2] MMWR, 1994

Ewen C. D. Todd (1987) suggested that public health authorities should pay more attention to the economic impact of foodborne diseases on local, national and international economies. According to Todd, the following facts remain : (1) foodborne disease, unlike most communicable diseases, is not diminishing, (2) preventive measures or antibiotic treatment are rarely effective, (3) food as much as water is the vehicle for the millions of diarrhoeal cases each year in developing countries, (4) traditionally-recognized pathogens, such as *Salmonella*, are becoming more of a problem as more food is being processed, and (5) every decade new pathogens are being identified as foodborne, for example *Campylobacter, Listeria* and *E. coli* 0157:H7.

From the traditional viewpoint, the main cause of diarrhoea has been contaminated water supplies, but food is now recognized as a vehicle contributing to a high proportion of the cases (WHO, 1984). According to Montarjemi and Kaferstein, (1994), home-prepared foods under unhygienic conditions contribute to frequent contamination and diarrhoeal diseases.

Although the economic impact of foodborne diseases in developing countries has never been estimated, it has been suggested to be much greater than the industrialized countries; not in purely monetary costs but in the impact on family, local and national economies (Todd, 1987). The social cost has to be considered in terms of high infant mortality, malnutrition, chronic diarrhoea, lost work and child care. In industrialized countries, where convenience foods are prepared for people

who want to spend as little time in the kitchen as possible, its society would have to contend with the increasing risks of contamination in the mass production of foods and the economic disruption arising from foodborne illnesses and/or outbreaks. *Salmonella* (poultry carcasses), *Campylobacter* (carcasses), *Clostridium botulinum* (canned foods), *Listeria monocytogenes* (cheeses), *Staphylococcus aureus* (foodhandlers) and *E. coli* (chopping boards) are some of the more commonly cited bacteria of foodborne diseases pertaining to food preparation and production in the developed countries (Todd, 1987; Maurice, J., 1994; CDR, 1990 & 1996).

One suggested method by Todd (1987) to combat these costs (from foodborne illness) is the "early warning system": reporting and taking immediate action from the first case identified. Current and historical measures used to prevent and to control foodborne infections and intoxications are voluntary processing and handling controls practised by the food industry together with surveillance, educational and/or regulatory activities. With voluntary controls practised by the food industry, there could be surveillance of : (1) diseases, (2) food handlers, (3) foods, (4) facilities in which foods are processed, transported, stored and prepared and equipment on which foods are processed and prepared and (5) operations (practices, procedures, or processes) to which foods are exposed. Improved surveillance, including improved laboratory services, is needed to assess the extent of illness and death associated with infectious diseases so that priorities can be assigned to control efforts (Bryan, 1986).

Bryan (1986) has classified the approaches to implement food safety laws and to reduce the risks of foodborne diseases under the following six categories:-

(1) **Surveillance of foodborne diseases**: using preventive and control measures; data can indicate prevalent foodborne diseases, common causative agents, places where mishandling occurs and factors that contribute to outbreaks.

(2) **Surveillance of foods**: using organoleptic (smell, appearance, mouthfeel) evaluations, measurements of physical properties, chemical analysis and microbiological testing.

(3) **Surveillance and training of people who handle foods**: based on medical history, physical examination, blood analysis, X-rays and examination of faeces (with significant limitations to each of the examinations - WHO, 1989) and training in safe food-handling practices.

(4) **Surveillance of facilities and equipment used for production or preparation of foods**: providing potable running water, adequate plumbing systems, toilet and hand-washing facilities, and functioning sewage disposal systems.

(5)     **Surveillance of food operations** : ensuring  the safety of food processing, preparation, storage operations and the physical facilities to avoid proliferation of micro-organisms.

(6)     **Education of the public** : incorporating information of food safety in the school curriculum;  informing adults of hazardous practices associated with preparation and storage of common foods and the appropriate measures to counter the hazards.

Factors that have contributed to outbreaks of foodborne illness have reflected hazards. These factors aid in establishing critical control points (CCPs) using measures that would  either eliminate or  reduce hazards (Bryan, 1982;  WHO, 1992). Data obtained from such exercises could provide vital information upon which to assess the severity of the hazards and risks.

### 2.2.1     HACCP

Efforts by the international public health authorities to address the global problem have led to the official endorsement by the Codex Alimentarius Commission of the growing international recognition of HACCP as the optimal food safety tool. HACCP was devised to predict the likely hazards associated with a particular food that can be applied to any point in the supply of that food (ILSI, 1996), including

improving the safety of street-vended foods (WHO, 1996; Bryan, 1993; Norlaili, 1996).

The implementation of the HACCP more than thirty years ago, as a means of systematically addressing food safety concerns, is gaining international acceptance both by industry and regulatory agencies. According to Buchanan (1995), an understanding of the relationship among HACCP, microbiological criteria and risk assessment is important.

The HACCP concept is a systematic approach to the identification, assessment and control of hazards - Diagram 3. HACCP is a series of interrelated actions that provide a high degree of assurance of food safety during production, processing, storage and preparation operations (Bryan, 1990). The HACCP system has been recommended for the food industry because it provides the most specific and critical approach to the control of microbiological hazards in foods (Buchanan, 1995).

## Diagram 3

**The HACCP Concept**

```
Determine Hazards and Assess their Severities and Risks
                        ↓
            Identify Critical Control Points
                        ↓
Institute Control Measures and Establish Criteria to ensure Control
                        ↓
            Monitor Critical Control Points
                        ↓
        Take Action Whenever Monitoring Results
               Indicate Criteria are not Met
                        ↓
      Verify that the System is Functioning as Planned
```

Source : Bryan, F.L., 1990

Detailed, accurate and global information on food contamination is essential if occurrences of foodborne illnesses are to be minimised (UNEP United Nations Environmental Programme, 1992). Data from countries like the United States, England and Wales and Australia show that the major factor in outbreaks of foodborne diseases is the holding of cooked foods at ambient (room and outside) temperature for several hours (Bryan, 1978, 1988b, 1993; Roberts, 1982; WHO 1996).

With the rapid growth of the "Small and Medium Industries" (SMIs) and the increased violation of the Food Regulations in Malaysia, the Food Quality Control Unit (FQCU), Ministry of Health, Malaysia introduced a systematic monitoring and surveillance on SMIs. It has been reported that training on the HACCP was provided at state and national levels (M.O.H, 1995). In Malaysia, HACCP was intended for the prevention and control of food safety hazards in foods and the risks of them occurring at specific points in food production and preparation (WHO, 1995; Bryan, 1992; Busta, 1998).

The need to improve the safety of hawker foods has been expressed by member countries of WHO (WHO, 1995). HACCP, the recommended approach for street-vending (WHO, 1995), could identify critical food safety risk factors which could be the basis for the training and education of foodhandlers, the control authority and consumers (ICMSF, 1989, 1997).

Bryan (1995) has suggested that although the risks of acquiring foodborne illnesses from foods prepared and/or vended on streets appeared to be high, there were however only scant epidemiological data to support this hypothesis. Epidemiological data could be extracted from sources like hawker push carts, work-tables, equipment and other factors that contribute to foodborne illness outbreaks (Bryan, 1995). According to Bryan, hazard analysis carried out at places where hawkers prepared and vended their food (part of HACCP) could help

detect on-site hazards and assess related risks where foodborne illness surveillance was either under-developed or under-utilized.

### 2.2.2    RISK ASSESSMENT

Risk assessment is an objective and scientific process (Potter, 1996). It evaluates the magnitude of health risks,  improves the safety of foods, facilitates the flexible public health distribution of pre-harvest, harvest and post-harvest food safety resources, and helps create a continuum for "farm-to-fork" foodborne disease prevention efforts (Potter, 1996). Risk assessment, from an application standpoint, is defined as the process of identifying hazards, assessing risks and evaluating their significance (LACOTS Local authorities coordinating body on food and trading standards, 1995).  Risk assessment has been highlighted as  "a way to delineate between significant risks that require action and a multitude of insignificant or at tolerable level risks" (Buchanan, 1995;  Pariza, 1995; Notermans & Teunis, 1996).

Several sources have highlighted that a particular risk factor could be assessed only when there was a distinction made between hazard and risk (WHO, 1996; FAO, 1997; ILSI,  !996;  Bryan, 1991) . The Food Safety Issues reported by WHO (1996) suggested hazard as "a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect". According to Henson and Traill (1993) risk could be considered as "the inverse of food safety - the probability of not suffering some hazard from consuming the food in question", whilst according to Bryan (1988a),  risks from processing,

preparing and eating foods have been assessed on the basis of the frequency of association with vehicles of foodborne pathogens and toxins (Bryan, 1988a).

Against a backdrop of new challenges to the safety of the food supply, new strategies for evaluating and managing food safety risks have been recommended (Lammerding et al., 1997). Scientists have found that changes in pathogens, food preparation, distribution and consumption and population immunity could cause adverse effects on human health. Although the HACCP concept seems appropriate to meet the needs of both food producers and legislative authorities, its use does not necessarily result in food free from pathogens (Notermans et al., 1995). According to Lammerding (1997), quantitative assessment of the hazards associated with consumption of a particular food product is the implied practical approach to food safety control. Risk assessment provides a framework for predicting the impact of changes and trends on the provision of safe food (Lammerding et al., 1997).

Studies by Bryan (1976, 1978, 1979, 1980 and 1987) have linked epidemiological data of foodborne illnesses to HACCP-based risk assessment from surveillance. The studies were carried out to determine the effects of practices, procedures, processes, vehicles (like meat, poultry and cream pastries), agents and many other factors contributing to foodborne diseases. Weingold et al. (1994) has suggested that a new system be developed whereby epidemiological data from foodborne disease surveillance could be readily incorporated into risk assessment.

Quantitative Risk Assessment or Risk Analysis (QRA) as defined by Notermans & Jouve (1995), is a stepwise analysis of hazards that may be associated with a particular type of food product, permitting an estimation of the probability of occurrence of adverse consequences from consuming that particular product. Risk assessment was conceived as a mechanism for identifying and analyzing potential dangers (risks) in a rational manner so that appropriate strategies for response might be fashioned (Pariza, 1992). Recent calls for the increased use of foodborne disease risk assessment from several international groups would increase the importance of risk assessment as a link to microbiological criteria for foods in HACCP (C.A.S.T., 1994; Rose et al., 1995). Risk assessment is a recommended tool for describing a system in which a microbial hazard reaches its host and causes harm (Pariza, 1992; Buchanan, 1995; Todd & Harwig, 1996: Notermans & Teunis, 1996). Risk assessment methodology consists of four distinct steps - Box 4 (C.A.S.T, 1994; Notermans & Jouve, 1995; Jaykus, 1996; Lammerding et al., 1997).

The widespread implementation of HACCP systems has resulted in the proposal of quantitative risk assessment as a means of providing a health-outcome-based specification of microbial criteria for HACCP plans (Buchanan, 1995; Rose et al., 1996). Lammerding (1997) cited an improved understanding of the many factors that determine the safety of the food supply as one of the most important benefits in the adoption of quantitative risk assessment; providing the only systematic

means to interpret the impact of changes or trends before they became a source of epidemiological data.

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**Box 4: Quantitative Risk Assessment Process**

1.    **Disease characterization/Hazard identification:** determining if a micro-organism(s)  is linked causally through food consumption to human health and as such seeks to identify the foods, agents and potential adverse health effects associated with the microbiological risk agent

2    **Exposure assessment**: the quantitative estimation of the dose of potentially hazardous organisms to which the consumer is exposed at time of consumption.

3.    **Dose-response assessment**: the process of obtaining information on the negative health effects of exposure to potentially hazardous organisms. Dose-response assessment translates exposure into disease and provides information about the probability (risk) that an adverse event will occur.

4.    **Risk characterization**: integrating the information gathered in Steps 1 - 3 and ranks the disorders according to severity and frequency, human perception and economic and social consequences, enabling a decision  to be made on the acceptance of a particular risk (including determination of the most important factors causing the risk).

## 2.2.3 EPIDEMIOLOGICAL DATA

It is widely accepted that for every reported case of foodborne illness, there are many more unreported. Estimates of the World Health Organization have shown that only 10% of incidences of foodborne illnesses occurring in European countries were reported (WHO, 1992). According to Scott (1996), reported cases were most likely those who sought medical attention and probably represent those who were seriously ill or those in the compromised immune systems (the very old, infants, recuperation patients, AIDS patients) category. The unreported cases were usually those with mild illness who treated themselves or consulted a doctor but for some reason did not get reported. USDA (1989) has confirmed epidemiological data as an invaluable source in determining educational priorities.

In Malaysia, foodborne diseases are on the increase. In the past, statistics from the Ministry of Health, Malaysia have shown low incidence rates for the country due to under-reporting. With the establishment of the National Food-Poisoning Register in 1988, there has been an improved system of monitoring food-poisoning outbreaks thus improving the reliability of data on the incidences of diseases in the country (Singh, J., 1993). The annual incidence of food-poisoning in Malaysia (1988 - 1992) has ranged from 9.3 to 20.5 per 100,000 of the population (M.O.H., 1992). From 1993 to 1996, the incidence rates of food poisoning ranged from 8.4 to 15.3 per 100,000 population (M.O.H., 1997) and in the first half of 1998, the statistics showed 1968 food poisoning cases, 987 cholera cases, 275 typhoid cases and 14 hepatitis A cases (NST, 1998).

In Malaysia, even though there has been a marked decrease in the incidence rate, food poisoning still remains a major cause of morbidity especially in institutions, factories and street food stalls. In 1995, a total of 33 notifications with 1,438 cases including two deaths were recorded with most of the outbreaks occurring in schools (83.8%). The true magnitude of the problem is unknown due to under-reporting. It was noted that food preparation and handling practices had been far from satisfactory and inadequate enforcement in urban areas had resulted in an increase in illegal hawking in ready-to-eat food (MOH- Malaysia, 1995).

There has been a decline in the incidence of dysentery over recent years (MOH, 1996), with an incidence rate for 1995 of 0.75 per 100,000 population. Its control was largely due to early reporting and treatment of the patients (MOH, 1995).

*Bacillus cereus, Staphylococcus aureus, Clostridium perfringens, Salmonella spp.* and *E. coli* have been commonly implicated in foodborne illness outbreaks in Malaysia. The 1995 statistics of the Ministry of Health, Malaysia showed high incidences of foodborne illness in school canteens (562 cases), hostels (1942 cases) and public eating houses (120 cases).- (M.O.H., 1995). The major contributory factors identified were poor personal hygiene of foodhandlers and improper storage or holding temperature of foods (Singh, 1993; M.O.H., 1995). Chicken was implicated in 10 outbreaks, eggs in eight, meats in seven, noodles in six, rice in five, vegetables in four and prawns, fish-cake, traditional cake ("putu mayam ") and UHT milk in one outbreak (M.O.H., 1996).

Documented "Reported Cases of Foodborne Illnesses in the Southeast Asian countries" (Table 1a) and "Incidence of Communicable Diseases (Reported Case) in Malaysia 1986 - 1996 per 100,000" (Table 1b) were published.

Epidemiological data are the best source of information that lead to identifying hazards, assessing risks and establishing priorities (Bryan, 1987). The data provide insight to common foodborne diseases, places where foods are mishandled, common vehicles, and factors that contribute to the cause of outbreaks. It is important for such data to be accurate and relevant to HACCP. Accompanying the development of epidemiology and improved surveillance of foodborne diseases, specific factors (faulty practices, procedures and processes) that contribute to the occurrence of outbreaks of these diseases have become apparent (Bryan, 1987; Desmarchier, 1994; Weingold, 1994).

## Table 1a:  Cases of Gastroenteritis of Southeast Asian Countries [3][4]

| Country | Population (millions) | Cases of Gastrointestinal Diseases Where Pathogens Isolated | | | | | | | Cases of General Gastroenteritis Reported to Government Health Facilities or Estimated | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cholera | Typhoid/ paratyphoid fever | Amoebiasis/ bacterial dysentery | Food Poisoning (bacterial) | Infectious Hepatitis | Total | No./100000 | Total | No/100000 |
| Indonesia | 146.8 | 47056 | 19038 | - | - | - | 66094 | 45.0 | 60000000 | 40872 |
| Japan | 120.0 | 55 | 338 | 997 | 31125 | - | 33515 | 27.1 | - | - |
| Philippines | 48.1 | 1898 | 3222 | 27378 | 719 | 9578 | 42795 | 89.0 | 250000 | 520 |
| Thailand | 44.8 | 645 | 6584 | 12984 | 36041 | 14200 | 70454 | 157.3 | 170000 | 380 |
| Malaysia | 13.8 | 67 | 2000 | 1545 | 1700 | 2223 | 7535 | 54.6 | 150000 | 1087 |
| Singapore | 2.4 | 40 | 118 | - | 619 | 601 | 1378 | 57.4 | 82552 | 3440 |

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[3] Jegathesan, 1986

[4] Southeast Asia Medical Information Centre, 1985

## Table 1 b: Incidence of Food and Waterborne Diseases (Reported Cases) in Malaysia 1986 – 1996 per 100,000[5]

| Year | Cholera | | | Typhoid inc. Paratyphoid | | | Food Poisoning | | | Dysentery | | | Hepatitis | | |
|------|------|-----|------|------|----|------|------|----|------|------|---|------|------|---|------|
| | Case | D* | IR** | Case | D | IR | Case | D | IR | Case | D | IR | Case | D | IR |
| 1986 | 54 | 2 | 0.33 | 2845 | 23 | 17.66 | 1877 | 11 | 11.65 | 846 | 1 | 5.25 | 7261 | 3 | 45.07 |
| 1987 | 584 | 9 | 3.53 | 2962 | 12 | 17.92 | 2272 | 10 | 13.74 | 955 | 1 | 5.77 | 4526 | 4 | 27.04 |
| 1988 | 753 | 17 | 4.44 | 1731 | 4 | 10.2 | 1643 | 25 | 9.68 | 774 | 0 | 4.56 | 1977 | 0 | 11.65 |
| 1989 | 393 | 14 | 2.24 | 1785 | 3 | 10.21 | 1782 | 2 | 10.2 | 633 | 0 | 3.62 | 1769 | 1 | 10.12 |
| 1990 | 2071 | 37 | 11.53 | 2223 | 9 | 12.38 | 1251 | 1 | 6.69 | 548 | 1 | 3.05 | 1265 | 0 | 7.04 |
| 1991 | 504 | 5 | 2.77 | 1999 | 26 | 10.99 | 1094 | 0 | 6.01 | 434 | 0 | 2.38 | 1666 | 0 | 9.16 |
| 1992 | 699 | 13 | 3.87 | 1764 | 5 | 9.76 | 960 | 2 | 5.31 | 379 | 1 | 2.1 | 1571 | 0 | 8.69 |
| 1993 | 995 | 13 | 5.13 | 1442 | 9 | 7.43 | 1638 | 1 | 8.44 | 261 | 0 | 1.35 | 915 | 0 | 4.72 |
| 1994 | 523 | 0 | 2.67 | 1031 | 9 | 5.27 | 1229 | 3 | 6.28 | 151 | 0 | 0.77 | 402 | 0 | 2.05 |
| 1995 | 2209 | 27 | 10.9 | 906 | 8 | 4.46 | 1438 | 3 | 7.08 | 152 | 0 | 0.75 | 419 | 0 | 2.06 |
| 1996 | 1486 | 2 | 7.02 | 953 | 9 | 4.5 | 3236 | 0 | 15.29 | 121 | 0 | 0.56 | 849 | 0 | 4.01 |

\* Death
\*\* Incidence rate

[5] Epidemiological Unit, Ministry of Health. Malaysia (unpublished data)

The annual incidence of food poisoning in Malaysia ranged from 11.6 per 100,000 in 1986 to 15.2 per 100,000 in 1996 (M.O.H., Malaysia). Restricted epidemiological data (M.O.H. unpublished data, 1996) suggested that places of outbreak were schools (65%), homes (7%), eating places (1%) and other institutions (factories, commercial establishments, universities, hospitals, airlines) - (27%). Contributory factors of foodborne illness outbreaks were identified as: (1) improper storage, (2) holding temperatures of foods, (3) poor personal hygiene, and (4) raw ingredients obtained from unsafe source. *Bacillus cereus, Staphylococcus aureus, E.coli, Salmonella and Clostridium perfringens* were reported as causative agents in local food poisoning outbreaks (M.O.H. unpublished data, 1996). Although limited contributory factors were reported locally, documented sources have highlighted additional factors of:

- a lapse of 12 hours or more between preparing and eating,
- cross-contamination of raw and cooked foods,
- inadequate temperature and time during cooking,
- improper cleaning of equipment,
- improper cooling,
- inadequate reheating, and
- colonised person/s handling food

(Bryan, 1988, 1993, 1995, Weingold et al., 1994; FAO, 1995, WHO, 1996)

Reports have indicated high health risk levels in food establishments, especially those selling take-away foods.

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Little is known of the extent these factors might contribute to food poisoning outbreaks from consumption of hawker foods. Hawker foods have been reported as high risk retail foods (Bryan, 1993; FAO, 1995). Yet according to Tinker (1997), hawker foods generally pose no greater risk for public consumption than foods prepared in an average home or in a local restaurant. Studies in the past have highlighted findings of bacteria types (*Salmonella, B. cereus, E. coli*) and colonies in home-prepared and hawker foods (Bryan, 1993; Desmarchier et al., 1994; Arumugaswamy et al., 1995; Rusul et al. 1996). Findings of this nature are curative in nature; little is known of studies in the preventive direction.

Reducing the incidence of food poisoning would depend on concerted action on farms, in abattoirs and food processing plants, in wholesale and retail outlets and in kitchens (CDR, 1995). All links in the food chain are important but epidemiological data have indicated the home and foodservice establishments as more frequently implicated (ICMSF, 1989, 1997; Bryan, 1988, 1992, 1993; Desmarchier et al., 1994; Albrecht, 1995; Scott, 1996). Although the risks of acquiring foodborne illnesses from hawker foods appear relatively large, there has been only scant epidemiological information to confirm this hypothesis (Bryan, 1993).

## 2.2.4  KNOWLEDGE, ATTITUDES AND PRACTICES

It is believed (Howes et al., 1996) that reducing foodborne illness in the general population depends on positively altering the behaviour of food handlers.

Sustainability of safe foodhandling practices can be enhanced by continuing food handler education, developing and implementing on-site foodhandling policies which support the knowledge learned, and by maintaining a positive attitude towards safe food-handling among all employees within the hawking sector.

It has been documented that hawkers are poor, uneducated and lack appreciation for safe food handling (WHO, 1995, 1996) and that females dominates the industry (CIDEF [Centre International de l'Enfance], 1994). Studies by FAO (1995) have found poor knowledge of food handling practices among the foodhandlers. An informal study by Dewan Bandaraya (City Hall), Kuala Lumpur (DBKL), revealed a lack of knowledge of good food handling and a failure of hawkers to comply with health requirements (George, 1990). Problems associated with hawking cannot be easily eliminated unless there is an in-depth investigation to ascertain the causes. Studies by Albrecht (1995) on food handling knowledge and practices (time/temperature control, prevention of cross-contamination and sources and modes of transmission of food poisoning bacteria) have shown a lack of knowledge in foodhandlers. Relevant to current issues on food safety/hygiene and foodborne illnesses and their prevention, several studies conducted in Malaysia have confirmed the prevalence of safety problems related to the preparation and handling of hawker foods (See et la., 1993; Desmarchier et al., 1994; Arumugaswamy et al., 1995; Rusul et al., 1996;). Documented outbreaks (MOH 1990-1995; WHO, 1993; FAO, 1995) on microbial food contamination of hawker foods due to a lack of knowledge, education, training and attitudes (Bryan, 1993) have also been highlighted.

Bryan (1991) has postulated that knowledge and attitudes are key attributes of concern in outbreaks of food poisoning and their prevention, food handlers' hygiene and safe hawker foods. Attitudes, an important factor besides knowledge and enforcement, ensure a downward trend of foodborne illnesses (Howes et al., 1996). The necessary link of positive behaviour, attitudes and continued education of foodhandlers towards the sustainability of safe food handling practices have been highlighted (Howes et al., 1996).

According to CDC [Centre for Disease Control], (1994) contamination of food items is frequently found in preparation places of food service establishments and homes. Epidemiological data pertaining to foodborne illnesses from hawker foods are under-developed with cases of foodborne illnesses often unreported.

The epidemiological data (Box 2) collected over two decades (1961-1982) has shownd that certain operations have contributed to foodborne outbreaks. The most commonly identified places of mishandling have been foodservice establishment. Outbreaks also follow mishandling in homes and some large and devastating outbreaks have followed improper processing.

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╔══════════════════════════════════════════════════════════╗
║  ┌────────────────────────────────────────────────────┐  ║
║  │   Box 2:  Contributory Factors to Foodborne Outbreaks │ ║
║  └────────────────────────────────────────────────────┘  ║
```

1. **Improper cooling**: holding foods at room temperature or storing large deep containers of foods in refrigerators.

2. **Lapse of 12 or more hours** between preparing and serving.

3. **Colonized person** handled implicated food.

4. **Incorporating contaminated raw food**/ingredients into foods that received no further cooking.

5. **Inadequate cooking**, canning or heat processing.

6. **Improper hot holding.**

7. **Inadequate reheating.**

8. **Obtaining food from unsafe source.**

9. **Cross contamination**

10. **Improper cleaning of equipment and utensils.**

Source : F. L. Bryan (1990)

In the food industry (manufacturing and certain retailing establishments, primary emphasis has been placed on the microbiological monitoring of foods. Observations thus far indicate that much less is known about the levels of contamination in the kitchen environment (Roberts, 1980; Tebbutts, 1990). According to Tebbutt, (1991), inspection of food premises was in the past carried out based on the overall appearance and the physical condition of the buildings. However, recent developments have highlighted the need for more structured inspections particularly in premises selling foods which can present a higher microbiological risk. A joint study of the Audit Commission and the Institute of Environmental Health Officers on 5000 premises in the UK found 17% of

restaurants had a significant risk. The study identified areas of particular concern such as hygiene awareness and practices, the lack of effective temperature control and the likelihood of cross-contamination from equipment (Audit Commission, 1990). One study highlighted a risk assessment approach (using visual assessments and microbiological sampling to quantify the risks) as an effective system for monitoring potential health risks in high-risk food premises (Tebbutt, 1991).

Microbiological hazards identified through HACCP have continually been cited as one of the more important and persistent food safety concerns. These have led to significant increase in foodborne diseases in many countries during recent years (Buchanan, 1995; Montarjemi et al., 1996). Weingold et al. (1994) and Bryan (1989) have contended that those responsible for food safety should set programme priorities rationally on the basis of the nature and magnitude of local and regional problems and on the quantity and quality of available or obtainable resources.

## 2.2.5   CONTROL AUTHORITY AND ENFORCEMENT

It has been reported that RM 40 million ($\cong$ US$ 10 million) was allocated for the hawker industry in Malaysia (NST [New Straits Times], 1997). A National Hawker Policy for Malaysia to protect the interests of the hawkers and the consumers and to ensure the systematic development of the sector (acknowledged as a significant contributor to the country's economy) was formulated (NST, 1997). The policy also set guidelines for enforcement officers so as to prevent the abuse of power. In

a move to upgrade and relocate the hawker sector, the Malaysian Government has since made it a requirement for new buildings to be equipped with food courts to house food vendors hawking along roadsides (NST, March 19 1997). This line of action reflected an additional effort to phase out dirty eateries (NST, May 24 1997) by the year 2000 (NST, August 23 1997).

Increased awareness of food safety issues by the general public, the education of street food hawkers, greater sensitivity on the part of regulatory officials, and improved commitment of governments in assisting the expansion would help in achieving the overall goals of food safety (Parson, 1997). The aetiology of food safety, its impact on public health, and epidemiology all vary and the problems associated with these issues in developed countries can be expected to emerge also in developing countries (Desmarchier et al., 1993). It has been reported that Asian countries offering a rich diversity in food production, marketing and cooking, have a relatively long history of having had recourse to the law to ensure the safety of food (Jayasuriya, 1994).

The safety of food through a variety of laws, regulations, standards, guidelines and control measures is frequently documented (IFST [Institute of Food Science & Technology, UK], 1992; Hendon & Traill, 1993) It has, however, been suggested that the enforcement effort of regulatory agencies be focused on working with establishments to prevent problems from occurring in the first place (IFST, 1992). Recommendations for the training of regulatory officials to include preventive

measures (foodborne diseases and spoilage rather than on aesthetics) in critical operations are well-documented (Jayasuriya, 1994; WHO, 1996).

An integrated approach involving all the authorities having responsibilities relating to the control of food quality, safety and health risks of hawker foods has been advocated. This would include local authorities, top foodservice management personnel and the local police working with hawkers to help solve these problems.

More and more consumers world-wide are concerned about the safety of the food they eat. Their major concerns involve foodborne pathogenic micro-organisms, pesticides residues, food additives/ preservatives and nutritional imbalances (Henson and Traill, 1993; Wolf and Lechowich, 1989). This concern has been further reinforced by food regulators and food microbiologists who have ranked microbiological hazards as the main issue in food safety. Because of this, the Food and Drug Administration (FDA) of the United States has shifted its emphasis from relatively low risk additives to foodborne microorganisms (Wolf and Lechowich, 1989).

One of the major objectives of food policy in all developed and developing countries has been the control of risks associated with food production and consumption. Although many factors are related to the foodborne disease risk of a food establishment, three specific factors have been identified: (1) food property risk, (2) food operation risk and (3) population (meal/consumer volume) risk. Establishments, which sell many different kinds of potentially hazardous

foods, are considered to be in a high food property risk category. Establishments at which foods are subject to extensive processing/handling are considered to be in a high food operation risk category and high sales volume establishments were said to have a high population risk (Henson & Traill, 1993; Lawrence, T.W, 1997).

Recommending the epidemiological history (factors that are known to have contributed to outbreaks of foodborne diseases) of foods as an essential prerequisite for setting up priorities, Bryan, (1988a) has suggested that establishments selling foods that have been identified as vehicles of foodborne illnesses should be given a high priority for preventive and control activities by initiating HACCP systems.

For the HACCP approach to microbiological control to be the keystone of food safety and quality control, both food producers and regulatory agencies must share the belief that the identification and control of critical points is integral to the control of microbiological hazards (ICMSF, 1988; Food Technology, 1992). In this context, the International Commission on Microbiological Specifications for Foods (ICMSF) has suggested the use of a regulatory agency to minimise the public health hazards of foods and to provide a total management commitment to the HACCP approach in order to achieve mutual goals. Examination of the monitored data and the responses made by the food establishment to these data

could enable the health inspector to have more confidence in the control programme than any single inspection visit could provide.

As for food regulations in the hawker food sector, experts have recommended an integrated approach involving all the authorities (at the municipality level) with responsibilities for improving the food quality, safety and health risks of street foods (FAO, 1997). The FAO's past experience in the matter has resulted in its recommendations to accommodate or consider the expectations of all municipal authorities concerned in order to achieve food quality and safety objectives. At the Municipal level, mutual co-operation of the street food vendors and local authorities, top management in the Health Ministry and the local police could help in solving problems

The high prevalence of foodborne illnesses coupled by the limitation of resources in the developing world make the HACCP system a potential and viable solution to combat the problems faced. According to Montarjemi (1996), there has been increasing awareness in developing countries about the importance of the HACCP system. Malaysia, amongst other developing countries, has taken a regulatory approach to promote HACCP in the food safety system. Its Ministry of Health, besides having incorporated HACCP system into the draft Food Hygiene Regulations, had introduced programmes to sensitise its staff to the HACCP system since 1989. Consequently, health inspectors, public health officers and food scientists have undergone training and since 1990, the HACCP system has

been incorporated into the basic training curriculum for health inspectors (Montarjemi et al., 1996). Bryan (1992) has suggested that the critical control points that have been identified to control the preparation of food have been the targets for food safety education programmes aimed at preventing foodborne illnesses.

Hence, in a concerted effort to achieve the goal of providing foods of "tolerable" or "acceptable" risk, food scientists and governments have resorted to the triple approaches of legislation, education and training (Jayasuriya, 1990 :Abdussalam & Kaferstein,1993; WHO,1996; FAO,1995).

### 2.2.5.1    *Food Hygiene Legislation*

In the past, innumerable ordinances, codes of practices, and laws concerning the processing, handling and sale of foods have been promulgated by local, national and international authorities to protect the public from adulterated food, fraud and foodborne illnesses (Bryan, 1992). The diversity of cultures in Asian countries has led to different approaches for assuring the safety of food (Jayasuriya, 1990). Some societies rely on strict enforcement of detailed food safety regulations whereas others depend on informal, voluntary approaches based more on traditional methods of food production and handling. Hence, Food safety laws and control mechanisms of Asian Pacific countries were classified in August 1990 (as a result of the WHO Regional Seminar on Food Safety Legislation held in Kuala Lumpur, Malaysia) into three broad groups  (Box 3).

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┌─────────────────────────────────────────────┐
│  ┌──────────────────────────────────────┐   │
│  │              Box 3                    │   │
│  │ Food safety laws and control mechanism│   │
│  │     of Asia Pacific countries         │   │
│  └──────────────────────────────────────┘   │
│                                               │
│   A.  Countries with developed regulatory    │
│       system                                  │
│       Australia, China, Hong Kong, Malaysia,  │
│       New Zealand, Philippines, Republic of   │
│       Korea and Singapore.                    │
│                                               │
│   B.  Countries with a Basic System           │
│       Fiji, Papua New Guinea, Vanuatu and     │
│       Vietnam.                                 │
│                                               │
│   C.  Countries without a System              │
│       Brunei Darussalam, Federated States of  │
│       Micronesia, Laos and Western Samoa.     │
│                                               │
└─────────────────────────────────────────────┘
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### 2.2.5.2  *The Control of Hawker Foods*

Studies to-date (Dawson, 1990) have shown a lack of uniformity in licensing requirements (including health certification) among countries. According to Jayasuriya (1993), the policy and framework within ' which hawker foods is regulated must strive to balance competing concerns; each country should devise a mix of policy and legislative approaches appropriate to its social, economic and developmental context, taking into account rural/urban differentials.

A survey was carried out by WHO in 1993 for its Member States to:

(1)  assess the hawker food situation and

(2)  to obtain the views of responsible authorities concerning

the hazards posed by hawker foods.

The results of the survey  (reflecting a wide variety of ethnic foods, types of operation, facilities and infrastructure) indicated a concern by Member States of the potential hazards of hawker foods as well as approaches for managing these hazards.  It was also acknowledged that many of the hawkers belong to the lower income and social group and they have inadequate knowledge on safe food handling (WHO, 1996).

Reported concerns about microbial contamination of hawker foods in Malaysia and other Asian countries are well documented (See et al., 1993; Arumugaswamy et al., 1995; Whitehead, 1991; Bryan, 1992).  Desmarchier, P. et al. (1994) reported that the bacterial counts in some  fish food items were reduced to acceptable levels when it was fried, steamed or boiled.   Microorganisms implicated in past studies were mesophilic aerobic bacterial counts - *Bacillus cereus,  Staphylococcus aureus* and *Clostridium.*

## 2.3 EDUCATION AND TRAINING

It has been reported (Eilers, 1990; Oblinger, 1988) that improper foodhandling practices contribute to approximately 87 % of foodborne illnesses in foodservice establishments and homes. According to Howes et al. (1996), several private and governmental agencies have introduced foodhandler education courses as one of the measures to reduce the number of foodborne illnesses. Reports and documents of the FAO and WHO have echoed the call for improvements in the preparation and sale of hawker foods to meet the growing awareness and demands of consumers for safe and nutritious foods. (Torres, - FAO, 1995).

Calls for the interaction and cooperation of local governments worldwide with consumer associations in an effort to prepare and disseminate educational information on food safety and quality have been aimed at protecting consumerism through education and training (Torres, FAO, 1985). According to WHO (1992), the training of food handlers in personal hygiene, safe handling and preparation of food is an essential part of any strategy to improve the safety and quality of street-vended food and should be done in conjunction with licensing. Bryan has suggested that food safety be incorporated into health education curricula in schools because the pupils either are already consumers of hawker foods or will soon be and in some may become vendors themselves. Bryan has further proposed the development of appropriate health education material for use by teachers who should be appropriately trained in the principles of food safety.

### 2.3.1    *Hawkers*

The education and training of hawkers are cost-effective interventions for governments to ensure the safety of food as most foodborne hazards might be prevented if food handlers are equipped with the knowledge pertaining to thorough cooking, hot holding, rapid cooling, cold storage, and avoidance of cross-contamination (WHO, 1995). WHO (1995) has recommended the use of information gathered during HACCP studies regarding monitoring procedures and corrective actions for training health and food inspection personnel and hawkers. By identifying the critical practices of specific street-vended operations and by helping to rank operations according to risk, HACCP could be used to target education, training and legislation where they would be of the greatest benefit to protect public health (WHO, 1995).

### 2.3.2    *The Control Authority*

Implementing the triple approach (education, training and legislation) in Malaysia has been hampered by problems related to improper personal hygiene, insanitary handling practices and habits, improper basic amenities/infrastructure and lack of financial support   (George, J., 1990; Harrison, 1990).   Little information is available on hawker food practices in Malaysia. A restricted informal study conducted in 1986 revealed a low level of education among the hawker population and it was thought that this could contribute to inadequate knowledge of hygienic food practices (George, 1990). The work is in need of updating and expanding and needs to include information on hawkers' profile and attitudinal studies. Domestic

kitchens remain a major source of human food for home consumption and for sale through the hawker informal food distribution sector (Desmarchier et al., 1994). Hence, the importance of a culturally acceptable education on safe food-handling practices has been seen to prevent foodborne illnesses (Desmarchier et al., 1994). To achieve this, WHO (1987) have suggested identifying unsatisfactory practices and the sociocultural factors that influenced them.

According to WHO (1993), remedial educational strategies which should be developed in line with local needs. In the past, isolated studies have been carried out on the social, cultural, economic and public health aspects of hawkers and hawker foods, there is no evidence of studies linking profile, culture, environment, food safety knowledge, attitudes, practices and control of hawker foods. A study to link these variables with a laboratory validation would be valuable and worthwhile research endeavour towards filling the research gap identified thus far. It is timely for an on-site visual and measurable challenge study with a view to establishing a hawker database for use in countries with hawker culture worldwide.

# RESEARCH METHODS

# AND

# STRATEGIES

*"The simple truth is that a truly representative sample is an abstract ideal unachievable in practice".*
Coolican, M. (1994)

## 3.1 RESEARCH METHODS AND STRATEGIES

This section provides an overview of the methodologies employed and a brief discussion on the strengths and limitations of each research instrument used. Two main elements critical to this research are sample (respondent) selection and the *hybrid* [2] or combined studies (standardised interview, survey-type data, risk assessment) and laboratory research strategies.

### 3.1.1    Sample Characteristics

This thesis covers a wide spectrum of research areas as indicated by the Aims and Objectives. To best present it, the research is based upon three distinct studies (Diagram 4: Study 1, Study 2 and Study 3) with different modes of sample selection (diagram 5). Detailed descriptions of the research samples will be provided in each individual chapter.

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[2] Inbreeding between strategies (Robson, 1996)

## Diagram 4

Three distinct studies pertaining to the research "The
Evaluation and Control of Food Safety in Hawker Foods".

THE EVALUATION AND CONTROL OF FOOD
SAFETY IN HAWKER FOODS

**Study 1**

- Assessing Hawkers' Profile,
  Knowledge and Attitudes

**Study 2**

- Risk assessments of Food-
  handling Practices and
  Food-contact Surfaces
  in Hawker Stalls

**Study 3**

- Assessing Profile, knowledge
  and enforcement practices of
  Control Authority.
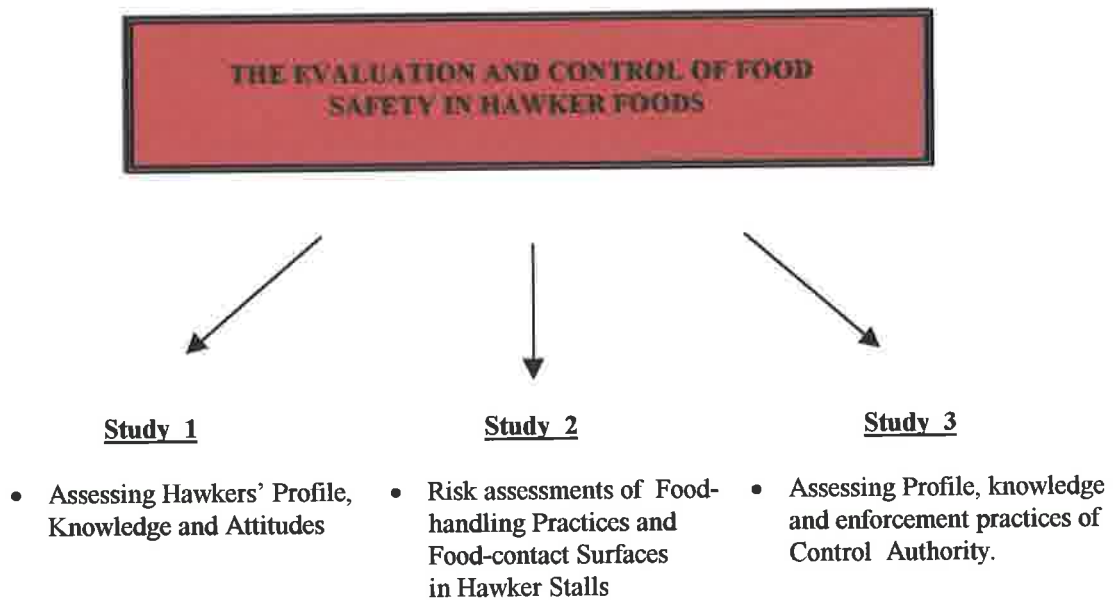
# FLOW DIAGRAM OF SAMPLE SELECTION PROCEDURES

Diagram 5

**Total Participants**
196

*Hybrid [3] Studies*
- Interview
- Questionnaire
- Assessment

**Study One** (100)
Assessing Hawkers' Profile, Knowledge and Attitudes

**Cultural Background:**
| | |
|---|---|
| Malay | (40) |
| Chinese | (43) |
| Indian | (16) |
| Other | (1) |

**Stall Environment:**
| | |
|---|---|
| Designated Hawker Site | (55) |
| Day/Night Market | (6) |
| Private Kiosk | (5) |
| By The Roadside | (34) |

**Validation**

**Study Two** (9)
Evaluating Foodhandling Practices and Food-contact Surfaces in Hawker Stalls

**Cultural Origin:**
| | | |
|---|---|---|
| *Nasi Lemak* | (Coconut rice) | (3) |
| *Char Koay Teow* | (Rice noodles) | (3) |
| *Roti Canai* | (Indian pancake) | (3) |

**Stall Environment:**
| | |
|---|---|
| Designated Hawker Site | (9) |

**Laboratory Studies**
- Contamination Assessment (27)

**Study Three** (60)
Assessing Profile, Knowledge and Enforcement Practices of Control Authority

**Job Type:**
Health Inspectors (60)
- Junior
- Middle
- Senior

**Work Environment:**
DBKL (60)
- Hawker Department
- Health Department

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[3] inbreeding between strategies (Robson, 1996)

In the sample selection process, due considerations were given to cultural (exhibiting indigenous beliefs and practices) and environmental (surroundings and its effect on related studies) factors for purposes of tapping additional information to enhance the quality of findings based on the primary and secondary aims and objectives.

### 3.1.2    Cultural Factor

Although there were studies in the past on hawkers and hawkers foods, to-date there is no evidence of studies on the cultural impact of the three main ethnic groups (Malay, Chinese and Indian) in Malaysia on hawker knowledge, attitudes and practices.

Another plausible reason in favour of the cultural factor in this study is that, Malaysians by nationality, the Malays, Chinese and Indians have different upbringings, cultural practices and food habits. These attributes could influence knowledge, attitudes and practices.

**Study 1:**    In order to provide a representative sample (100) of the ethnic breakdown of the country, ethnic Malays (43), Chinese (40), Indians (16) and Other (1) were considered. The sample is made up of hawkers between the ages of below 20 to above 50 (30 years and below: 41%; 31 years and above: 59%). Educational background ranged from no formal education (29) to primary (32) and secondary (39) school education.

**Study 2:** Similar principles used for sample selection in Study 1 are applied for this study. The only difference being the research sample (9) for this study (Study 2) reflect ethnic hawker food types and not hawkers. Samples for this study (assessments of foodhandling practices (FHP) and food-contact surfaces (FCS) in hawker stalls) were selected on-site at "high-sale-volume" stalls. This is important given that the practices of hawkers and FCS could be visually and appropriately (on-the-spot) assessed. Three popular (Merpati, 1997) and high-consumption-frequency-typed (DBKL [Dewan Bandaraya, Kuala Lumpur], 1997) ethnic foods were chosen, namely ethnic Malay *Nasi Lemak* (3), Chinese *Char Koay Teow* (3) and Indian *Roti Canai* (3) selected from three (TPCA [Tamil Physical and Cultural Association], Chow Kit, and Bangsar) out of the fifteen hawker sites of Study 1. The samples were taken from three different stalls of each ethnic food (total of nine samples) for purposes of comparison and to obtain the mean values.

**Study 3:** Ethnic selection was not possible for this study as the Health Inspectors (HIs) in both the Hawker and Health Departments of the DBKL are predominantly (Annual Report of DBKL, 1996) ethnic Malays. Health Inspectors being the only field enforcers or control authority are made up of the male gender only. Hence, the demography section of the questionnaire has omitted the ethnic and gender variables. The sample (actual population of HIs=60).

### 3.1.3 Environmental Factor

Hawkers in Kuala Lumpur are classified by the DBKL under their respective location and categories and the control of KL hawkers is directly under the charge of DBKL. The environmental factor and its impact on food safety, control and public health are vital in the context of hawker foods.

Similar to the "cultural factor", there is a lack of studies on the impact of the environment in KL on the knowledge, attitudes and practices of hawkers. Issues pertaining to the surroundings (near the drains, along a busy road, maintenance of the hawker sites, condition of garbage and frequency of disposal, etc), amenities and infrastructure are relevant to food safety and public health and need to be explored.

**Study 1:** Samples (100) for this study were selected from four main hawker categories (prescribed hawker sites, day/night markets, private kiosk and by the roadside) and in fifteen different locations in Kuala Lumpur. The samples were selected from big, medium and small hawker set-ups for a better representation of the varied environments.

**Study 2:** The selected samples (9) were from three typically ethnic and high-consumption frequency hawker foods (3 *Nasi Lemak* (NL), 3 *Char Koay Teow* (CKT) and 3 *Roti Canai.*(RC) ). Due to the competition between hawkers selling the same type of food and religious constraints (muslim hawkers are placed in

different locations from hawkers selling "non-halal" [4] foods), the samples of this study were selected from different locations (TPCA, Chow Kit, and Bangsar). "by the roadside" category of hawkers are not represented in this study (Study 2) as most of the stalls are not equipped with the three items pertaining to FCS (work surface, chopping board and dishcloth) for assessments.  Due to the lack of amenities (water, electricity), most of the pre-preparation of raw items and initial cooking processes (like soup stock, garnishes, relishes, etc.) were done at home and transferred on-site.

**Study 3:**   The selected samples ($n$=60) for this study were taken from the enforcement arm of DBKL or City Hall, Kuala Lumpur. As all hawkers in Kuala Lumpur are under the control and jurisdiction of DBKL, the questionnaires could only be administered to all the field control authority or Health Inspectors (HIs) in the Hawkers' (25) and Health (35) Departments.

### 3.1.4   Sample Selection Process

**Study 1:**   There was no pre-determined sample selection process for hawkers. Due to the "non-specific" (unpredictable day/time of business) work schedule and co-operation (willingness to participate in the interview), the hawkers ($n$=100) were selected on-site.  It was planned to interview as closely as possible a sample representative of the actual hawker population in terms of cultural and environmental factors.

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[4]  Muslim taboo

**Study 2:** The selection of three ethnic hawker foods was based on a review of books on culture and tradition and historical background of local ethnic hawker foods (Preston, 1986; Majeed, 1991, 1995, Merpati 1997) and recommendations (on high consumption frequency) from the Hawker Department, DBKL. Hence, three samples each of three traditional ethnic foods (NL, CKT and RC) were chosen.

**Study 3:** There was no specific sample selection process as all HIs ($n$=60) are included in the survey. The sample, made up of actual population of the "on-the ground" control authority (HIs), located in two departments of the DBKL (Hawkers' and Health). The Hawkers' Department has 25 HIs and the Health Department 35 HIs.

It is appropriate to mention again that the actual population of Health Inspectors is 60 and HIs are predominantly ethnic Malays of male gender. The generaliszation of the findings of this research is restricted to these specific groups of HIs.

## 3.2 OVERVIEW OF METHODOLOGY

Past research on local (Perdigon, 1989; George, 1990; Whitehead, 1991; See et al., 1993; Desmarchier et al., 1994; Arumugaswamy et al., 1995) and foreign (Winarno & Allain, 1988; Bryan, 1988, 1992a, 1992b; Yang et al, 1991; WHO 1993) hawker foods and the hawker industry were inclined to use laboratory, on-site observations and survey-typed of studies to investigate the training of hawkers

(or street food vendors), safety of hawker foods and control in the hawker industry. Whilst Bryan (1995) is in favour of on-site observations and measurements and challenge studies for risk assessments in an attempt to link to epidemiological data, Tebbutt (1991) has proposed a combined approach of laboratory and visual assessments to provide the best chance of improving and controlling hygiene risks in stalls/shops. Recent studies by EPOC [Enquiry Policy Center 5] on street foods have highlighted a need to adapt generic research/project design to real life situations (Tinker, 1997).

In the review of techniques for measuring knowledge, attitudes and practices, studies have been carried out on measuring knowledge and practices of foodhandlers using questionnaires but not on attitudes. Bryan (1991) and Howes (1996) have indicated the importance of the attitude factor in quality assurance or safety of foods. Studies of hawkers by WHO and FAO using survey methods are well documented. Using past recommendations as a yardstick, this research will attempt on a methodology that is made up of *hybrid* (combined) studies with laboratory research strategies to investigate food safety and control in hawker foods. With a research design in place, the internal validity (can plausibly demonstrate a causal relationship) via laboratory (the controlled environment *par excellence*) studies and external validity (generalizability) through using *hybrid* studies have been given maximum attention.

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[5] a small think tank in Washington, D.C.

This research uses a combination of structured interview, questionnaire and risk assessment studies with the laboratory as complimentary tools in an attempt to validate findings of hawkers' knowledge, attitudes and practices. The detailed descriptions of each method will be given in each respective chapter.

**Study 1:** This study of hawkers employs the traditional survey research strategy (using structured interview schedule) and lends itself particularly well to fulfil the exploratory (to determine a situation or to seek explanation and provide data for testing hypothesis) and descriptive (how many people in a given population possess a particular attribute, opinion, etc.) purposes of the study. The use of structured interview schedule was chosen for the food hawkers ($n$=100) based on recommendations on survey methodology (Cooligan, 1994) and taking past suggestions relating to the lack of formal education of hawkers (FAO, 1995; WHO, 1996) into consideration. Hence, a structured interview is appropriate and timely as the hawkers are not required to read or fill in the interview schedule. Recommendations for on-site studies are well documented (Robert, 1980; Tebbutt, 1991 and Bryan, 1995).

This structured interview schedule or instrument for gathering structured information from hawkers comprised three distinct sections, namely: (1) demographics (2) knowledge-based items and (3) attitude-based items. The advantages of the structured interview schedule are that it is made up of standardised objective-type items/questions which would elicit a fixed choice of

answers, conducted (control process) by the same interviewer and in a more relaxed real life environment (naturalistic environment). Additionally, the interviewees are not required to reveal their identity.

There are shortcomings in using structured interview schedule in terms of what to ask and how best to formulate the "interviewee-friendly" questions (items) and responses. Sensitive issues related to religion (pork is forbidden in Islam and beef to the strict Buddhist and Indians), culture and politics are avoided. The language of communication that the interviewee is most comfortable with and the measuring scale to evaluate a certain construct has to be determined. The interview schedule was therefore constructed in three of the most frequently used local and foreign languages (Bahasa Malaysia, Mandarin and English).

The limitations of a structured interview are time and cost intensive factors. Based on the feedback of the piloting, the interview per hawker lasted between 1 to $1\frac{1}{4}$ hours, depending on how busy the hawkers are and their levels of understanding. Hawkers with their non-stop business schedule do not pay full attention to questions and choice of answers provided; questions and answers have to be repeated (read and reread) several times.

**Study 2:**  Risk assessments of Foodhandling Practices (FHP) and Food-contact Surfaces (FCS) will be carried out at hawker stalls ($n$=9) using pre-formatted risk assessment forms. Due to the specificity and technical nature of this

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area of research (hawker foods), there are only scant suggestions from Code of Practice No. 9 and Food Hygiene Inspections (1995), LACOTS Local Authorities Coordinating Body on Food and Trading Standards 1995, Roberts (1980) and Tebbutt (1991) on the research method and/or instrument. Hence, the assessment instrument (Risk Assessment Audit Sheet) for measuring foodhandling practices are adapted and the revised version of the format carried out on fast-food/take-aways establishments (in UK) was localised (tailored for use in KL taking into consideration local norms, regulations and environment).

The second assessment instrument (Micro-C dipslides) for measuring contamination levels of food-contact surfaces (work surface-WS, chopping board-CB and dishcloth-DC) have to be purchased directly from the manufacturer in Yorkshire, UK. Interpretation of the contamination levels on the dipslides will be based on the guidelines given by: (1) Griffith (1978) (2) Roberts (1980) (3) Tebbutt (1991) and PHLS Public Health Laboratory Services , (1996).

Localising the risk assessment audit sheet is of utmost importance (similar method used by EPOC) as this study on three ethnic hawker food (NL, CKT and RC) stalls should provide indicators in an attempt to validate the relationships between the findings of Study 1 and Study 2. Additionally, this method offers additional options for the Malaysian local authority to adopt (risk assessment) for the purposes of enforcement. This risk assessment or audit allows the assessor to explore at length into the practices of hawkers, the environment and equipment at

their respective stalls. This on-site visual (with researcher immersion) study delivers richer information, which is an added advantage when interpreting the data. Considered as a challenge study, it is the first of its kind to be carried out in KL or even in the region.

This study fulfils a research gap that offers answers to current safety and control dilemmas in the hawker industry in the region. Both assessments (FHP and FCS) are standardised methods with fixed constructs and conducted with a full pledge of anonymity. Hence, even if there is any subjectivity of assessment in the study, it is confined to one assessor.

This risk assessment audit process, however, is an arduous and time-consuming process. Experience gained from the piloting indicated that it takes about 45 minutes to complete each assessment. The second assessment or process (using dipslides with triphenyltetrazolium chloride (TTC) to obtain food samples on food-contact surfaces) of measuring contamination levels (after incubating for 48 hours) is equally a time-consuming process and requires precision in recording the results. In addition to that, it is an expensive process due to the high cost of the dipslide and the incubator.

**Study 3:** A survey-using structured questionnaire was chosen for assessing knowledge and enforcement practices of the control authority. Studies of a similar nature have been well documented (DBKL, 1986; WHO, 1993: FAO,

1995: Tinker, 1997). Past studies (Williamson et al., 1992; Albrecht, 1995; Altekruse et al., 1995) have shown questionnaires as useful research instruments for measuring practices and knowledge.

Compared with the three other instruments used for Study 1 (structured interview) and Study 2 (risk assessment and laboratory), questionnaires are cost and time effective. Respondents do not feel frustrated by the constraints imposed by a fixed choice answer and can decide on a more relaxed time to fill in the questionnaire. There is less chance of ambiguity as the respondents have the opportunity to choose their answer of their thought. Questionnaires offer anonymity to the respondents.

Some of the shortcomings arising from the use of questionnaires are the construction of questions. The process is not only time-consuming but it requires care to phrase questions clearly and unambiguously, such that the respondent is in no doubt which answer to give. The ideal is that all respondents will interpret an item in the same way. The quality of responses and the response rate are beyond the control of the constructor.

The six-page questionnaire measuring respondents' background profile, knowledge of food safety and control and enforcement practices will require only 10 to 15 minutes of the respondents' time (as stated in the questionnaire) to complete. The questionnaire was made available in two languages (Bahasa

Malaysia and English) to suit the language choice and proficiency of each respondent. Details of the questionnaire are given in Chapter Six.

# STUDY 1
The Structured Interview Schedule Study

# ASSESSING HAWKERS' PROFILE, FOOD SAFETY KNOWLEDGE AND ATTITUDES

*"Life is short, science is so long to learn, opportunity is elusive, experience is dangerous, judgement is difficult".*
Hippocrates

## 4.1   INTRODUCTION

*"Testing of samples can never take the*
*place of observation, but results can*
*provide supportive data and perhaps*
*confirm hypotheses"*
*Bryan, F.L., 1992.*

Food hawking is a lucrative business. Bryan (1993) attributed the growth of the

hawker population to positive cash flow, tax-free earnings (profits are not easily

computed), independent choice of food items to sell and operating hours, very low

capital outlay and a small likelihood of being subjected to regulations. Hawking

will always remain a part of the social, cultural and economic fabric of life in

Southeast Asia (Jayasuriya, 1994) even though health threat issues continue to be

prevalent in the micro industry [1] (M.O.H Ministry of Health, 1995; 1998).

Hawker foods, synonymous with street foods, are "ready-to-eat" or prepared-on-

demand foods for consumption on-site, or takeaways prepared by ubiquitous small

entrepreneurs (Toh and Birchenough, 1999; 2000). Benefits of food hawking

activities are clouded by social and public health problems. Past studies have

highlighted problems related to the micro industry such as inappropriate hawker

locations, poorly-designed stalls, inadequate basic amenities, poor management,

lack of training and formal education of hawkers (Harrison, 1990). It was

documented that hawkers are poor, uneducated and lack appreciation for safe

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[1] Micro-industry will be used for the entire thesis in an attempt to redress past terminology of the "informal sector". Hawkers in Kuala Lumpur are regulated. Given time and recognition, the micro-industry promises growth potential.

food handling (WHO, 1995, 1996) and the male gender predominates the industry (CIDEF [Centre International de l'Enfance], 1994). Studies by FAO [Food and Agriculture] Organization (1995) found poor knowledge of food handling practices among the foodhandlers. An informal study by Dewan Bandaraya, Kuala Lumpur (DBKL), or City Hall of Kuala Lumpur, confirmed a lack of knowledge of good food handling and failure of hawkers to comply with health requirements (George, 1990). Problems associated with hawking cannot be easily eliminated unless there is an in-depth investigation to ascertain the causes.

Studies by Albrecht (1995) on food handling knowledge and practices (time/temperature control, prevention of cross-contamination and sources and modes of transmission of food poisoning bacteria) showed lack of knowledge in foodhandlers. Relevant to present issues on food safety/hygiene and foodborne illnesses and their prevention, several studies conducted in Malaysia confirmed the prevalence of safety problems related to preparation and handling of hawker foods (Arumugaswamy et al., 1995; Rusul et al., 1996; Desmarchier et al., 1994). Documented outbreaks (MOH 1990-1995; WHO, 1993; FAO, 1995) on microbial food contamination of hawker foods due to a lack of knowledge, education, training and attitudes (Bryan, 1993) were also highlighted.

Bryan (1991) postulated that knowledge and attitudes are key attributes of concern in outbreaks of food poisoning and their prevention, foodhandlers' hygiene and hawker foods. Positive attitudes, an important factor besides

knowledge and enforcement, ensure a downward trend of foodborne illnesses (Howes et al., 1996). The necessary link of positive behaviour, attitudes and continued education of food handlers towards the sustainability of safe food handling practices has been highlighted (Howes et al., 1996).

More than a third (36%) of the total population (DBKL, 1998) of 100,000 hawkers (Dawson and Canet, 1991) of the country are situated in Kuala Lumpur (KL). It is felt that KL is an appropriate place to conduct a challenge study (using an on-site structured interview schedule) as part of the *HACCP* Hazard Analysis Critical Control Points approach to food safety (Bryan, 1992).

This chapter will present the demographic profile of hawkers based on the mapping[2] activities and outcomes from the structured interviews of hawkers of varied cultures (ethnicity), environment (category or where hawkers are sited), age and education background in Kuala Lumpur. The main aims of this study are to investigate the culture[3] and environment[4] impact on the quantitative aspects of hawkers' identity, significance of hawker foods, prevalence of health problems and knowledge/attitudes of food safety/hygiene, foodborne illnesses and its prevention and food regulators and regulations. This chapter on hawkers' knowledge and

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[2] Capturing hawker activities such as locations, types of foods, gender, age groups, sex, pattern of meals served and type of preparation.
[3] "culture" in this thesis implies cultural traits demonstrated by each individual ethnic group (Malay, Chinese and Indian). For example ethnic Malays possess a blend of cultural traits of local indigenous groups.
[4] Environment, in this research, indicates the hawker vending locations and/or surroundings.

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attitudes will be validated by laboratory studies of hawker foods, which is presented in Chapter Five.

## 4.2 Hypotheses

- Hawkers from different cultural (ethnic) background are not likely to demonstrate differences in food safety/hygiene knowledge and attitudes.

- Younger adults (hawkers 30 years and below) are not likely to demonstrate better knowledge and attitudes than older adults (above 31 years).

- Educational backgrounds of hawkers are not likely to influence knowledge and attitude scores.

- Hawkers in different locations (geographical location) and categories (type of vending) are not likely to demonstrate differences in food safety/hygiene attitudes (environmental impact on attitudes) and knowledge.

# 4.3 METHODS

*"Control is proactive since remedial action is*
*taken in advance of problems developing"*
Notermans, A. et al., 1995

## 4.3.1 SELECTION OF SUBJECTS

Selection of subjects of this nature was of utmost importance. Every effort was made to include the major ethnic groups (Diagram 6a) and all categories of

hawkers (designated site, day/night markets, kiosk and by the roadside – Diagram 6b).

## Distribution of Samples (*n*=100): cultural and environmental perspectives

Diagram 6a



Malay (43 %)

Chinese (40%)

Indian (16%)

Others (1%)

**Cultural** (ethnic groups)
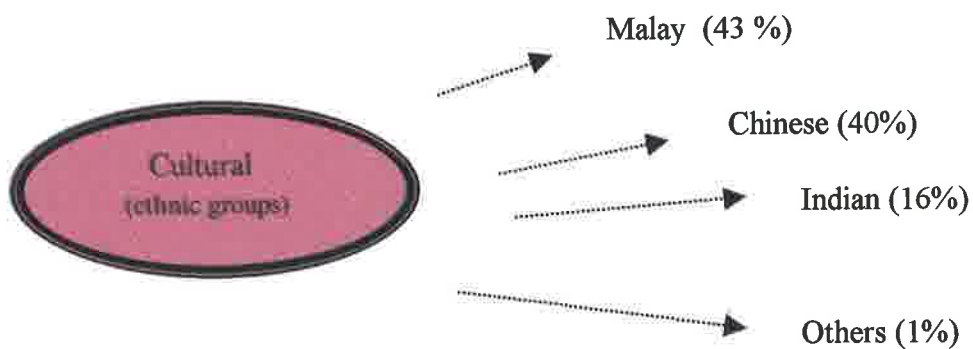
NB. Sample reflects actual ethnic population breakdown in KL. (NST, 1997).

Diagram 6b



**Environment** (category and location)

Designated site (55%)
(J. Pahang , J. Walter Grenier, Ckt. Raja Chulan, J. Bangsar,  J. Imbi )

Day/night market (6%)
(Pudu, Chow Kit, Pandan Jaya, Setapak Jaya)

Kiosk (5%)
(Lrg. Binjai, Jln. Kejang, Tmn. Sri Rampai

By the roadside (34%)
(Petaling St., Kampong Baru, J. Doraisamy)

75
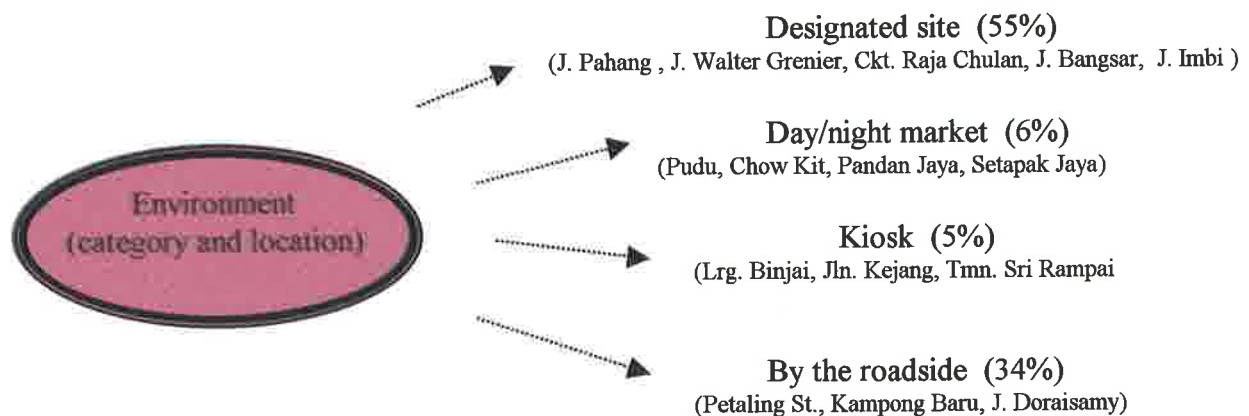
A sample of 100 food hawkers was pre-determined by the author to be representative of the food hawkers in Kuala Lumpur. The locations, size and category of hawkers were selected by stratified random-sampling (selection based on category) from the DBKL or the City Hall of Kuala Lumpur's hawker census. However, due to the "non-stop" flow of customers and time-constraints during business hours, hawkers had to be selected (on-the-spot interviews) from only those "willing-to-participate". Efforts were made to ensure as close as possible a sample that assessed a representative cross-section (ethnicity, gender, age and category) of the hawkers' population in Kuala Lumpur.

## 4.3.2 DEVELOPMENT OF SURVEY INSTRUMENT

The research instrument in the form of a structured interview schedule covered three areas, namely: (1) demography, (2) 30 main knowledge-based constructs and (3) 13 attitude-based items. Questions for the schedule were developed in two broad areas of food safety concerns (food safety and hygiene practice and food safety system and the legislation) and attitudes towards food safety, foodborne illnesses and their prevention. Knowledge-based constructs on food handling and practices were based on documented practices that have contributed to foodborne illness outbreaks such as:

- inadequate cooling
- lapse of 12 or more hours between preparing and serving
- colonized person handling implicated food
- inadequate cooking, canning or heat processing

- inadequate hot holding

- inadequate reheating

- cross contamination

- obtaining food from an unsafe source

- incorporating contaminated raw food/ingredients into food that received no further cooking

- improper cleaning of equipment and utensils

(Bryan, 1992; 1995)

References were also made to past studies (Albrecht, 1995; Howes et al., 1996; WHO, 1996) and food hygiene course books for food handlers (RIPHH [Royal Institute of Public Health & Hygiene] and Sprenger, 1996) in accordance with the aims and objectives of the study and guided by scant epidemiological data on hawker foods.

Data for the demographic profile were to be extracted from the mapping activities which included gender, age groups, levels of education, levels of income, working hours, type and number of food items, income and type of ownership.

Every care was taken to ensure that only the necessary relevant information was included in the interview schedule. In line with the pluralistic structure of the Malaysian society, the schedule was constructed in the three commonly-used languages in Malaysia, namely Bahasa Malaysia, the national language of Malaysia, Mandarin and English (Appendix 3) to suit the language comprehension and hence ensure better quality responses from the interviewed hawkers.

### 4.3.3 PRE-TESTING OF INSTRUMENT

Members of the academic and public health authorities in the UK and in Malaysia reviewed the structured interview schedule for feedback. The instrument was amended taking into consideration all pertinent and relevant feedback from the reviewers. Pilot- testing of the schedule was administered by a Local Co-ordinator in Malaysia. A copy of the schedule (instrument) was sent from Cardiff (Wales) together with detailed instructions to the Local Co-ordinator to be reproduced (10 copies) and piloted for snags and ambiguities. Regular close contact was maintained between the author in Cardiff and the Local Co-ordinator in Malaysia through e-mail, fax and telephone.

The final revision to the interview schedule was made with due consideration to the feedback of the piloted copies on accuracy, comprehension and appropriateness of the questions. Second piloting was carried out in Malaysia by the author; no modifications were necessary, as the hawkers had no problems understanding the modified version while the attitude items were tested for reliability using the Cronbach's[5] alpha (probability value). A moderate sized ($\alpha$ = .5996) reliability coefficient was obtained – Appendix 4.

The location and sample for the piloting were different from the actual sample and interview. Shah Alam was chosen as the location for the piloting because Shah Alam being a twin-city of Kuala Lumpur (KL) has similar hawker structures and

types as KL. It was within close proximity to the Local Co-ordinator, therefore it was cost-effective and convenient.

## 4.3.4   ADMINISTERING THE QUESTIONNAIRE

Administering the structured interview schedule proper was carried out with due consideration to the feedback from the pilot study. The structured interview was thought of as the best method to conduct a study of hawkers and in line with documented calls for on-site studies (Bryan, 1995, WHO, 1996). It has been reported (WHO, 1996; Dawson, 1990, Bryan, 1992; FAO, 1995) that hawkers lack education and time as stalls are operated without any break from morning until the evening with "non-stop" customers during business hours. Therefore, a questionnaire survey would have been inappropriate. Proper planning in terms of time management and technique of interviewing is important.

The structured interview has an added advantage as it allows the interviewer to observe the cultural factors involved in food handling and preparation and the condition of the environment. The interviewer is also able to take note of hawkers' problems, opinions and suggestions when interpreting and/or confirming the findings of the study.

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[5] reliability coefficients based on the average correlation of items within a test if the items are standardised. If the items are not standardised, it is based on the average covariance among the items (Coakes and Steed, 1999).

The process of the structured interview was carried out in the following sequence:-

1. Food hawkers were selected (and interviewed) on-site to reflect as close as possible a representative sample in terms of ethnicity, gender and food type.

2. The objectives of the study were explained and the letters of approval (from the Mayor of KL and Hawkers' Department, DBKL) for the study (Appendix 1a and 1b) were shown to the prospective interviewee (food hawker) so as to allay whatever fears or doubts the hawkers might have about the interview.

3. Questions from the structured interview were read to each interviewee and, whenever necessary, technical terms were explained. Questions and answers (multiple-choice) were also repeated a few times to the subjects.

4. The interviewer recorded all verbal answers. Relevant remarks of the subjects were also recorded as added

information for the interpretation of data (where appropriate).

5. The duration of each interview took between one to one and a half hours. Even though the hawkers were interviewed at low peak hours (in-between breakfast, lunch and dinner hours), the interviews were often conducted amidst interruptions (hawkers serving customers in-between).

## 4.3.5    DATA COLLECTION, ANALYSIS AND INTERPRETATION

Quantitative data were entered into a data editor and analyzed using the SPSS Software packages for the social sciences. Significance was determined at the level of $p \leq .05$ giving the analysis of this study a five percent (5%) error margin or otherwise known as the level of uncertainty. The Levene's Test of homogeneity of variance (how spread out, or scattered, a set of scores is) was carried out on the knowledge-based scores (DV Dependent Variable:s : overall knowledge scores, total food safety and hygiene practices and total food safety system and the legislation scores) from the cultural (ethnicity), age, education and environment factors (IV Independent Variables). The homogeneity assumption ($p > .05$) of the knowledge-based schedule has generally not been violated except on the cultural factor (Levene's test = .048). In this study, the analysis of variance (ANOVA) is used specifically

to test the knowledge and attitude scores of hawkers. Post-hoc[6] multiple comparisons using Bonferroni $t$-tests were carried out for purposes of adjustment with Type 1 error (error by chance) of inference.

The interpretation of data (in percentages) was tabulated, based on the total interviewed population ($n$=100) less those in the categories "not applicable" and "missing values". For knowledge-based constructs in the schedule, interpretation of the data would be based on the total interviewed food hawkers; all correct answers were accorded a point and a zero for incorrect answers and "don't know" responses. Data analysis was carried out in line with descriptive statistical methods at two macro levels (Overall (%) knowledge scores based on 30 constructs and Overall (%) attitude scores based on 13 items) and two micro levels (Total (%) scores: Food Safety and Hygiene Practices based on 5 constructs, and Total (%) scores: Food Safety System and the Legislation based on 2 constructs). Descriptive statistics for responses included percentages, means and standard deviations where appropriate.

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[6] Post hoc multiple analysis: follow-up analysis performed only "after the fact" of a significant F ratio from an ANOVA. Such comparisons are used for conservative adjustment with Type 1 error of inference (Herzog, 1996).

For the attitude items, the Likert[7] rating scale was used. Each response of strongly agree (SA) to positive statements carries five (5) points, four (4) points for agree (A), three (3) points for unsure (U), two (2) points for disagree (D) and one (1) point for strongly disagree (SA). For negative statements, each response of "strongly disagree" carried five (5) points, four (4) points for "disagree", three (3) points for "unsure", two (2) points for "agree" and one (1) point for "strongly agree". An overall breakdown of the attitude scores (by percentages, means and standard deviations) was carried out for the thirteen attitude items. In order to facilitate a more comprehensive and precise interpretation of the findings, all responses of "strongly agree" and "agree" were grouped together and interpreted as "agreement" and all responses of "disagree" and "strongly disagree" were grouped together and interpreted as "disagreement" for attitude-based questions in Section C of the interview schedule. Similarly, responses of "unsure" would be used in decision-making in the event that there were equal percentages of responses in the positive and in the negative (Appendix 5).

Knowledge and attitude scores (overall knowledge scores, overall attitude scores, food safety and hygiene practice scores and food safety system and the legislation scores) are used as dependent variables and compared with independent variables such as cultural (ethnicity), environmental (category) and related demographic

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[7] A Likert scale consists of a set of statements selected by the researcher to be clearly favourable or unfavourable toward an issue or topic. The same step scale for responding accompanies each statement. A typical example: 5-point agreement scale ranging from "strongly agree" to "strongly disagree". Each response is associated with a point value and an individual's score is determined by summing the point values for each statement (Herzog, 1996).

characteristics (age and education). Knowledge scores for analysis of variance (ANOVA) are used to examine differences in demographic data such as ethnicity, age, educational background and environment (category) between the cultural groups.

## 4.4   RESULTS

*"Joining HACCP with another related management*
*philosophy growing in popularity - Total Quality Management -*
*can provide a formidable combination for competitive advantage"*
*National Food Processors Association, 1992*

The maximum attainable scores for knowledge and attitudes are 41 and 65. The overall mean knowledge score ($n$=99) is 18± 1.66%. Although 100 hawkers were interviewed, the results were based on three main culture groups, namely ethnic Malay, ethnic Chinese and ethnic Indian. The overall mean attitude score ($n$=99) is 35± 1.86%. The one percent (1%) Others will be omitted to allow further treatment of the ANOVA results by post-hoc multiple comparisons.

### 4.4.1   Demographic Profile

The demographic profile of the interviewed hawkers is summarised in Table 2a. The contextual characteristics of Malaysian hawkers differ greatly from documented reports.

## Table 2a

| Breakdown (%) of Demographic Profile of Interviewed Hawkers (n=100) | | | | | | |
|---|---|---|---|---|---|---|
| | **Total (%)** | **(n)** | | | **Total (%)** | **(n)** |
| **Ethnicity** | | | **Working hours/week** | | | |
| Malay | 43 | | 30 hours and below | | 9 | |
| Chinese | 40 | | 31-50 hours | | 14 | |
| Indian | 16 | | 51-60 hours | | 77 | 88 * |
| Others | 1 | | | | | |
| | | | **Number of years in hawking** | | | |
| **Age** | | | 1-10 years | | 78 | |
| Junior (30 years and below) | 41 | | 11-20 years | | 20 | |
| Senior (31 and above) | 59 | | more than 20 years | | 2 | |
| | | | **Number of food items** | | | |
| **Education** | | | single | | 5 | |
| No formal education | 29 | | 2-4 | | 14 | |
| Primary school | 32 | | 5-8 | | 81 | |
| Lower secondary | 28 | | | | | |
| Upper secondary | 11 | | **Number of employees (assistants)** | | | |
| | | | none | | 4 | |
| **Location** | | | 1-3 | | 68 | |
| Designated site | 55 | | 4-6 | | 28 | |
| Day/night market | 6 | | | | | |
| Kiosk | 5 | | **Monthly income (from hawking)** | | | |
| By the roadside | 34 | | RM[8] 500 and below | | 6 | |
| | | | RM 501-2000 | | 18 | |
| **Gender** | | | RM 2001- above RM 3000 | | 76 | 62* |
| Male | 69 | | | | | |
| Female | 31 | | | | | |
| | | | | | | |
| **Ownership** | | | | | | |
| Single | 68 | | | | | |
| Family | 32 | 81 * | | | | |

- Interviewed population less responses in the category "not known"

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[8] RM : Ringgit Malaysia, the Malaysian currency

The mean knowledge and attitudes scores from the ethnic (depicting cultural factor), age, education and environment perspectives of the interviewed hawkers are presented in Table 2b and 2c respectively.

### 4.4.2 Macro Levels

Mean overall knowledge scores of the sample ($n$=99) from the ethnic and age perspectives

| Ethnicity | | | | | | Age in years | | | |
|-----------|---|---------|---|--------|---|--------------|---|--------------|---|
| Malay | $n$ | Chinese. | $n$ | Indian | $n$ | 30 & below | $n$ | 31 and above | $n$ |
| 18 | 43 | 16 | 40 | 20 | 16 | 18 | 40 | 18 | 59 |

Mean overall attitude scores of the sample ($n$=99) from the ethnic and age perspectives

| Ethnicity | | | | | | Age in years | | | |
|-----------|---|---------|---|--------|---|--------------|---|--------------|---|
| Malay | $n$ | Chinese | $n$ | Indian | $n$ | 30 & below | $n$ | 31 and above | $n$ |
| 35 | 43 | 34 | 40 | 38 | 16 | 35 | 40 | 35 | 59 |

Mean overall knowledge scores of the sample ($n$=99) from the education and environment perspectives

| Education | | | | | | | | Environment | | | | | | | |
|-----|---|-----|---|-----|---|-----|---|-----|---|------|---|-----|---|------|---|
| NFE | $n$ | PSC | $n$ | LSS | $n$ | USS | $n$ | DS | $n$ | DNM | $n$ | K. | $n$ | BTR* | $n$ |
| 16 | 29 | 17 | 32 | 19 | 27 | 21 | 11 | 19 | 55 | 16 | 6 | 19 | 4 | 17 | 34 |

Mean overall attitude scores of the sample (*n*=99) from the education and category

perspectives

| Education | | | | | | | | Environment | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFE | *n* | PSC | *n* | LSS | *n* | USS | *n* | DS | *n* | DNM | *n* | K. | *n* | BTR* | *n* |
| 33 | 29 | 35 | 32 | 36 | 27 | 37 | 11 | 35 | 55 | 35 | 6 | 39 | 4 | 34 | 34 |

- NFE : no formal education;  PSC : primary school education;  LSS:  lower secondary school;
  USS :  upper secondary school
  DS :  designated site   DNM :  day/night market   K : kiosk   BTR :  by the roadside

The one-way analysis of variance (ANOVA) showed a positive significance in the

overall food safety knowledge (Chart 1a) between the cultural groups of hawkers

(F=6.31,  df=2, *p*=.05). Post-hoc comparisons was carried out and showed ethnic

Malays having demonstrated better knowledge than ethnic Chinese ($t = .018$, df =

2, $p = .05$). Similarly, ethnic Indians demonstrated better overall food safety

knowledge than ethnic Chinese ($t = .001$, df = 2, $p = .05$).

**Overall (%) Knowledge Scores (n=99)**
**- Culture Perspective**
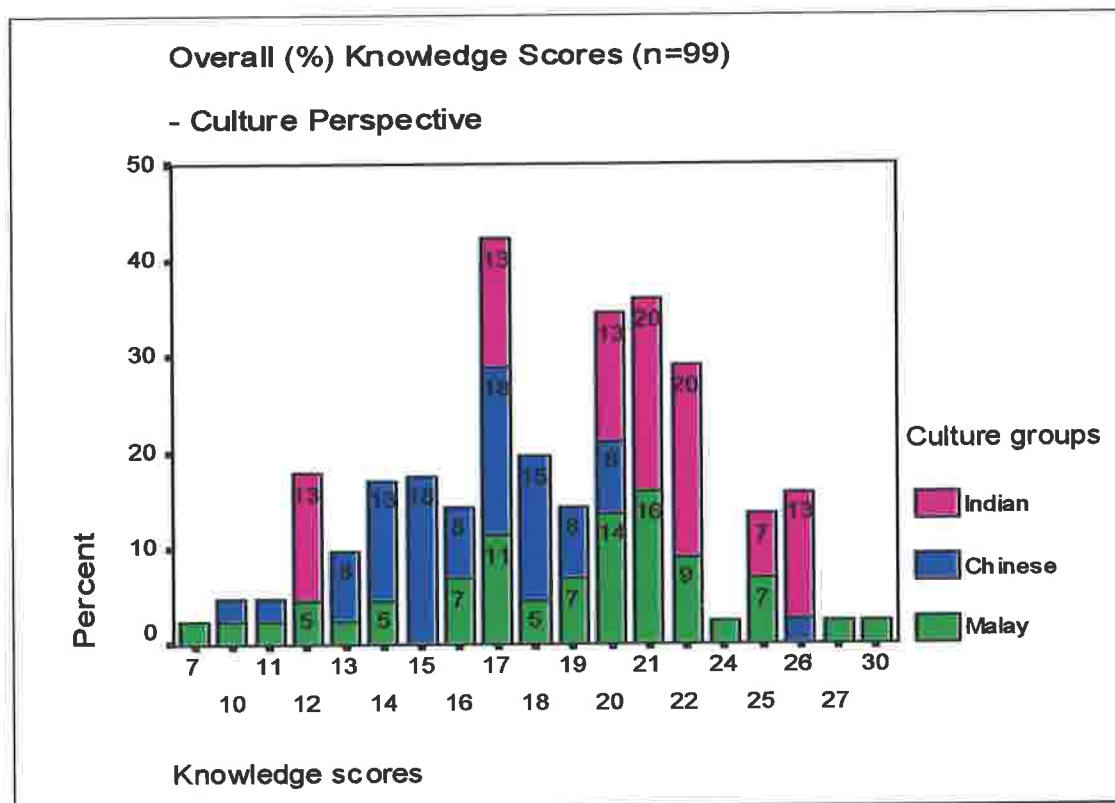
Maximum attainable scores: 41

The ANOVA also showed similar positive significance on overall attitudes (Chart 1b) of the cultural groups towards food safety/hygiene, foodborne illnesses and their prevention (F= 3.77, df=2, $p$=.05). Post hoc multiple comparisons showed ethnic Indians demonstrating better attitudes towards food safety/hygiene, foodborne illnesses and their prevention than ethnic Chinese ($t$=.005, $p$ = .05). There is no significant difference among the hawkers of different age groups in terms of knowledge and attitudes perspectives.

Overall (%) Attitude Scores of the Interviewed Hawkers (n=99)
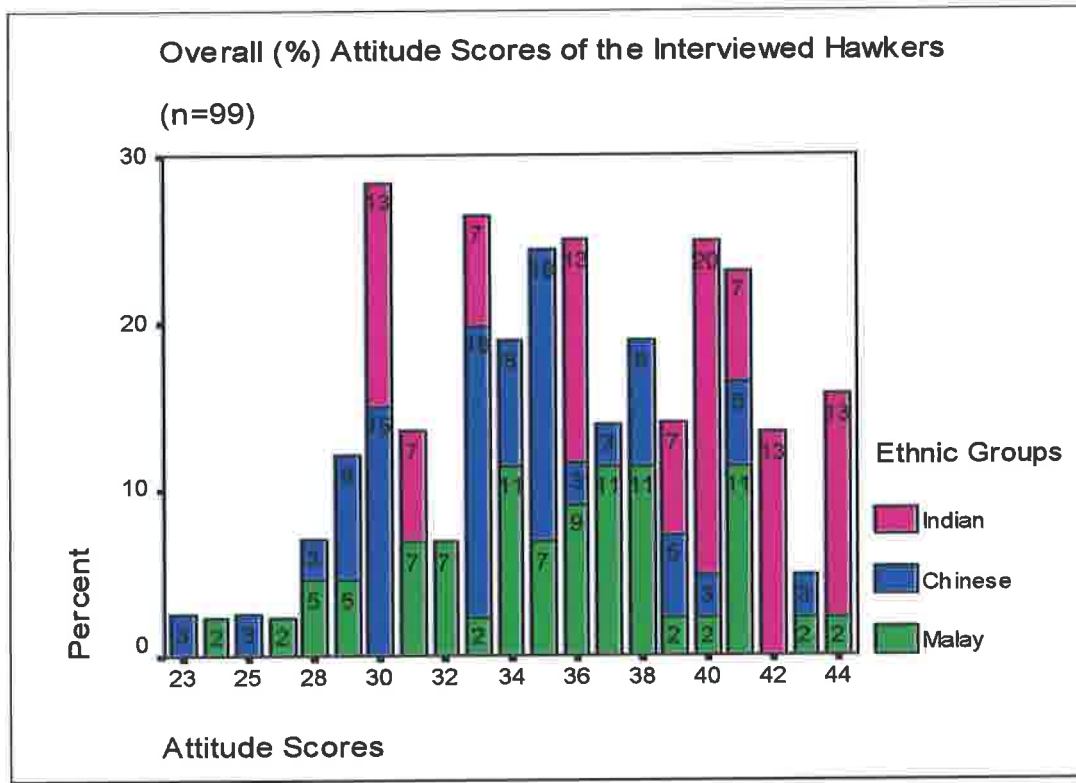
Maximum attainable scores: 65

The ANOVA results show negative significance in the overall knowledge and attitudes of hawkers in different environments (categories and/or locations). There were significant differences in knowledge (F= 6.31, df=3, $p$=.05) and attitudes (F= 3.77, df=3, $p$=.05) of hawkers with different educational background (Charts 1c and 1d). Post hoc multiple comparisons show hawkers with upper secondary school education demonstrated better knowledge than those with primary school education ($t$ =.010, $p$=.05) and no formal education ($t$ =.003, $p$=.05). Similarly, hawkers with lower secondary school education have demonstrated better knowledge than hawkers with no formal education ($t$ =.028, $p$=.05). Hawkers with upper secondary school education demonstrated better attitudes than hawkers

with no formal education ($t=.043$, $p=.05$). Similarly, hawkers with lower secondary school education demonstrated better attitudes than hawkers with no formal education ($t=.036$, $p=.05$).

Overall (%) Knowledge Scores (n=99)

- Education Perspective

Overall (%) Attitude Score (n=99)

- Education Perspective
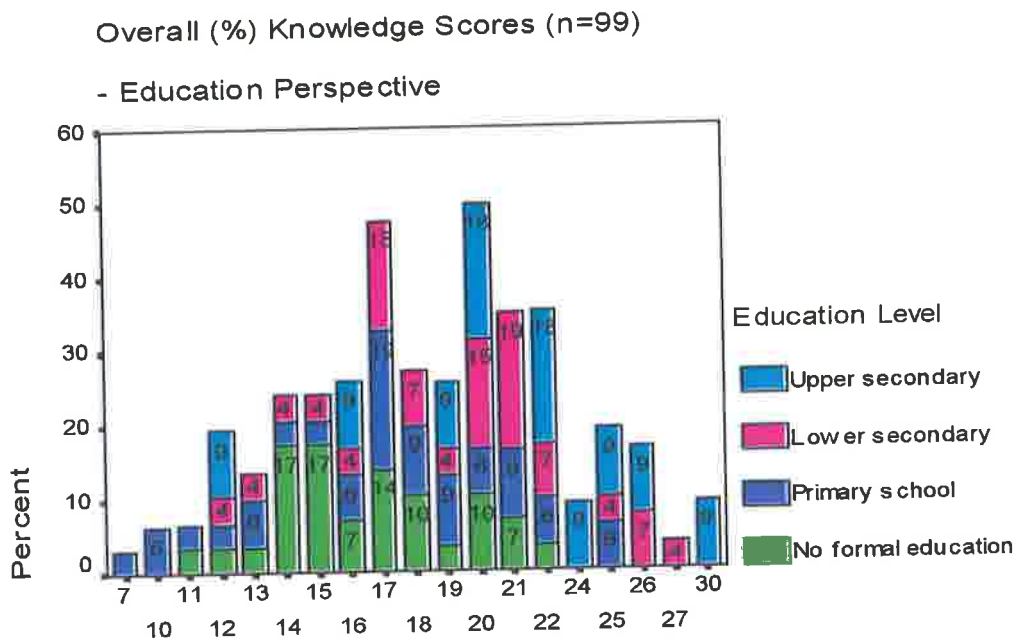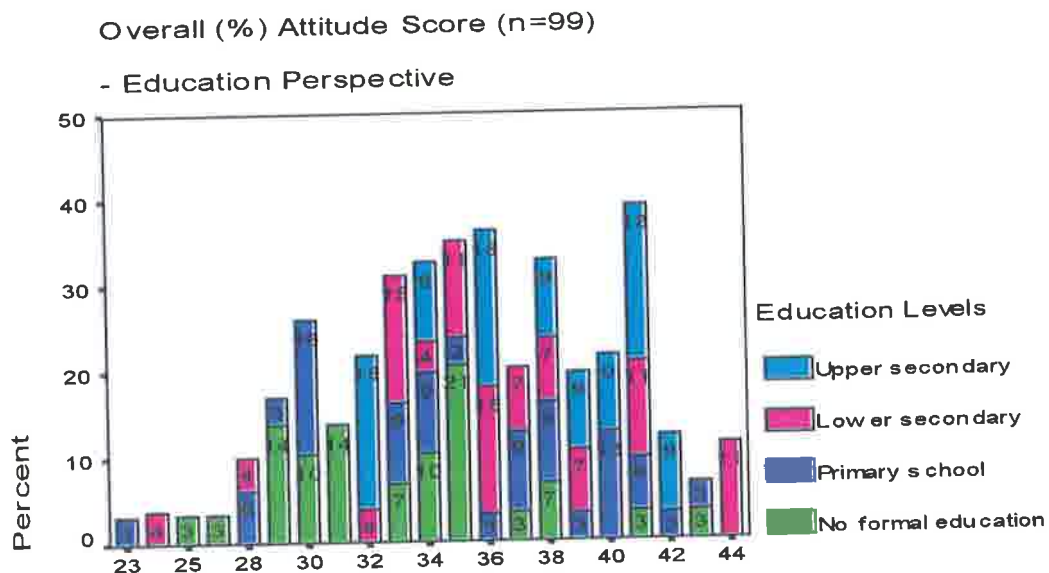
### 4.4.3  Micro Levels

The micro levels of the knowledge scores (*n*=99) are presented in two distinct

areas of:-

1.  Food Safety and Hygiene Practices, made up of

    five constructs  (Diagram 7a), and


2.  Food Safety System and The Legislation, made up of

    two constructs (Diagram 7b)


#### *4.4.3.1  Knowledge of Food Safety and Hygiene Practices*

This section consists of five main constructs aimed at evaluating contextual

knowledge of  safety and hygiene practices of hawkers (Diagram 7a). The results

pertaining to each of the five constructs were analysed and presented by culture

and environment sub-sample and complemented by age and educational

dimensions.  Discussions are carried out on only significant results.


Diagram 7a



| Food Safety and Hygiene (5 constructs) | → | Time/temperature control |
| | → | Cross contamination |
| | → | Micro-organisms and foodborne illnesses |
| | → | Personal hygiene |
| | → | Equipment, utensils and premises |
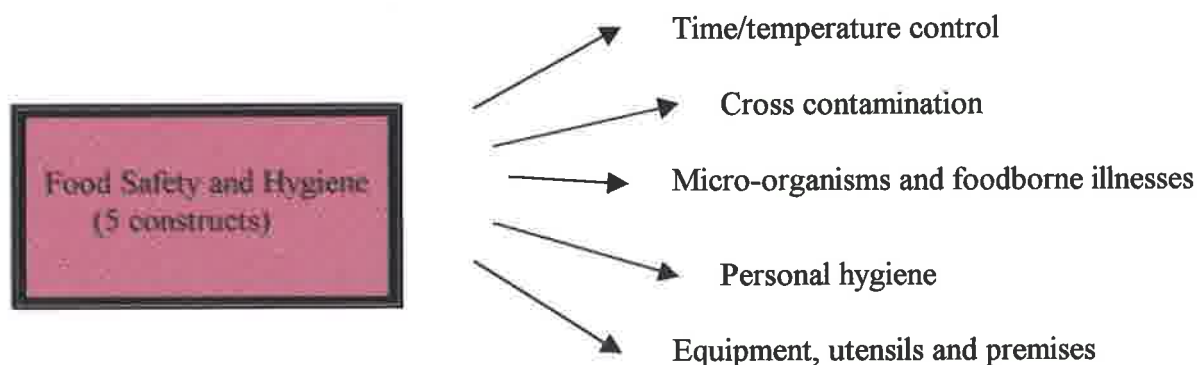
Significant differences of knowledge scores from the culture and education perspectives are presented in Charts 2a and 2b. The overall "Knowledge of Food Safety and Hygiene Practices" mean scores of the interviewed hawkers ($n$=99) from the culture (ethnic), environment (category; where hawkers are situated), age and education factors are presented in Tables 3a (i) and 3a(ii). Mean knowledge scores and standard deviation for the five constructs from the cultural and education perspectives are presented in Tables 3b (i) and Table 3b(ii).

Chart 2a



Knowledge Scores for Food Safety and Hygiene Practices - Cultural (ethnic) Perspective (n=99)
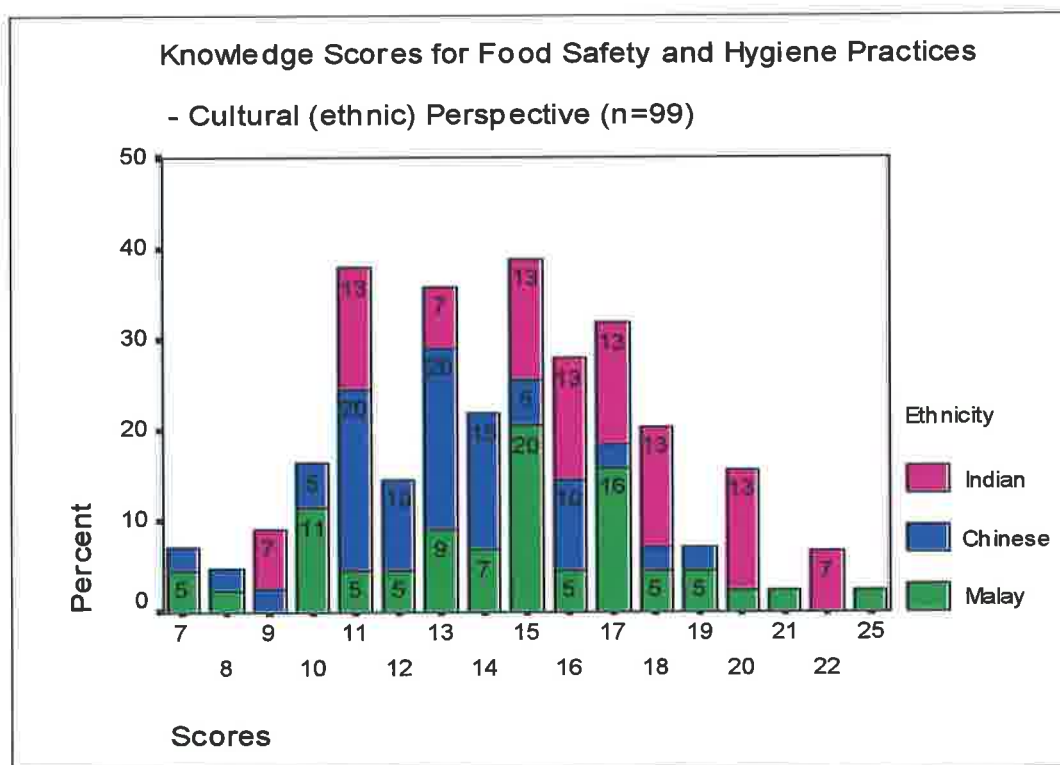
Maximum attainable score: 33

92

**Overal l (%) Food Safety and Hygiene Practices  scores (n=99)**

**- Education Perspective**
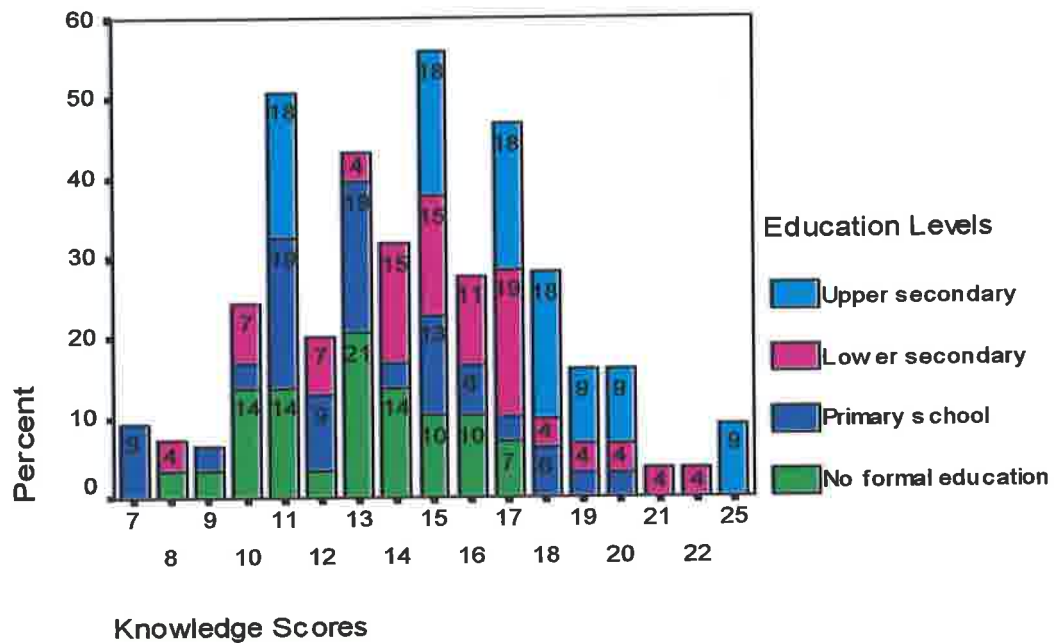


Knowledge Scores

<u>Table 3a (i)</u>

Mean Knowledge of Food Safety and Hygiene Practices Scores of the sample ($n$=99) from the ethnic and age perspectives

| | | Ethnicity | | | | Age in years | | | |
|---|---|---|---|---|---|---|---|---|---|
| Malay | $n$ | Chinese. | $n$ | Indian | $n$ | 30 & below | $n$ | 31 and above | $n$ |
| 14.50 | 44 | 12.90 | 40 | 15.87 | 15 | 14.30 | 40 | 13.90 | 59 |

Table 3a(ii)

Mean Knowledge of Food Safety and Hygiene Practices Scores of the sample (*n*=99) from the education and environment perspectives.

| Education | | | | | | | | Environment | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFE | *n* | PSC | *n* | LSS | *n* | USS | *n* | DS | *n* | DNM | *n* | K. | *n* | BTR | *n* |
| 12.90 | 29 | 13.06 | 32 | 15.33 | 27 | 16.91 | 11 | 14.22 | 55 | 13.00 | 6 | 16.00 | 4 | 13.76 | 34 |

Table 3b(i)

Mean Knowledge Scores of Interviewees (*n*=99) for the Five Constructs (Food Safety and Hygiene Practices) – Cultural Perspective

| Constructs | Malay | | Chinese | | Indian | |
|---|---|---|---|---|---|---|
| | M. | S.D. | M. | S.D. | M. | S.D.* |
| Time/Temperature Control | 1.00 | .89 | .95 | .93 | .56 | .96 |
| Cross-contamination | 2.74 | 1.21 | 2.30 | 1.01 | 3.18 | 1.10 |
| Micro-organisms and Foodborne Illnesses | 3.74 | 1.43 | 3.42 | 1.33 | 4.31 | 1.49 |
| Personal Hygiene | 3.72 | 1.07 | 3.92 | .99 | 3.93 | 1.12 |
| Equipment, Utensils and Premises | 3.23 | 1.25 | 2.30 | 1.04 | 3.93 | .99 |

* M: Mean;  S.D.: Standard Deviation

Table 3b(ii)

Mean Knowledge Scores of Interviewees ($n$=99) for the Five Constructs (Food
Safety and Hygiene Practices) – Education Perspective

| Constructs | NFE | | PS | | LSS | | USS | |
|---|---|---|---|---|---|---|---|---|
| | M. | S.D. | M. | S.D. | M. | S.D. | M. | SD* |
| Time/Temperature Control | .96 | .98 | .71 | .85 | 1.00 | .87 | 1.09 | 1.13 |
| Cross-contamination | 2.41 | .94 | 2.43 | 1.10 | 2.88 | 1.36 | 3.18 | 1.07 |
| Micro-organisms and Foodborne Illnesses | 3.51 | 1.12 | 3.40 | 1.18 | 3.96 | 1.72 | 4.45 | 1.75 |
| Personal Hygiene | 3.55 | .98 | 3.71 | .95 | 4.29 | .91 | 3.81 | 1.47 |
| Equipment, Utensils and Premises | 2.44 | 1.05 | 2.78 | 1.33 | 3.18 | 1.14 | 4.36 | .80 |

* NFE : No Formal Education;  PS: Primary School;  LSS Lower Sec.School;  USS: Upper Sec. School

The one-way analysis of variance (ANOVA) showed significant difference in knowledge of culture groups (F=5.10, df=2, $p$=.05). Post-hoc multiple comparisons showed ethnic Indians demonstrated better knowledge in Food Safety and Hygiene Practices than ethnic Chinese ($t$=.011, $p$=.05). Looking at each of the five constructs pertaining to this area, ethnic Indians demonstrated better knowledge of cross-contamination ($t$ = .027, $p$=.05) (Chart 3a) and of equipment, utensils and premises ($t$ =.000, $p$=.05) (Chart 3b) than ethnic Chinese. Ethnic Malays demonstrated better knowledge of equipment, utensils and premises ($t$ =.001, $p$=.05) than ethnic Chinese  (Chart 3b). There is no significant difference in knowledge from the age perspective.

**Percentages of Knowledge Scores for Cross--Contamination**

**(n=99) - Culture Perspective.**
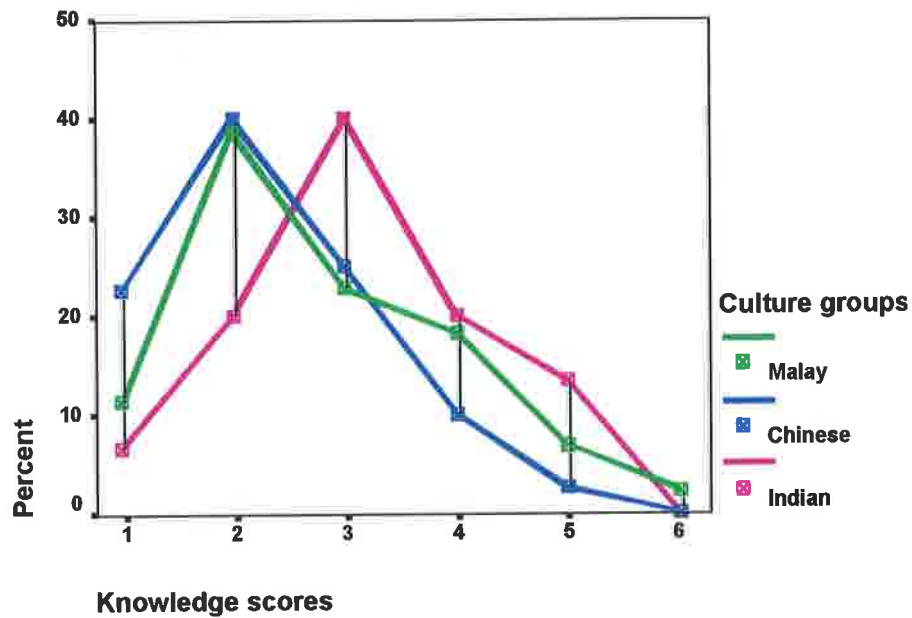
Percentages of Knowledge Scores for Equipment, Utensils and Premises

(n=99) - Culture Perspective
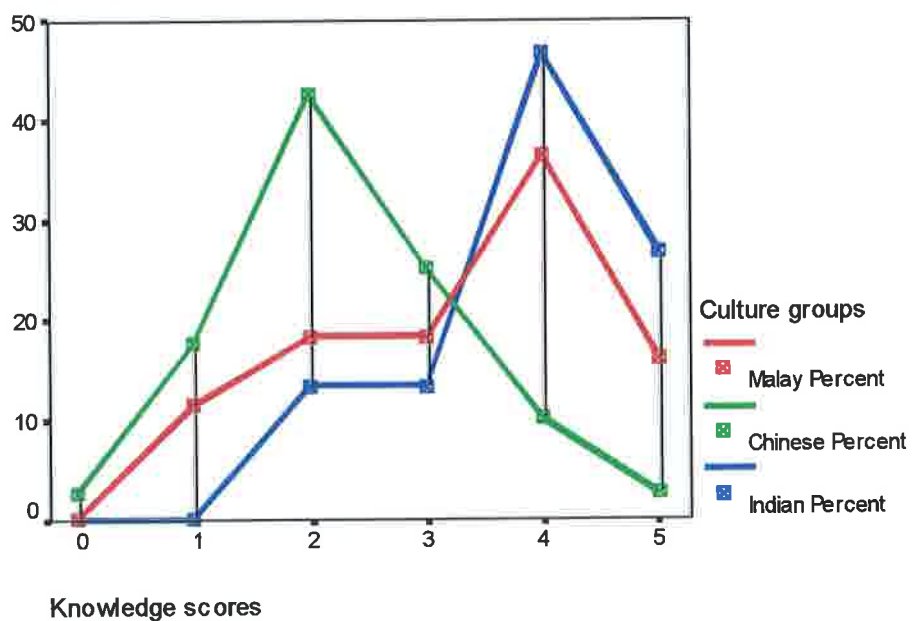
Hawkers from different environmental (category) background did not demonstrate any differences in knowledge of Food Safety and Hygiene Practices. Significant difference is prevalent in the knowledge of hawkers with different educational background (F= 6.78, df 3, $p$=.05). Post-hoc multiple analysis show hawkers with upper secondary school education have demonstrated better knowledge than hawkers with lower secondary school ($t$ = .032, $p$=.05), primary school ($t$ =.001, $p$=.05) and no formal education ($t$= .000, $p$=.05) in the area of maintenance of equipment, utensils and premises (Chart 3c). Similarly, hawkers with lower secondary school education have demonstrated better knowledge in personal hygiene (Chart 3d) than hawkers with no formal education ($t$= .045, $p$=.05).

Chart 3c

Percentages of Knowledge Scores for Equipment, Utensils and Premises (N=99) - Education Perspective

**Percentages of Knowledge Scores for Personal Hygiene (n=99)**

**- Education Perspective**



Knowledge scores

**Education Levels**

- □ No formal education
- □ Primary school
- □ Lower secondary
- □ Upper secondary
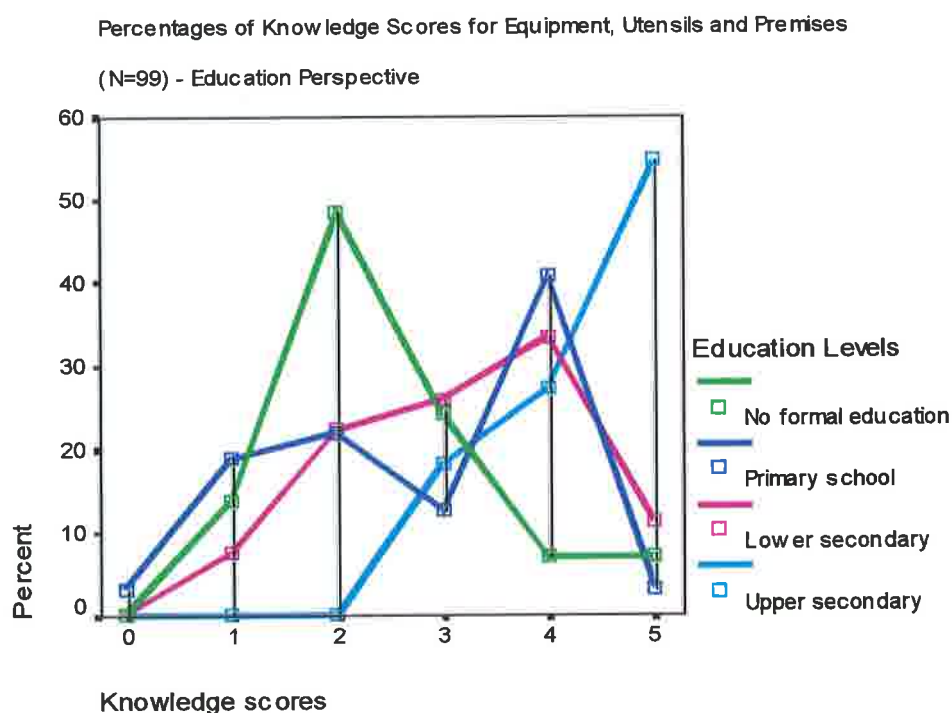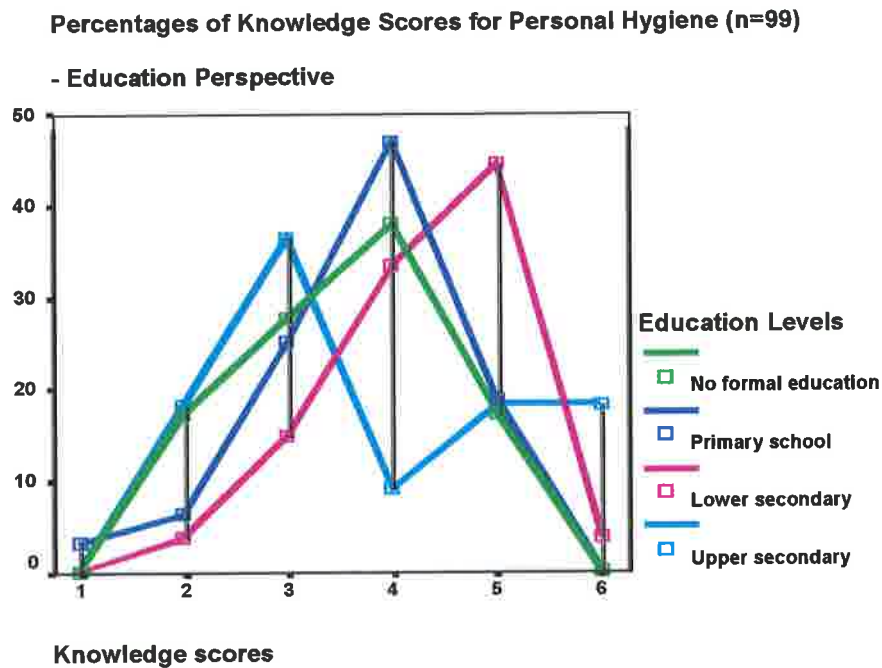
### *4.4.3.2* **Knowledge of Food Safety System and the Legislation**

This section is made up of two main constructs aimed at evaluating knowledge of food hawkers in Food Safety System and the Legislation (Diagram 7b). This section will present the results pertaining to each of the two constructs analysed and presented by cultural and environment sub-sample and complemented by age and educational dimensions.

Diagram 7b



HACCP

Food Safety System and the Legislation
(2 constructs)

Food Regulation and Control
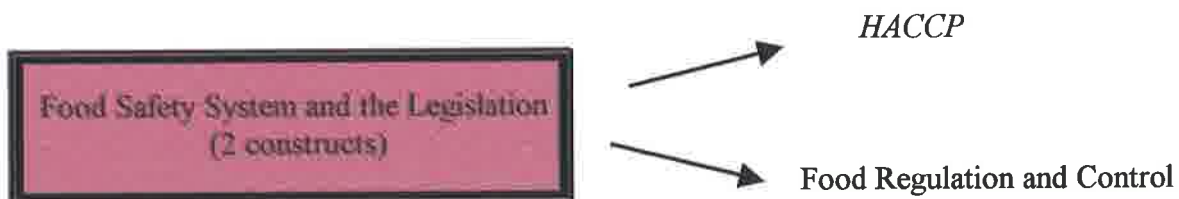
Significant differences of knowledge scores from the culture, environment and education perspectives are presented in Charts 4a, 4b and 4c. The overall "Knowledge of Food Safety System and The Legislation" scores of the interviewed hawkers ($n$=99) from the cultural (ethnic), environment (category and geographical locations), age and education factors are presented in Table 3c(i) and 3c(ii). The ANOVA show positive significance between the ethnic groups (F = 3.76, df = 2, $p$ = .05). Post hoc multiple analysis show that ethnic Malays ($t$ = .000, $p$ = .05). and Indians ($t$ =.004, $p$=.05) have demonstrated better knowledge than ethnic Chinese in the area of *HACCP* (Chart 4d).

<u>Chart 4a</u>
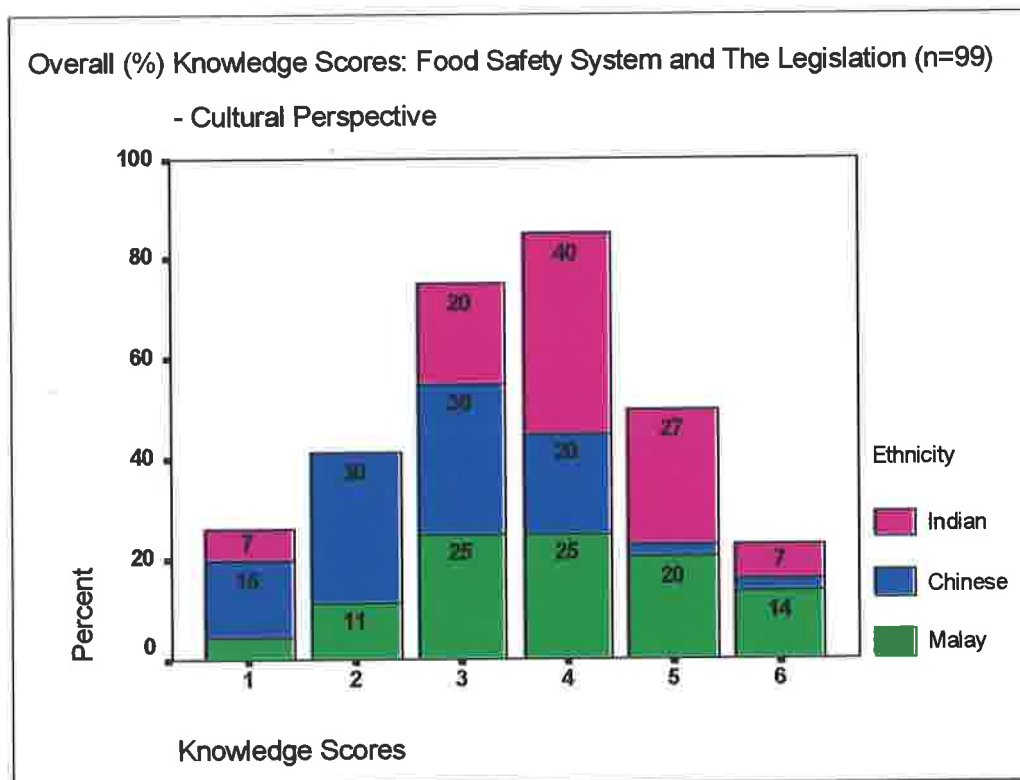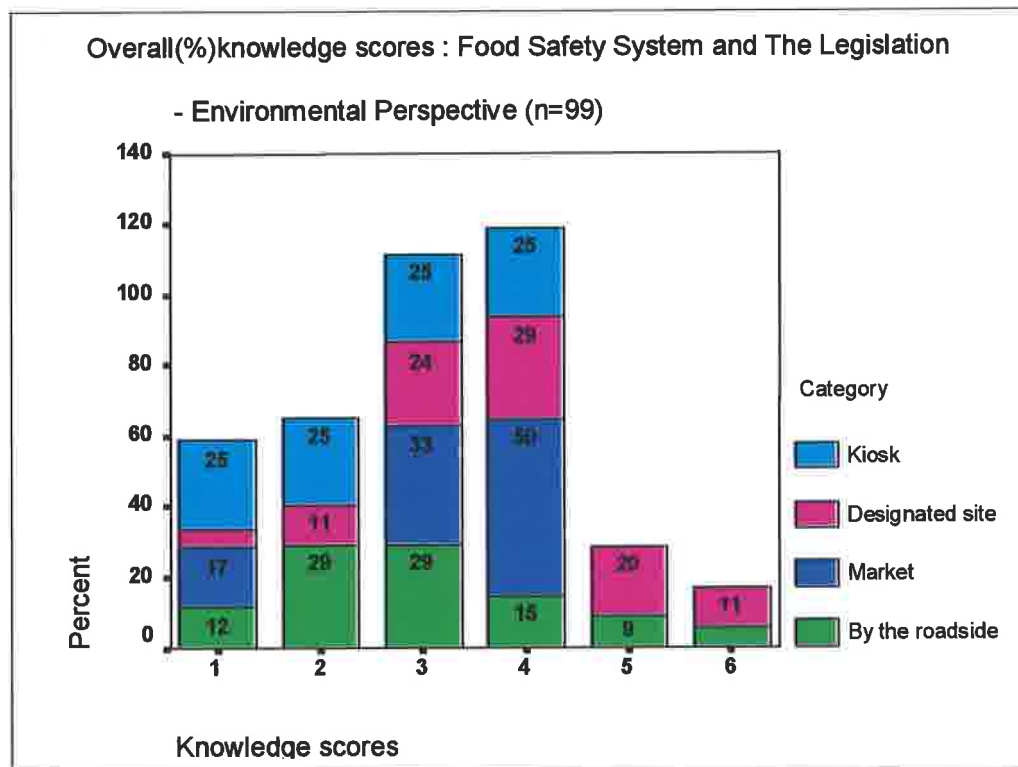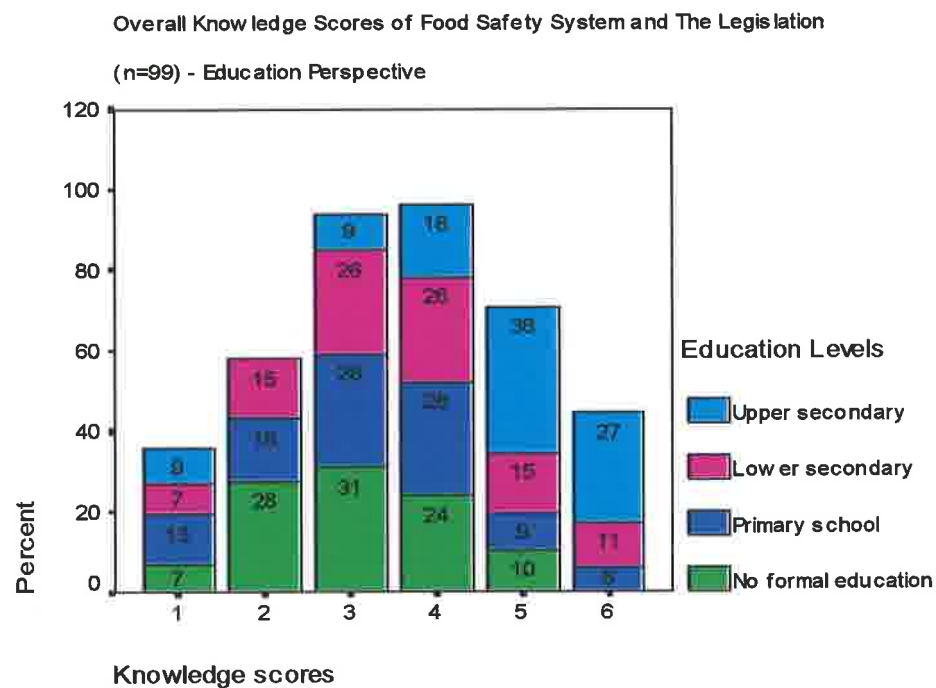


99

Overall(%)knowledge scores : Food Safety System and The Legislation
- Environmental Perspective (n=99)



Category

Kiosk
Designated site
Market
By the roadside

Overall Knowledge Scores of Food Safety System and The Legislation
(n=99) - Education Perspective



Education Levels

Upper secondary
Lower secondary
Primary school
No formal education

Mean Knowledge of Food Safety System and The Legislation Scores of the sample (*n*=99) from the ethnic and age perspectives.

| Ethnicity | | | | | | Age in years | | | |
|---|---|---|---|---|---|---|---|---|---|
| Malay | *n* | Chinese. *n* | | Indian | *n* | 30 & below | *n* | 31 and above | *n* |
| 3.86 | 44 | 2.73 | 40 | 4.00 | 15 | 3.15 | 40 | 3.61 | 59 |

Chart 4d

### Percentages of Knowledge Score for HACCP (n=99)

#### - Culture Perspective
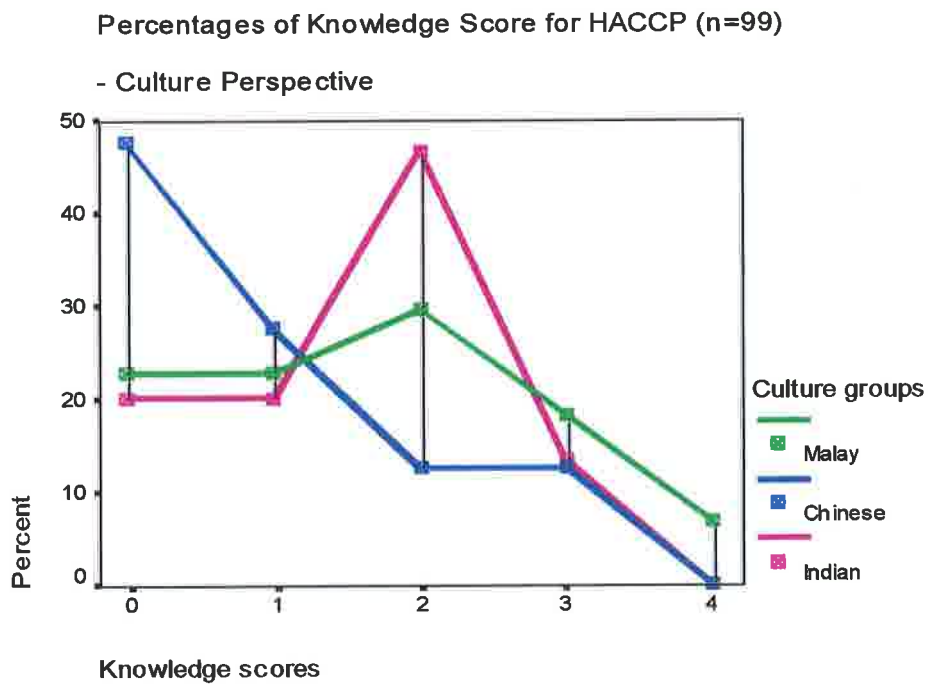
Positive significance is also prevalent between the ethnic groups pertaining to knowledge of Food Regulation and Control (F = 4.24, df = 2, $p$ = .05) – Chart 4e. Post-hoc multiple analysis show ethnic Indians to have demonstrated better knowledge of Food Regulation and Control than ethnic Chinese ($t$ = .025, $p$ = .05). There is no significant difference in knowledge of the hawkers from the age perspective.

<u>Chart 4e</u>

Percentages of Knowledge Scores for Food Regulation and Control (n=99) - Culture Perspective

Mean knowledge of Food Safety System and The Legislation scores of the sample ($n$=99)

from the education and environment  perspectives

| Education | | | | | | | | Environment | | | | | | | |
|------|---|------|---|------|---|------|---|------|----|------|---|------|---|------|----|
| NFE | $n$ | PSC | $n$ | LSS | $n$ | USS | $n$ | DS | $n$ | DNM | $n$ | K. | $n$ | BTR | $n$ |
| 3.03 | 29 | 3.25 | 32 | 3.59 | 27 | 4.55 | 11 | 3.80 | 55 | 3.17 | 6 | 2.50 | 4 | 2.97 | 34 |

The ANOVA show a positive significance in the knowledge of Food Safety and the Legislation of hawkers from different environment background (F=3.46, df=3, $p$=.05). Post hoc multiple analysis show hawkers in designated sites have demonstrated better knowledge of *HACCP* than by the roadside hawkers ($t$= .023, $p$ = .05) – Chart 4f.

Hawkers with upper secondary school ($t$ = .006, $p$=.05) and lower secondary school ($t$= .009, $p$=.05) have demonstrated better knowledge of Food Regulation and Control than hawkers with no formal education (Chart 4g).

Percentages of Knowledge Scores for HACCP (n=99)

- Environment Perspective

Percentages of Knowledge Scores for Food Regulation and Control

(n-99) - Education Perspective
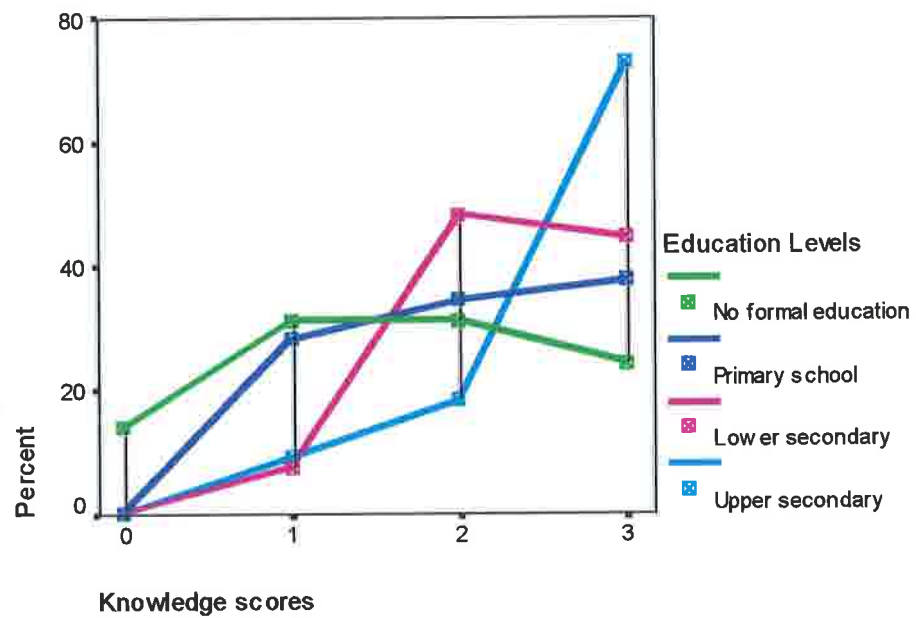
### *4.4.4* **Attitudes of Hawkers**

Section C of the Structured Interview Schedule consists of 13 attitude items pertaining to food safety/hygiene, foodborne illnesses and their prevention. The overall attitude scores of the interviewed hawkers are presented in Charts 5a & 5b. The mean attitude score is 35 ($n$=99). The breakdown by percentages of the responses of the interviewed hawkers to each item in the attitude scale is presented in Appendix 4. All responses of "strongly agree" and "agree" are interpreted as agreement and all responses of "disagree" and "strongly disagree" are interpreted as disagreement.

The ANOVA show a positive significance between the cultural (ethnic) groups (F=4.57, df=2, $p$=.05) in attitudes towards food safety/hygiene, foodborne illnesses and their prevention. Post hoc multiple analysis show ethnic Indians to have demonstrated better attitudes than ethnic Chinese ($t$=.010, $p$=.05). There is no significant difference in attitudes of hawkers from different age group.
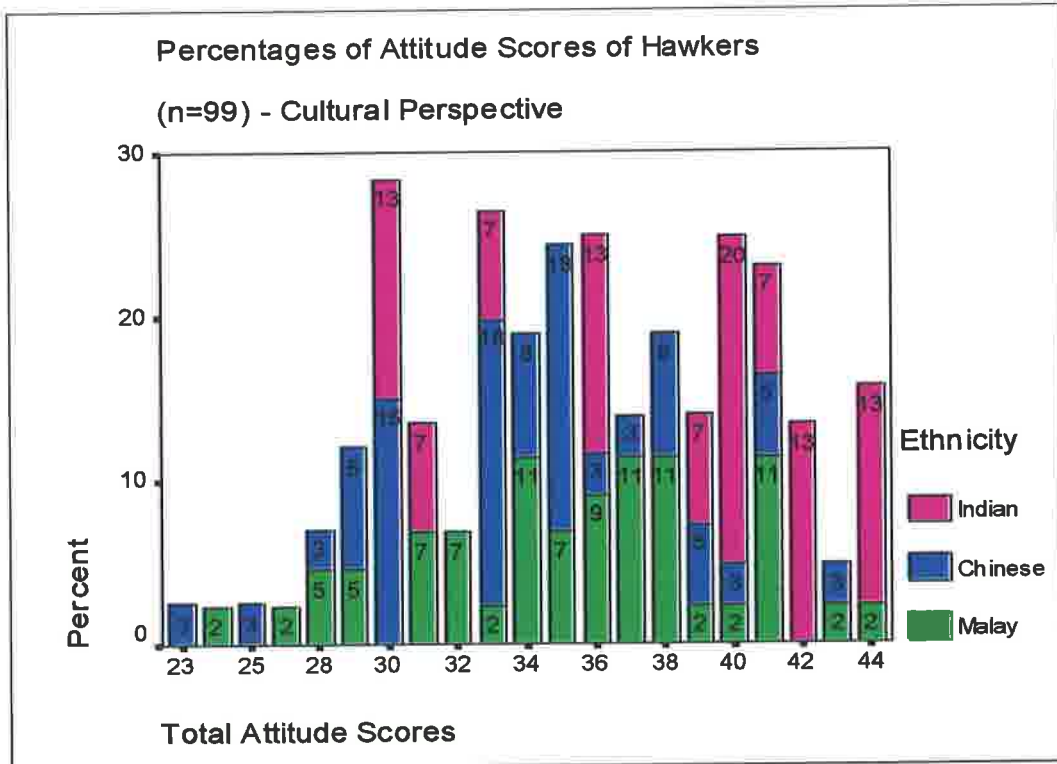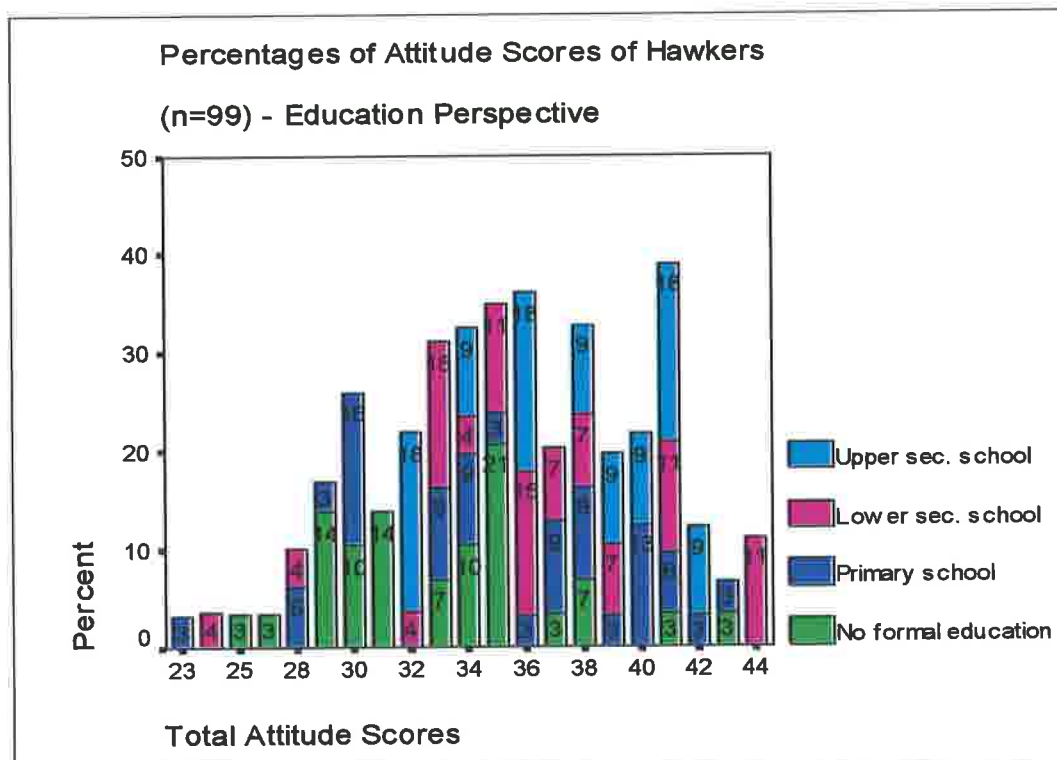
## Percentages of Attitude Scores of Hawkers
## (n=99) - Cultural Perspective

## Percentages of Attitude Scores of Hawkers
## (n=99) - Education Perspective

There is no significant difference in attitudes of hawkers from different environmental background. Hawkers from different educational background have demonstrated significant differences in attitudes (F= 3.77, df=3, $p$=.05). Post hoc multiple analysis show hawkers with upper ($t$ =.036, $p$=.05) and lower ($t$ =.030, $p$=.05) secondary school education demonstrate better attitudes towards food safety/hygiene, foodborne illnesses and their prevention than hawkers with no formal education.

Total attitude scores are correlated to total knowledge scores of the interviewed hawkers. Pearson parametric bivariate correlation (two-tail) characterises an association exists between knowledge and attitude of the interviewed hawkers ($r$ =.424, $p$< .01). A scatterplot showing the correlation between knowledge and attitude scores is presented in Chart 6.

Chart 6



Correlation between Knowledge and Attitude Scores (n=99)
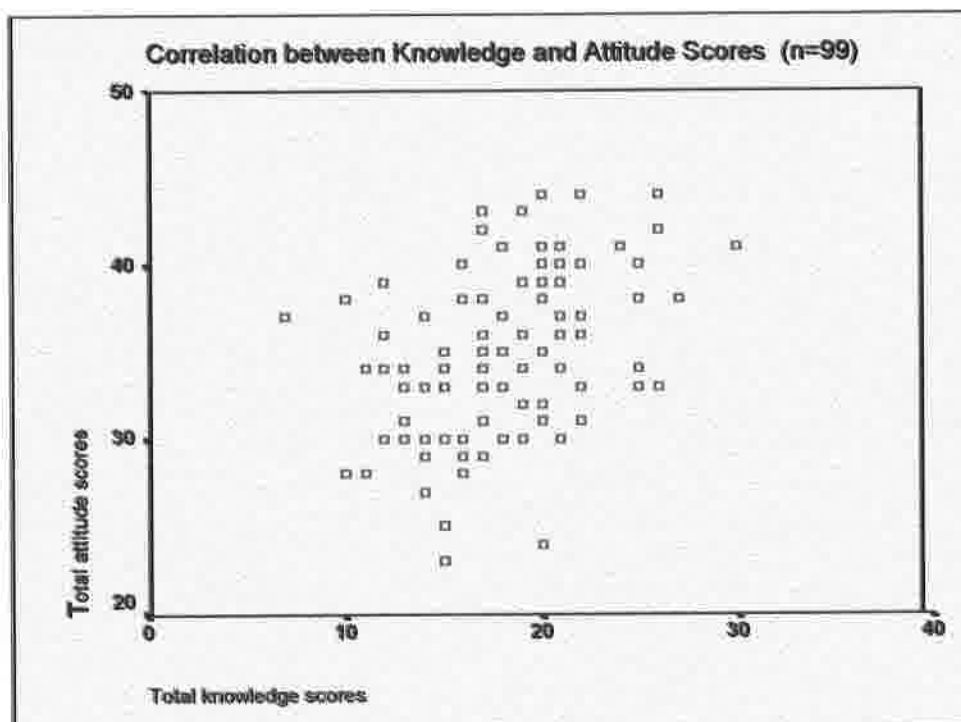
## 4.5    Summary of Results

### 4.5.1   Hawkers' Demographic Profile

- The contextual characteristics of Malaysian hawkers differ from documented reports. The hawker micro industry in KL is a multi-cultural (ethnicity), multi-location, male dominated and a wide cross-section of age groups and educational backgrounds population.

- There is a trend showing the hawker micro industry moving towards a more organised hawking environment (designated sites).

### 4.5.2   *Macro Levels*

- Mean differences in overall knowledge of the three ethnic groups (Malay, Chinese and Indians) are marginal although the ethnic Malays and ethnic Indian are more knowledgeable on Food Safety/Hygiene, Foodborne illnesses and their prevention than ethnic Chinese.

- Mean differences in overall attitudes of the three ethnic groups are also marginal. Ethnic Indians demonstrated better attitudes towards food safety, foodborne illnesses and their prevention than ethnic Chinese.

### 4.5.3   *Micro Levels*

#### 4.5.3.1   Food Safety and Hygiene Practices

- Ethnic Indians are found to be more knowledgeable than ethnic Chinese in the area of cross-contamination and maintenance of equipment, utensils and

premises. Similarly ethnic Malays are more knowledgeable than ethnic Chinese in the area of maintenance of equipment, utensils and premises.

- Hawkers of different age categories (junior and senior) do not have knowledge differences in food safety and hygiene practices.

- Hawkers with lower secondary school education are the only group who are more knowledgeable in the area of personal hygiene than those with no formal education.

- There is a wide gap in knowledge pertaining to maintenance of equipment, utensils and premises. Hawkers with upper secondary school education are more knowledgeable than those with lower secondary school education, primary school education and no formal education.

- From the environmental (category) perspective, there is no difference in knowledge of hawkers in the five areas of Food Safety and Hygiene Practices.

### 4.5.3.2 Food Safety System and The Legislation

- Ethnic Malays and Indians are more knowledgeable than ethnic Chinese in the area of *HACCP*. Ethnic Indians are more knowledgeable than ethnic Chinese in the area of Food Regulation and Control.

- Hawkers of different age categories (junior and senior) are no different in knowledge pertaining to Food Safety System and The Legislation.

- Hawkers with upper and lower secondary school education are more knowledgeable than those with no formal education in the area of Food Regulation and Control.

- From the environmental (category) perspective, hawkers in designated sites are more knowledgeable in the area of *HACCP* than those hawking by the roadside.

### 4.5.4   Attitudes of Hawkers

- There are differences in attitudes of the ethnic groups towards food safety and hygiene.  The ethnic Indians have demonstrated a more positive attitude than ethnic Chinese.

- There is no difference in attitudes towards food safety and hygiene in hawkers of different age groups.

- Hawkers with lower and upper secondary school education have better attitudes towards food safety and hygiene than those with no formal education.

- There is no difference in attitudes in food safety and hygiene in hawkers of different environmental (category) situations.

## 4.6 Discussion

*"Formal training programmes will be more effective if supported by practical reinforcement of hygiene messages".*
Rennie, D.M., 1996

The findings seem to suggest an emergence of a new generation of hawkers with demographic profile that challenges the stereotyped image (lack of education and training) given in past literature (Abdussalam & Kaferstein, 1992; WHO, 1993). The interviewed sample shows hawkers are made up of various age groups (30 years and below :41% and 31 years and above: 59%) and more than two thirds (71%) of the interviewed hawkers have formal education. The findings of this study are of particular importance to redress the present stereotyped perception of hawkers' education.

The hawker micro industry in Malaysia is dominated by men. The sample of this study is an exact representation of the actual hawker population of 69% male and 31 % female of KL (DBKL, 1998). The findings of male dominance show the KL hawker micro industry to be different from other Southeast Asian, South American, Indian and Pakistani countries where females play a major role in

hawking to supplement family income (Dawson & Canet, 1991; CIDEF, 1994; FAO - Kadidia Kanie-Devautour, 1995; WHO, 1996).

The data show more than half (55%) of the interviewed population are from designated sites. It is not wrong to postulate that findings of a new hawking structure has emerged in Kuala Lumpur, towards organised hawking activities and in line with the national relocation of hawkers plan from year 2000 (NST [New Straits Times], 1997; The Star, 1997).

The findings of this structured interview study have highlighted the impact of the cultural (ethnicity) background and environmental factor on knowledge and attitudes of hawkers. There is no literature to-date to show knowledge and attitudes of hawkers pertaining to food safety and hygiene from the cultural (ethnic) and environmental (category and geographical location) perspectives. The findings of this study will attempt to relate to past findings on knowledge and attitudes of foodhandlers in general. FAO (1995) has suggested the interaction of a municipality task force with vendors for attitudinal changes in their behaviour.

Food safety, hygiene and practices cover a wide spectrum. Of immediate importance and relevance to domestic foodhandlers and hawkers are factors frequently related to outbreaks of foodborne illnesses such as: (1) improper storage or holding temperature, (2) inadequate cooking, contaminated equipment or work surfaces, (3) food obtained from an unsafe source, (4) poor personal hygiene of foodhandler and (5) other (Weingold et al., 1994). It is postulated that

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improper food-handling practices due to lack of knowledge contribute to 97% of foodborne illnesses in food service establishments and homes (Howes et al., 1996).

The findings suggested ethnic differences in knowledge of food safety and hygiene practices are mainly in the areas of cross-contamination and maintenance of equipment, utensils and premises. Ethnic Indian hawkers have demonstrated better knowledge of cross-contamination and maintenance of equipment, utensils and premises than ethnic Chinese while ethnic Malays have demonstrated better knowledge of maintenance of equipment, utensils and premises than ethnic Chinese. Similarly, ethnic Malays are more knowledgeable than ethnic Chinese on the concept of *HACCP* and ethnic Indians are more knowledgeable than ethnic Chinese on Food Regulation and Control. Ethnic Indian hawkers are more positive in attitudes towards food safety and hygiene practices than ethnic Chinese.

The outcome did not reach statistical significance at the cross-section of all cultural groups. However, the findings have demonstrated a consistency in better knowledge of ethnic Malays and Indians over ethnic Chinese in certain topical areas of Food Safety and Hygiene Practices. These are practices such as protecting food from contamination, storing of raw and cooked foods in the refrigerator and handling of raw and cooked foods and also Food Safety System and The Legislation (cleaning of food-contact surfaces, handling of garbage, pests control, mode of cleaning and maintenance of equipment, utensils and premises).

However, of the five constructs pertaining to Food Safety and Hygiene Practices, there were three (time/temperature control, micro-organisms and foodborne illnesses and personal hygiene) showing no significant differences in knowledge between the three groups of different cultural (ethnic) backgrounds.

The findings seem to suggest that hawkers from different cultural backgrounds are not likely to demonstrate differences in food safety/hygiene knowledge and attitude. Hence the findings support the null hypothesis. Ethnic Indians are found to have demonstrated better attitudes than ethnic Chinese suggesting disagreement with the null hypothesis that hawkers from different cultural background are not likely to demonstrate differences in food safety/hygiene attitudes.

The findings indicate that there is no gap in attitudes and knowledge of younger (30 years and below) and older (31 years and above) hawkers pertaining to the five constructs of Food Safety and Hygiene Practices and two constructs in Food Safety System and the Legislation. The findings show no statistical significance in the age of hawkers; hence no support for the null hypothesis. However, Albrecht (1995) found respondents over 55 years of age had better food contamination scores than respondents between 19-30 years.

Knowledge of hawkers with different educational background is significant statistically; higher scores achieved by hawkers with higher levels of education. Hawkers with (1) lower secondary school education demonstrate better

knowledge in personal hygiene than those with no formal education (2) upper secondary education secure higher knowledge scores in maintenance of equipment, utensils and premises than hawkers with lower secondary, primary and no formal education and (3) upper and lower secondary are more knowledgeable in food regulation and control than hawkers with no formal education. The findings suggest negative support for the null hypothesis. Similarly, the same trend of attitude scores is noted; hawkers with lower and upper secondary education demonstrate better attitudes than those with no formal education. There is also a suggestion that the educational background of hawkers influences knowledge scores in the four constructs pertaining to food safety and hygiene practices.

Findings of this study echoed findings of Howes et al. (1996) showing knowledge scores decreased significantly in foodhandlers having difficulty in reading and understanding. Albrecht (1995) arrived at similar findings in a study on food safety knowledge and practices with statistically lower scores from respondents without higher school education than respondents with higher school education.

Hawkers in different environmental locations (category and geographical location) have not demonstrated differences in knowledge of food safety and hygiene practices in general. However, in the topical area of *HACCP,* hawkers in designated sites have demonstrated better knowledge than hawkers by the roadside. This study, showing no differences in hawkers' attitudes in general from the environment perspective, support the null hypothesis. However, hawkers in

designated sites with amenities and regular monitoring from the authority have demonstrated better knowledge than hawkers by the roadside. The findings reinforce findings by Albrecht (1995) of positive impact of environment on knowledge of food safety scores.

# STUDY 2
### The Risk Assessment and Laboratory Study

# RISK ASSESSMENTS:

- ## FOODHANDLING PRACTICES
- ## FOOD-CONTACT SURFACES

*"Even if risk has a numerical value, it may often be helpful for this to be expressed qualitatively when communicating the risk to others".*

ACDP, UK. (1996)

# 5.1 INTRODUCTION

*"Food quality assurance systems are necessary at every segment of the food chain and in every sector of the food industry to ensure the quality and safety of food".*
Orriss, G.D. (1998)

Food Safety is a globally endorsed issue. According to CDC [Centre for Disease Control] (1994), contamination of food items is frequently found in preparation places of food service establishments and homes. Epidemiological data pertaining to foodborne illnesses from hawker foods are under-developed with cases of foodborne illnesses often unreported. Bryan (1995), in an effort to circumvent the prevailing (lack of epidemiological data) situation, recommended linking available epidemiological data of foodborne illnesses to HACCP-based risk assessment surveillance.

The implementation of the HACCP more than thirty years ago, as a means of systematically addressing food safety concern is gaining international acceptance both by the industry and the regulatory agencies. According to Buchanan (1995), an understanding of the relationship among HACCP, microbiological criteria and risk assessment is important. Microbiological hazards picked up through the HACCP process have continually been cited as one of the more important and persistent food safety concerns; substantiated by a significant increase of foodborne diseases in many countries during recent years (Buchanan, 1995; Montarjemi et al., 1996). Weingold et al. (1994) and Bryan (1989) contended that those responsible for food safety should set programme priorities rationally on

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the basis of the nature and magnitude of local and regional problems and on the quantity and quality of available or obtainable resources.

Risk assessment is an objective and scientific process (Potter, 1996). It evaluates the magnitude of health risks, improves the safety of foods, facilitates the flexible public health distribution of pre-harvest, harvest and post-harvest food safety resources, and helps create a continuum for "farm-to-fork" foodborne disease prevention efforts (Potter, 1996). Risk assessment, from an application standpoint, is defined as the process of identifying hazards, assessing risks and evaluating their significance (LACOTS Local authorities coordinating body on food and trading standards, 1995). Risk assessment was highlighted as "a way to delineate between significant risks that require action and a multitude of insignificant or at tolerable level risks" (Buchanan, 1995; Pariza, 1995; Notermans & Teunis, 1996).

The annual incidence of food poisoning in Malaysia ranged from 11.6 per 100,000 in 1986 to 15.2 per 100,000 in 1996 (M.O.H, 1998). Restricted epidemiological data (M.O.H.unpublished data, 1996) have suggested that places of outbreak were schools (65%), homes (7%), eating places (1%) and other institutions (factories, commercial establishments, universities, hospitals, airlines) - (27%). Contributory factors of foodborne illness outbreaks have been identified such as: (1) improper storage, (2) holding temperatures of foods, (3) poor personal hygiene, and (4) raw ingredients obtained from an unsafe source. *Bacillus cereus, Staphylococcus aureus, E.coli, Salmonella and Clostridium perfringens* have been reported as causative agents in local food poisoning outbreaks (M.O.H.

unpublished data, 1996). Although limited information on contributory factors is available locally, documented sources have highlighted the following additional factors:

- lapse of 12 hours or more between preparing and eating,

- cross-contamination of raw and cooked foods,

- inadequate temperature and time during cooking,

- improper cleaning of equipment,

- improper cooling,

- inadequate reheating, and

- colonised person/s handling food

(Bryan, 1988, 1993, 1995, Weingold et al., 1994; FAO, 1995, WHO, 1996)

Studies have predicated the contributory factors of contamination, food soiling, holding temperatures, and cleaning techniques in home kitchens (Nese et al., 1994). Little is known as to what extent these factors might contribute to food poisoning outbreaks from consumption of hawker foods. Hawker foods have been reported as high risk retails foods (Bryan, 1993; FAO, 1995). Yet, according to Tinker (1997), hawker foods appear to be posing no greater risk for public consumption than foods prepared in an average home or in a local restaurant. Studies in the past have highlighted findings of bacteria types (*Salmonella, B. cereus, E. coli*) and colonies in home-prepared and hawker foods (Bryan, 1993;

Desmarchier et al., 1994; Arumugaswamy et al., 1995; Rusul et al. 1996). Findings of this nature are curative in nature; little is known of studies in the preventive direction.

In the light of the paucity of current research findings on the safety of hawker foods and the limited epidemiological data, a study was carried out on ethnic (Malay, Chinese and Indian) hawker foods in Kuala Lumpur in Spring 1998. This study, using observational and measurable criteria (quantitative and qualitative), was aimed at determining: (1) the degree of risk of foodhandling practices (FHP) and food-contact surface (FCS) of culture groups, and (2) to what extent documented contributory factors of foodborne illness were exhibited, in hawker foods of different cultures. The method takes into consideration the *HACCP-*based food management system and the more recent food assurance method of risk assessment.

On-site risk assessments of foodhandling practices and food-contact surfaces were carried out in relation to three popular and traditional (Merpati, 1997) ethnic hawker foods (*Nasi Lemak, Char Koay Teow* and *Roti Canai*). The use of observational, measurable and microbiological assessment methods in this study are well documented (Roberts, 1980; Tebbutt, 1991; Bryan, 1992; Kramer, 1992; Nese et al., 1994; Weingold et al., 1994; Assured Safe Catering, 1996; Carpenter, 1997; Industry Guide to Good Hygiene Practice, 1997).

This chapter will be used in an attempt to provide indicators of a rapid and preventive nature with a view to strengthen (validate) the findings of Chapter Four.

## 5.2    Hypotheses

Two investigative hypotheses are formulated to assist with the interpretation of the findings.

- Cultural (ethnic) hawker foods in different environments (where the stalls are located) are likely to exhibit different levels of risk concerns in foodhandling practices (FHP)

- Cultural hawker foods in different environment are likely to exhibit different risk concerns (contamination levels) in food-contact surfaces (FCS).

# 5.3 METHODS

*"Risk assessment is the primary scientific process in risk analysis and represents an evaluation of the probability of occurrence (likelihood) and severity (magnitude) of known potential adverse health effects resulting from human exposure to foodborne hazards".*

Hathaway, S. (1998)

Risk assessment in the context of this study is akin to the participant observation method[1] The risk/contamination assessments were devised to assess areas which are contamination-susceptible hence posing health risks (Roberts, 1980; Bryan, 1992; 1993; 1995; Tebbutt, 1989, 1991; Desmarchier et al., 1994). Risk assessments (semi-participant observation) of foodhandling practices (FHP) and food contact surfaces (FCS) using dipslides, were thought of to be the better methods to determine practices of food handlers and safety of hawker foods. Risk assessments were carried out by evaluating and observing on-the-spot (without any prior notice to the operator of the stall but accompanied by a Senior Health Inspector (for power of entry) of DBKL) evidential practices in detailed sequence and a naturalistic environment whilst contamination assessments (using dipslides) provide the enumeration of total aerobic bacteria (shown on contact agar -TTC[2] dipslides as red colonies) on food-contact surfaces.

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[1] The author immerses herself, over a period of time, in the setting to observe and assess accurately and using a variety of procedures (supplementing observations with interviews, examination of equipment and other output produced in the setting).

[2] nutrient agar with 2, 3, 5 triphenyl tetrazolium chloride (TTC)

### 5.3.1 Sample Selection

A total of 36 samples were selected for this study. Three samples of each traditionally-popular (Merpati, 1997) ethnic food (NL, CKT and RC) items were recommended by the Environmental Health Offices in Cardiff and Hawkers' and Health Departments, DBKL in Malaysia to offer good repeat results for risk and contamination indicators. Additionally, the feedback from the piloting reinforced the recommendation of the respective Local Authorities in KL and in UK with regards to the sample size for FHP and FCS. The sample distribution of the population[3] ($n$=36) is presented in Diagrams 8a, 8b and 8c.

Nine culture (ethnic) foods/stalls namely: (1) 3 Nasi *Lemak* (NL) or ethnic Malay coconut rice, (2) 3 *Char Koay Teow* (CKT) or ethnic Chinese fried rice noodles and (3) 3 *Roti Canai* (RC) or ethnic Indian pancake were chosen for the risk assessments of foodhandling practices (FHP) and food-contact surfaces (FCS) from three of the eight designated sites of Study 1. The hawker stalls were selected by pre-defined[4] ethnic hawker groups in different environment such as: (1) TPCA[Tamil Physical and Cultural Association] for NL (2) Chow Kit for CKT and (3) Bangsar for RC. In view of the Malaysian government's plan to relocate hawkers from year 2000 (NST[New Straits Times], 1997), the stalls were selected from three designated (more developed) environment for purposes of comparison and obtaining

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[3] population in this chapter denotes food samples of three culture origins.

[4] The strata of the population (identified as relevant) is confined to the particular research. For the purpose of this study, pre-defined (Coolican, 1994) groups are used to represent the hawkers in KL.

appropriate data which could serve as a yardstick for standardised monitoring by the control authority and intervention by the government.

Another reason for deciding on the designated site for the study was to ensure the certainty of finding the FCS (work surface, chopping board and dishcloth) items on-site in each of the selected samples. Stalls, other than those in the designated sites, do not always have the three FCS items. *Mise-en-place* (pre-preparatory work) is often carried out at home by ambulant and semi-permanent hawkers.

### 5.3.2 Developing the Research Instruments

The risk assessment instrument for hawkers was adapted from Tebbutt (1990; 1991), amended to suit the local hawker situation and reviewed by the Environmental Health Authorities in Pembrokeshire (Wales) and Cardiff and the Hawkers' Department in Kuala Lumpur. All pertinent amendments were made according to professional advice and feedback from pilot-testing of instruments.

# DISTRIBUTION OF SAMPLES FOR RISK ASSESSMENTS

Diagram 8a

Total Population (36)

→ Risk assessments (FHP[Foodhandling practices]) (9)

→ Risk assessments (FCS[Food-contact surfaces]) (27)

Diagram 8b

Risk Assessments (FHP) 9

→ NL [Nasi Lemak] (3) (TPCA)*

→ CKT [Char Koay Teow] (3) (Chow Kit)

→ RC [Roti Canai] (3) (Bangsar)
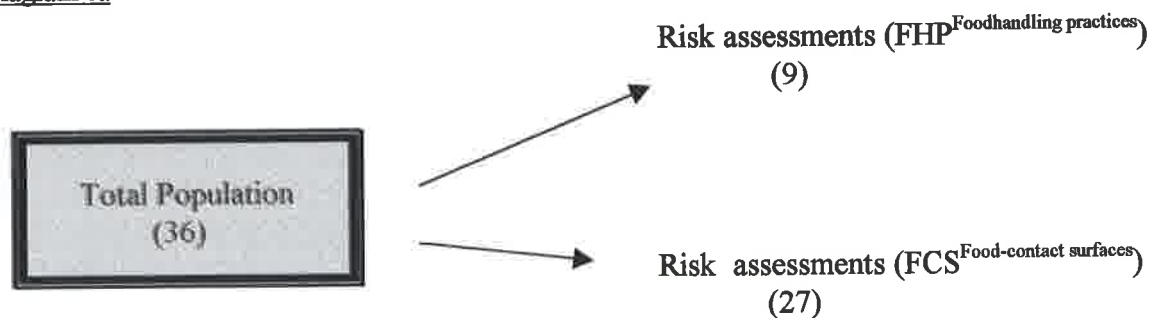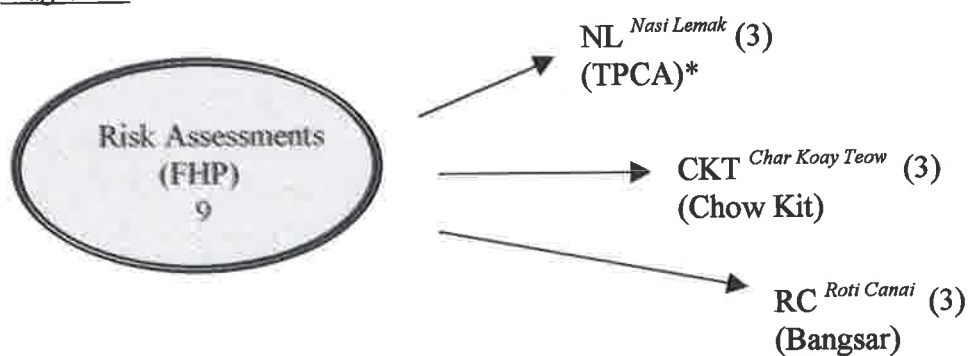
* denotes environment (where stalls are located)

Diagram 8c

Risk Assessments (FCS) 27

→ NL (9)
  → WS [work surface] (3)
  → CB [chopping board] (3)
  → DC [dish cloth] (3)

→ CKT (9)
  → WS (3)
  → CB (3)
  → DB (3)

→ RC (9)
  → WS (3)
  → CB (3)
  → DC (3)
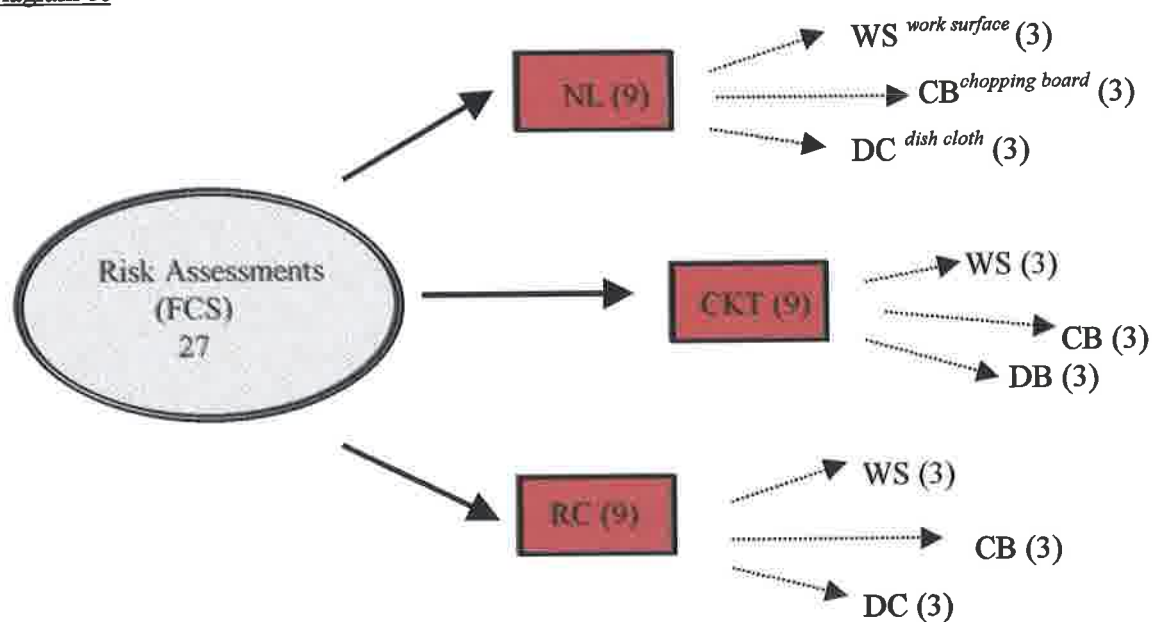
Risk assessment instruments in this study comprised: (A) risk assessment format for FHP and (B) dipslides (and Incupot) for FCS.

The risk assessment format (FHP) was adapted from Tebbutt and Midwood (1990) and Tebbutt (1991) and amended to suit local hawker situation. The format is made up of 13 main constructs in three broad areas, namely (1) Cleaning and Cleanliness, (2) Personal Hygiene and Training, and (3) Time/Temperature Control and Cross-Contamination. A temperature camera was also used to assist in ascertaining the temperatures of foods and equipment as and when necessary.

The contamination assessment instruments are in the form of dipslides and an incupot. The risk and contamination assessments took into account observational (visual evidence) and measurable (using a thermometer and an in situ test kit) evaluation methods of hawker foods and stalls. Past studies on food hazards and risks using observational and/or analysis of food sample methods are well documented (Griffiths, 1978; Roberts, 1980; Bryan, 1978, 1988, 1993, 1995; Tebbutts, 1990, Kramer, 1992, Nese et al., 1994; Desmarchier, 1994, and Ashenafi, 1995). However, necessary amendments to the instruments were made to suit local hawker situations. A preventive (instead of curative) and rapid (results obtained within 48 hours) method, using dipslides, was used for obtaining contamination (hazard indicators of high concern, medium concern or low concern) indicators for public health protection.

### 5.3.3 Pre-testing of Instruments

The risk assessment instrument was piloted on ten (10) mobile "hot-dog/hamburger" vendors in Pembrokeshire (Wales) during the autumn of 1997 as proposed and supported by the Director of the Environmental Health Department, Pembrokeshire County Council. Similar piloting of the risk assessment format was carried out on three stalls of NL, CKT *and* RC in Kuala Lumpur. The piloted stalls were different from the study proper. Based on the feedback of the piloting, the risk assessment format was amended accordingly to reflect discriminatory power and reliability, and standardised for general and practical measures of risk characteristics.

Piloting for viability of use of the dipslides on food-contact surfaces was carried out on three ethnic foods (NL. *CKT and RC*). Piloting was carried out during the early spring of 1998. Readings (contamination levels) at 24 hours, 36 hours and 48 hours incubation were taken but only the results at 48 hours (to ensure maximum growth of all strains of bacteria) were used for the interpretation of results.

### 5.3.4 Administering the Risk/Contamination Assessments Proper

The Hawkers' Department, DBKL had graciously granted the presence of a Senior Health Inspector (for power of entry) at the selected hawker premises during the entire data collection (risk and contamination assessments) process. Risk assessments of FHP and FCS were carried out in the mornings from nine to

eleven o'clock for nine days consecutively. This is because the three food items are commonly eaten for breakfast and deteriorate in the heat of the afternoons. It was also desirable to carry out the assessments as quickly as possible in order to standardise for meteorological conditions. Hence, it was decided that the assessments of all nine cultural food stalls be carried out in the mornings. Assessments of foodhandling practices and the swabbing of the food-contact surfaces (using dipslides) were carried out at the same time at each of the hawker stalls selected for the study. Temperatures of foods and/or equipment in the stalls were taken and recorded.

The step-by-step execution of the risk assessment of FHP and FCS (using dipslides) were based on the following guidelines:-

Food handling Practices:

1. Food Hygiene Risk Assessment (LACOTS Local Authority Coordinating Body on Food and Trading Standards, 1995).

2. Draft Guidelines for the Design of Control Measures for Street-Vended Foods in Africa (CODEX Alimentarius Commission, 1997).

3. The Food Safety (Temperature Control) Regulations (1995; 1997).

Food-Contact Surfaces:

1. Knoll    MicroCheck    (manufacturer)    Bacteria
   Contamination    Readings    (1997)    –    adapted    from
   Griffiths, W.E. (1978).

Both assessments of the pre-determined nine hawkers in three separate locations (TPCA, Chow Kit and Jalan Bangsar) were conducted in the following manner: -

*Foodhandling Practices (FHP)*

1.  The assessment of food handling practices was carried out using a rating scale of Very Good (5 points),  Good (4 points), Acceptable (3 points), Poor (2 points) and Unacceptable (1 point) that best described the hygiene/safety standards of each hawker.

2.  Temperature    readings    were    recorded    for "Time/Temperature Control" constructs of:  (1)  cooking,  (2) holding,  (3) reheating,  (4) storage (leftovers) and (5) equipment (fridge, freezer, rice-cookers and ice-box, where applicable).

3.  As and when the situation demanded, sensory evaluation based on organoleptic values (smell, mouthfeel and appearance) was carried out to complement and supplement the risk (FHP) and

contamination (FCS) assessments and temperature reading processes.

4.  Any additional observations noted were recorded in the "Remarks" column under each construct. This, in the view of the author, was of utmost importance as it would help to justify and enhance the quality of interpreting data collected through the detailed visual/measurable assessments.

## Food-Contact Surfaces (FCS)

1.  Three food-contact surfaces (work surface, chopping board and dishcloth), adjudged essential to gauge the hygiene standards of hawkers, were pre-determined for the swabbing process using dipslides (indicators of total bacterial growth colonies). The bacteria picked up on the TTC agar grew quickly, forming colonies, which appear as red spots.

2.  Using 27 Micro-C dipslides with TTC Agar, the swabbing process was carried out on the pre-determined FCS: (1) work surface, (2) chopping board and (3) dishcloth of each of the nine selected hawkers (NL; CKT; RC). After swabbing, the dipslides were recapped into the same factory-sterilised aseptic container.

3.    The 27 samples (dipslides) were then incubated at a temperature of 30 °C using an Incupot. Contamination levels (growth density of bacteria colonies) on dipslides were recorded at: (1) 24 hours, (2) 36 hours and (3) 48 hours intervals using a comparison chart (Box 8) provided by the manufacturer together with the in situ test-kit.

4.    All used dipslides were carefully immersed in freshly prepared disinfectant (ten part of water to one part of concentrated Clorox) overnight; then wrapped and disposed of the next morning.

Box 8

INTERPRETATION OF CONTAMINATION LEVELS (Griffith, W.E., 1978; Tebbutt, 1991)



$10^3$    $10^4$    $10^5$    $10^6$    $10^7$    Bacteria per ml

$10^3$ – Slight infection    $10^5$ – Moderate infection
$10^6$ or more – High infection
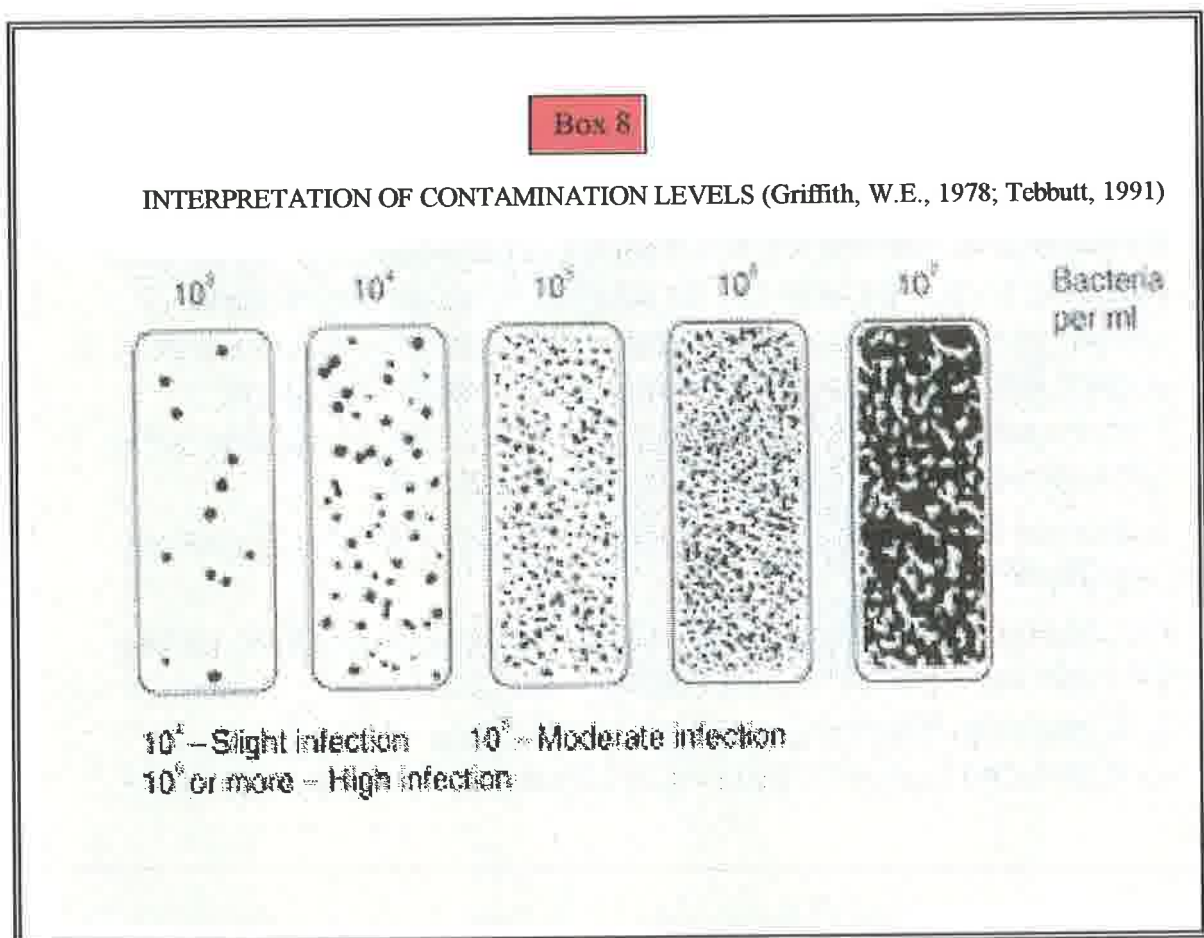
### 5.3.5 Data Analysis and Interpretation

Higher scores represent lower risks for FHP whilst higher scores represent higher risk for FCS. The analysis and interpretation of the results of the risk assessments (FHP and FCS) were carried out in two-tiered versions: macro and micro.

*FHP Scoring:*

All scores of "Very Good (5 points)" and "Good (4 points)" were grouped together and interpreted as "Good" or "Low Concern" and all scores of "Poor" and "Unacceptable" were grouped and interpreted as "Poor" or "High Concern". "Acceptable" scores are in the "Medium Concern" category. Scores of $<$ 120 points are in the High Concern, 120 - $<$ 160 points are in the Medium Concern and $\geq$ 160 points are in the Low Concern categories respectively (Appendix 6a.

Interpretation of FHP results were based on (1i) Macro level: overall mean scores (NL, CKT and RC), and (1ii) Micro levels: (a) total mean scores for Cleaning and Cleanliness (NL, CKT and RC), (b) total mean scores for Personal Hygiene and Training (NL; CKT; RC), and (iii) total mean scores for Temperature Control and Cross-Contamination (NL; CKT; RC).

*FCS Scoring:*

Interpretation of dipslide readings were based on scientific values of "very slight growth $(10^3)$", "slight growth $(10^4)$", "moderate growth $(10^5)$", "heavy growth $(10^6)$" and "very heavy growth $(10^7)$" (Appendix 6b). The dipslide readings,

taken into accounts the estimated number of bacteria present in the original fluid, were recorded in the following order at 24 hours, 36 hours and 48 hours respectively. For this study, microbiological guidelines (expert opinion) of the Public Health Laboratory Services (PHLS, 1996), UK, for some ready-to-eat foods were used to interpret the risk (shown on the dipslides).

For the purpose of this study "very slight growth" and "slight growth" were banded together to denote "Low Concern", "moderate growth" as "Medium Concern" and "heavy growth" and "very heavy growth" as "High Concern" in terms of risk to health if consumed. The contamination results (dipslide readings) would be used to complement and supplement the findings of FHP. Interpretation of FCS (dipslide readings) results were based on: (2i) Macro level: overall mean scores (NL, CKT and RC), and (2ii) Micro levels: (a) total mean scores of WS (NL, CKT and RC); (b) total mean scores for CB (NL, CKT and RC), and (3) total mean scores for DC (NL, CKT and RC).

All FHP and FCS risk assessment scores were analysed using SPSS to process quantitative and qualitative statistics. Significance was determined at the level of $p \leq .05$. 48-hour (incubation) readings were used for the interpretation of FCS results of this study. This is to permit strains of bacteria with varied growth capacities (length of time) to multiply fully. Interpretation of data made use of percentages, means and standard deviations as and when appropriate.

A one-way analysis of variance (ANOVA) test of significance and post-hoc multiple comparisons using Bonferroni $t$-tests were carried out on the three ethnic FHP risk mean scores. Post-hoc treatment of the ANOVA results was not carried out on the FCS risk scores because of semi-quantitative readings. A Pearson bivariate comparison was used to establish the relationships between FHP and FCS risk scores.

## 5.4   RESULTS

*"Low on a food safety priority list should be*
*aesthetic concerns, but program concerns are*
*often reversed in some jurisdictions and in the*
*minds of certain well-meaning but often*
*poorly-informed persons"*
Bryan,F.L. (1989)

Risk assessment methods for food handling practices and food-contact surfaces (using dipslides) adopted for this study were carefully standardised (after pilot-testing) to reduce as far as possible variations between the three different ethnic hawker foods. Differences in food preparation were inevitable but none was considered sufficient to reduce the overall validity of the results.

The results are presented in two-tiered versions. The macro versions are represented by the overall foodhandling practices (FHP) scores (Chart 7) and the overall food-contact surfaces (FCS) readings (Chart 8). The micro versions of the FHP are presented in three distinct areas: (1) Cleaning and Cleanliness: Factors of Risk (Cleaning and Cleanliness: visual evidence, detergents and

disinfectants and garbage), (2) Personal Hygiene and Training: Factors of Risk (Personal hygiene: food handler and course attended) and (3) Temperature Control and Cross-Contamination: Factors of Risk (Time/temperature control: cooking, holding, reheating, storage and equipment and Contamination: foodhandling methods and physical separation of raw and cooked foods). The micro versions of FCS are represented by three distinct items related to food-contact surfaces: ((1) work surface (WS), (2) chopping board (CB) and (3) dishcloth (DC) of the three ethnic (culture) samples.

### 5.4.1 Macro Levels

Overall Risk Indicators for Foodhandling Practices (FHP) (n=0) - Culture and Environment Perspectives

Risk levels
- high concern
- medium concern

Hawker foods
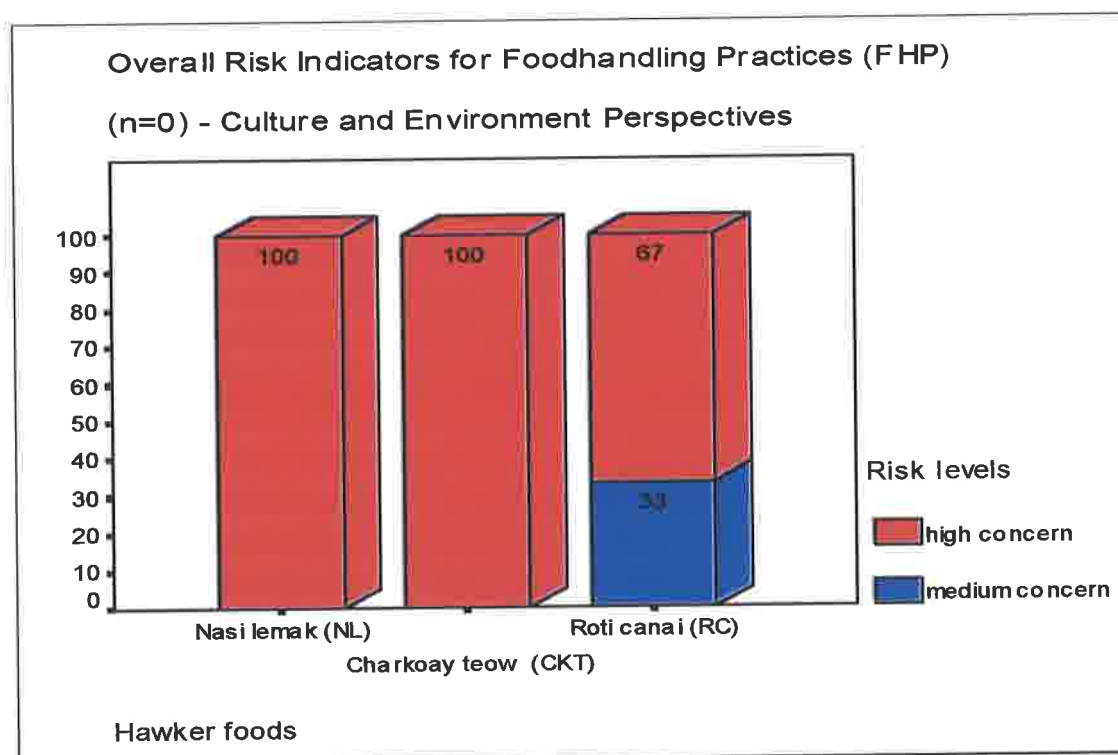
NL: Nasi Lemak;   CKT: Chow Koay Teow;   RC: Roti Canai

Chart 8



**Overall Risk Indicators for Food-Contact Surfaces (FCS)**
**(n=27)**

WS: work surface;  CB: chopping board;  DC: dish cloth
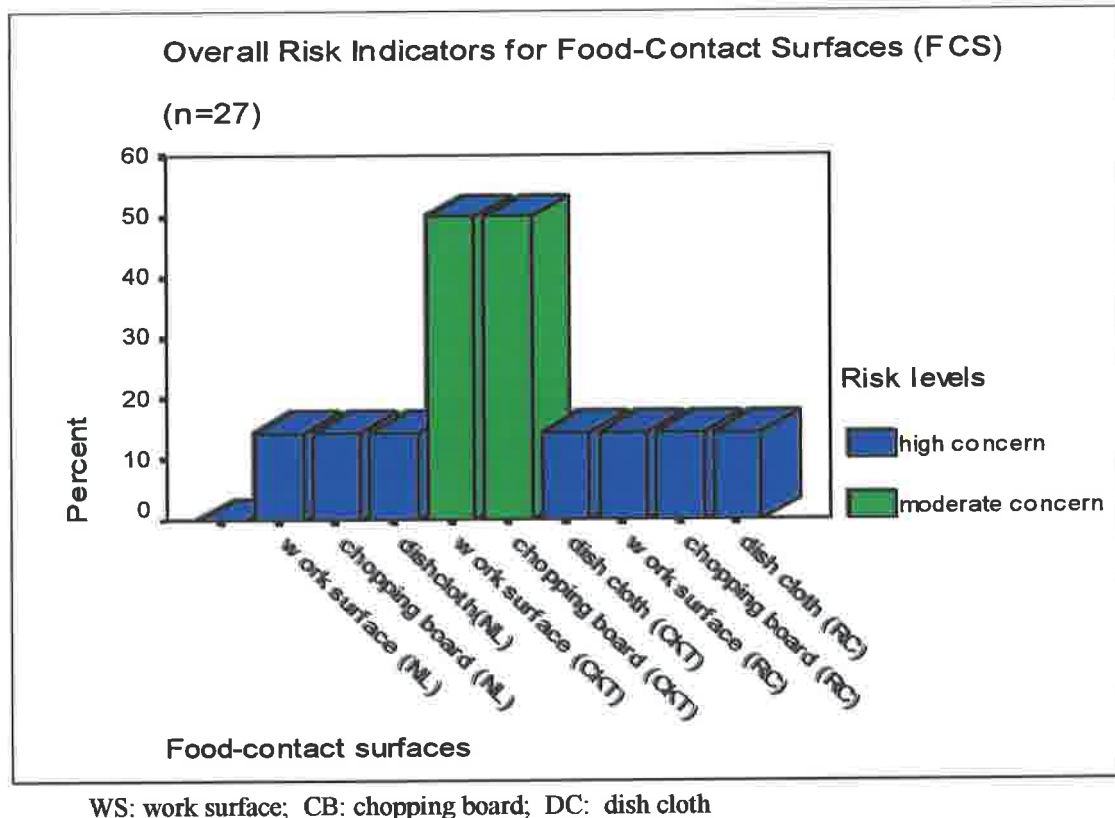
The overall risk assessment (FHP) mean scores for *Nasi Lemak* (NL1, NL2 and NL3), *Char Koay Teow* (CKT1, CKT2 and CKT3) and *Roti Canai* (RC1, RC2 and RC3) are presented in Table 4a.  The overall contamination mean scores for food-contact surfaces (work surface, chopping board and dishcloth) are presented in Table 4b.

Table 4a

The maximum and minimum attainable scores for the overall FHP (13 constructs) mean scores are 205 and 37. Higher mean scores are indicative of lower concern and lower mean scores, higher concern

| MALAY | | CHINESE | | INDIAN | |
|---|---|---|---|---|---|
| Nasi Lemak (TPCA) * | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
| M** | *n* | M | *n* | M | *n* |
| 56.3 | 3 | 96.3 | 3 | 102.6 | 3 |

\* Environment (designated sites)
\*\* M: mean

Table 4b

The maximum and minimum attainable scores for the overall FCS (WS; CB and DC) mean scores are 7 and 3. Lower mean scores are indicative of lower concern and higher mean scores, higher concern.

| ETHNIC MALAY | | | | | | | | ETHNIC CHINESE | | | | | | | | ETHNIC INDIAN | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nasi Lemak | | | | | | | | Char Koay Teow | | | | | | | | Roti Canai | | | | | | | |
| WS* | *n* | CB | *n* | DC | *n* | Ov. | *n* | WS | *n* | CB | *n* | DC | *n* | *Ov.* | *n* | WS | *n* | CB | *n* | DC | *n* | *Ov.* | *n* |
| 6.3** | 3 | 6.0 | 3 | 7.0 | 3 | 6.4 | 9 | 5.0 | 3 | 5.3 | 3 | 5.6 | 3 | 5.3 | 9 | 5.6 | 3 | 5.3 | 3 | 6.3 | 3 | 5.7 | 9 |

\* WS : Work surface;  CB: Chopping board;  DC:  Dish cloth; Ov.: Overall FCS (WS, CB; DC) mean scores
\*\* figures indicate indices

The analysis of variance (ANOVA) results on the overall risk assessment scores

showed a significant risk difference in FHP between the different culture foods

(F= 9.35; df=2; $p=.05$) sited in different designated environments (where the stalls are located). Post-hoc multiple comparisons showed significant differences in overall foodhandling practice scores between ethnic Malay and ethnic Chinese ($t=.041$; $p=.05$) and ethnic Malay and ethnic Indian ($t=.022$; $p=.05$).

### 5.4.2   Micro Levels   (FHP)

### 5.4.2.1    Cleaning and Cleanliness: Factors of Risk

The results in this section are based on the total risk scores of three constructs (visual evidence, detergents and disinfectants and garbage) – Chart 9.

Chart 9
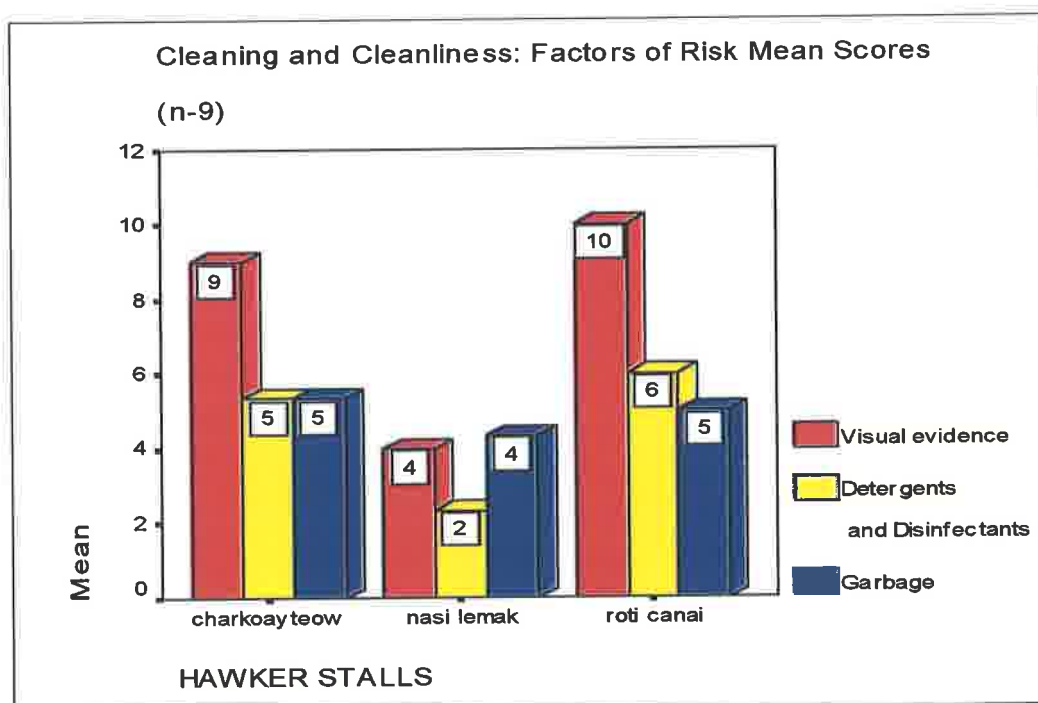


Chart 9 – Cleaning and Cleanliness: Factors of Risk Mean Scores (n-9)

N.B. Mean scores to the nearest whole number

139

The mean scores of the culture groups for the constructs pertaining to Cleaning and Cleanliness: Factors of Risk (visual evidence, detergents and disinfectants and garbage) are presented in Tables 5a and 5b.

Table 5a

Total Risk Assessment Mean Scores of Cultural Foods (in three distinct environments) for Cleaning and Cleanliness: Factors of Risks. Maximum and minimum attainable scores: 40 and 8.

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | *n* | M | *n* | M | *n* |
| 10.6 | 3 | 19.6 | 3 | 21.0 | 3 |

Table 5b

Total Risk Assessment Mean Scores of Cultural Foods (in three distinct environments) for:

***Visual Evidence*** (work surface, equipment/utensils, surroundings and dishcloth). Maximum and minimum attainable scores : 20 and 4.

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | *n* | M | *n* | M | *n* |
| 4.0 | 3 | 9.0 | 3 | 10.0 | 3 |

***Detergents and Disinfectants*** (choice of cleaning agents and frequency of usage). Maximum and minimum attainable scores: 10 and 2.

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | *n* | M | *n* | M | *n* |
| 2.3 | 3 | 5.3 | 3 | 6.0 | 3 |

*Garbage* (disposal and accumulation). Maximum and minimum attainable scores: 10 and 2

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | *n* | M | *n* | M | *n* |
| 4.3 | 3 | 5.3 | 3 | 5.0 | 3 |

The one-way analysis of variance (ANOVA) showed positive significance (F= 6.63; df=2; *p*=.05) of culture differences (NL, CKT and RC) in Cleaning and Cleanliness: Factors of Risk scores. Post-hoc multiple comparisons showed significant differences between risk scores of ethnic Malay and ethnic Indian (*t* =.050; *p*=.05).

### 5.4.2.2    Personal Hygiene and Training:  Factors of Risk

The results in this section are based on the total risk scores for the three constructs (hand-washing basin/facilities, foodhandler and course attended) -Chart 10.

Chart 10



Personal Hygiene and Training: Factors of Risk Mean Scores (n=9)

N.B. Mean scores to the nearest whole number
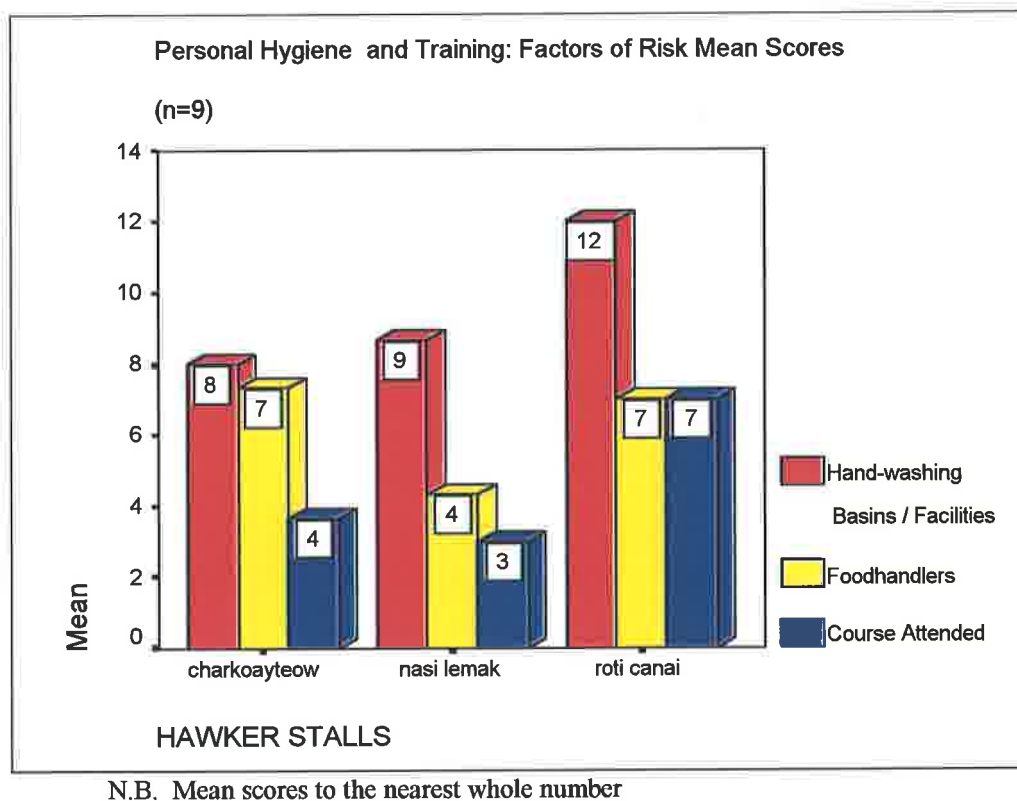
The mean scores of the culture groups for the constructs pertaining to Personal Hygiene and Training: Factors of Risk (hand-washing basin/facilities, foodhandler and course attended) are presented in Tables 6a and 6b.

Table 6a

Total Risk Assessment Mean Scores of Cultural Foods (in three distinct environments) for Personal Hygiene and Training: Factors of Risks. Maximum and minimum attainable scores: 55 and 11.

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 16 | 3 | 19 | 3 | 26 | 3 |

Total Risk Assessment Mean Scores of Cultural Foods  (in three distinct environments) for:

**_Hand-washing  Basin/Facilities_** (physical condition, drainage (waste water disposal), soap-dispenser, hot/cold water and hand-drying method). Maximum and minimum attainable score: 25 and 5

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 8.6 | 3 | 8.0 | 3 | 12.0 | 3 |

**_Foodhandler_** (general appearance, protective clothing, attitudes and hygiene practice). Maximum and minimum attainable scores: 15 and 3

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 4.3 | 3 | 7.3 | 3 | 7.0 | 3 |

**_Course Attended_** (formal, informal and periodic retraining). Maximum and minimum attainable scores: 15 and 3

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 3.0 | 3 | 3.6 | 3 | 7.0 | 3 |

The ANOVA showed a positive significance (F= 5.64; df=2; $p=.05$) of culture differences in the risk scores for Personal Hygiene: Factors of Risk. Post-hoc multiple comparisons showed no significant difference in the scores of the culture groups in this specific area. However, significant difference was noted to

denote lower risk of RC food handlers than NL ($t = .00$; $p = .05$) and CKT ($t = .00$; $p = .05$) food handlers.

Significant differences were noted between NL and CKT ($t = .048$; $p = .05$) in the topical area of food handler and between NL and RC ($t = .000$; $p = .05$) in the topical area of training.

### 5.4.2.3    Temperature Control and Cross-Contamination:  Factors of Risk

The results in this section are based on the total risk scores for seven constructs (cooking, holding, reheating, storage, equipment, food handling methods, physical separation of raw and cooked foods) - Charts 11a and 11b.

Chart 11a
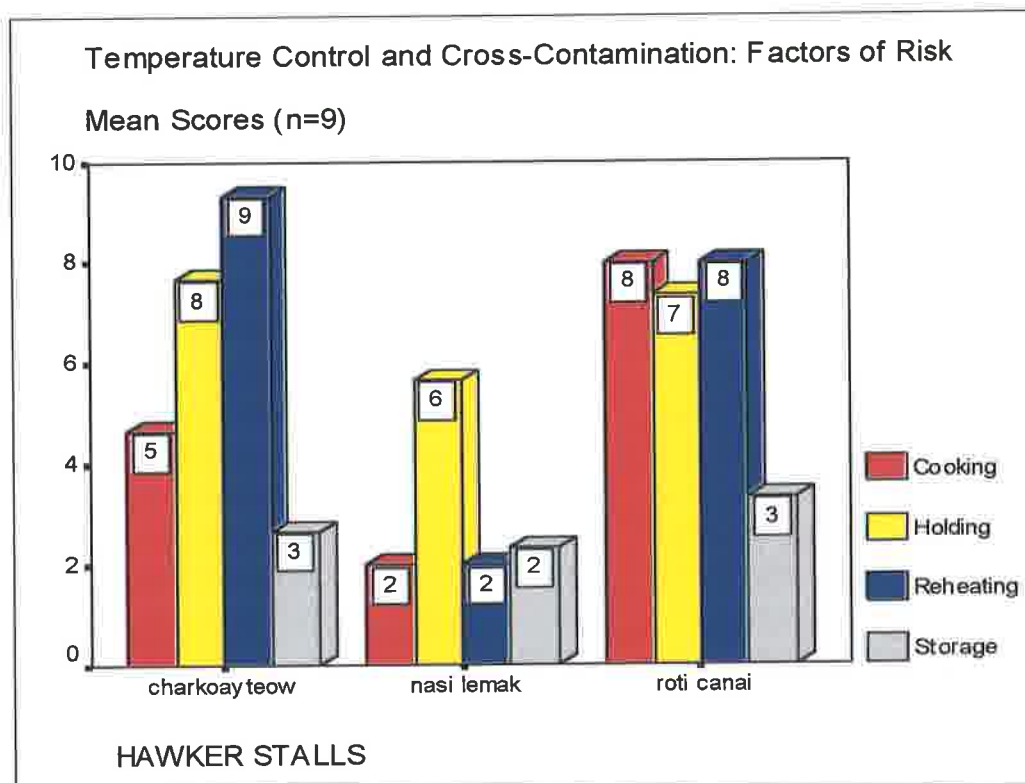


N.B. Mean scores to the nearest whole number
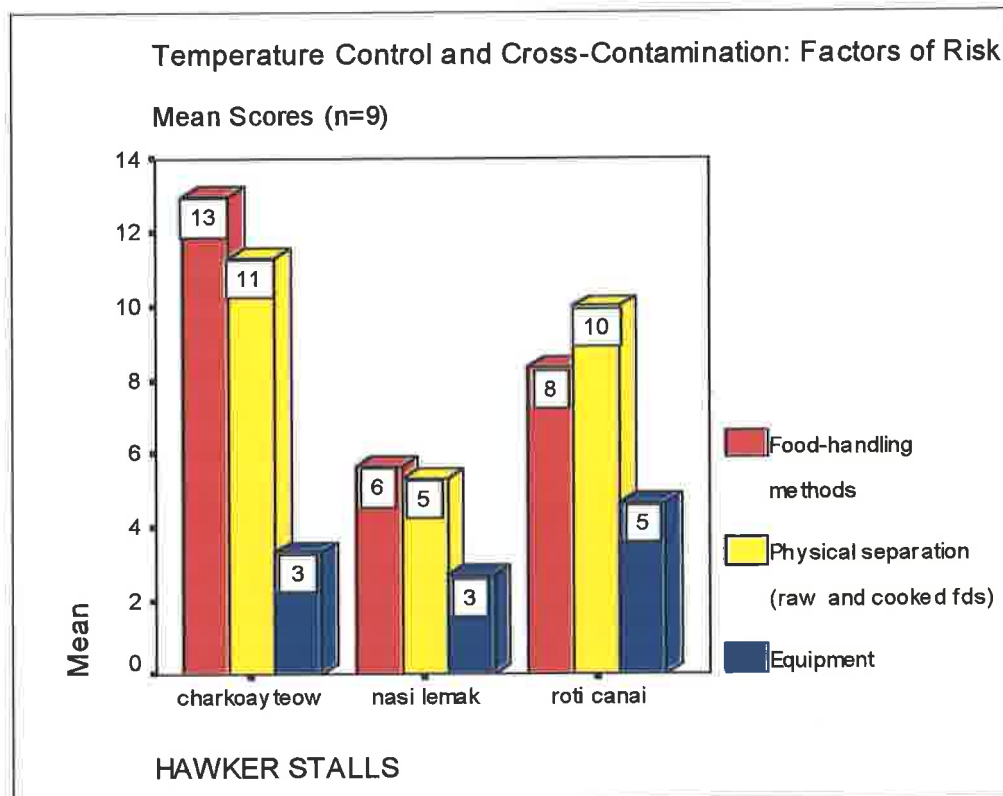
Temperature Control and Cross-Contamination: Factors of Risk

Mean Scores (n=9)

HAWKER STALLS

N.B. Mean scores to the nearest whole number

The mean scores of the culture groups for the constructs pertaining to Temperature Control and Cross-Contamination: Factors of Risks (cooking, holding, reheating, storage, foodhandling methods, physical separation of raw and cooked foods and equipment) are presented in Tables 7a and 7b.

Total Risk Assessment Mean Scores of Cultural Foods (in three distinct environments) for Temperature Control and Cross-Contamination: Factors of Risk. Maximum and minimum attainable scores: 115 and 23

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | *n* | M | *n* | M | *n* |
| 24.0 | 3 | 50.0 | 3 | 49.0 | 3 |

Table 7b

Total Risk Assessment Mean Scores of Cultural Foods (in three distinct environments) for :

## A.    Time/Temperature Control

***Cooking*** (t° monitoring efficiency and operational control of process). Maximum and minimum attainable scores: 10 and 2

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | *n* | M | *n* | M | *n* |
| 2.0 | 3 | 4.6 | 3 | 8.0 | 3 |

*Holding* (duration, t° control and condition of food on display). Maximum and minimum attainable scores: 15 and 3

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 5.6 | 3 | 7.6 | 3 | 7.3 | 3 |

*Reheating* (process control and stirring). Maximum and minimum attainable scores: 10 and 2

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 2.0 | 3 | 9.3 | 3 | 8.0 | 3 |

*Storage* (food kept at room t° and food kept outside recommended t°). Maximum and minimum attainable scores: 10 and 2

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 2.3 | 3 | 2.6 | 3 | 3.3 | 3 |

## B.  Cross-Contamination

*Foodhandling Methods* (during preparation of raw food, after cooking, after cooling, after reheating and display). Maximum and minimum attainable scores: 25 and 5

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 5.6 | 3 | 13.0 | 3 | 8.3 | 3 |

_**Physical Separation of Raw and Cooked Foods**_ (delivery, storage, processing, preparation and retail areas). Maximum and minimum attainable scores: 25 and 5

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 5.3 | 3 | 11.3 | 3 | 10.0 | 3 |

_**Equipment**_ (performance of t° control appliances and shared usage of equipment/utensils). Maximum and minimum attainable scores: 10 and 2.

| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
|---|---|---|---|---|---|
| M | n | M | n | M | n |
| 2.7 | 3 | 3.3 | 3 | 4.7 | 3 |

The ANOVA showed a positive significance (F= 9.35; df=2; $p$=.05) between the culture groups in the risk scores. Post-hoc multiple comparisons showed significant difference between ethnic Malay NL and ethnic Chinese CKT ($t$=.022; $p$=.05) and ethnic Indian RC ($t$ = .031; $p$=.05). Significant difference were noted in topical areas where RC was assessed lower risk concern than NL ($t$= .000; $p$=.05) and CKT was assessed a lower risk concern than NL ($t$ = .000; $p$=.05) in cooking practices. Significant difference was also noted for reheating. Ethnic Chinese CKT was assessed a lower risk concern than ethnic Malay NL ($t$= .000; $p$=.05) and RC ($t$ = .000; $p$=.05) and RC was assessed lower risk concern than NL ($t$ = .000; $p$=.05) in reheating of food practices.

### 5.4.3  Food-Contact Surfaces (FCS)

The results in this section are based on the contamination levels of three FCS constructs  (WS, CB and DC) presented in Tables 8a, 8b and 8c.

Total Mean Scores of Cultural Foods  (in three distinct environments) for :

### Work Surface (WS)

Table 8a

| MALAY | | CHINESE | | INDIAN | |
|---|---|---|---|---|---|
| Nasi Lemak (TPCA) * | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) | |
| M | n | M | n | M | n |
| 6.3 | 3 | 5.0 | 3 | 5.6 | 3 |

• Environment (designated sites)

### Chopping Board (CB)

Table 8b

| MALAY | | CHINESE | | INDIAN | |
|---|---|---|---|---|---|
| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) * | |
| M | n | M | n | M | n |
| 6.0 | 3 | 5.3 | 3 | 5.6 | 3 |

## Dish Cloth (DC)

Table 8c

| MALAY | | CHINESE | | INDIAN | |
|---|---|---|---|---|---|
| Nasi Lemak (TPCA) | | Char Koay Teow (Chow Kit) | | Roti Canai (Bangsar) * | |
| M | *n* | M | *n* | M | *n* |
| 7.0 | 3 | 5.6 | 3 | 6.3 | 3 |

The overall picture of the readings on FCS of the three culture foods (NL; CKT; RC) showed moderate to high risk concerns (Chart 12).

Chart 12

### Contamination Levels of Food-contact Surfaces

(n=27) - Nasi Lemak; Char Koay Teow; Roti Canai
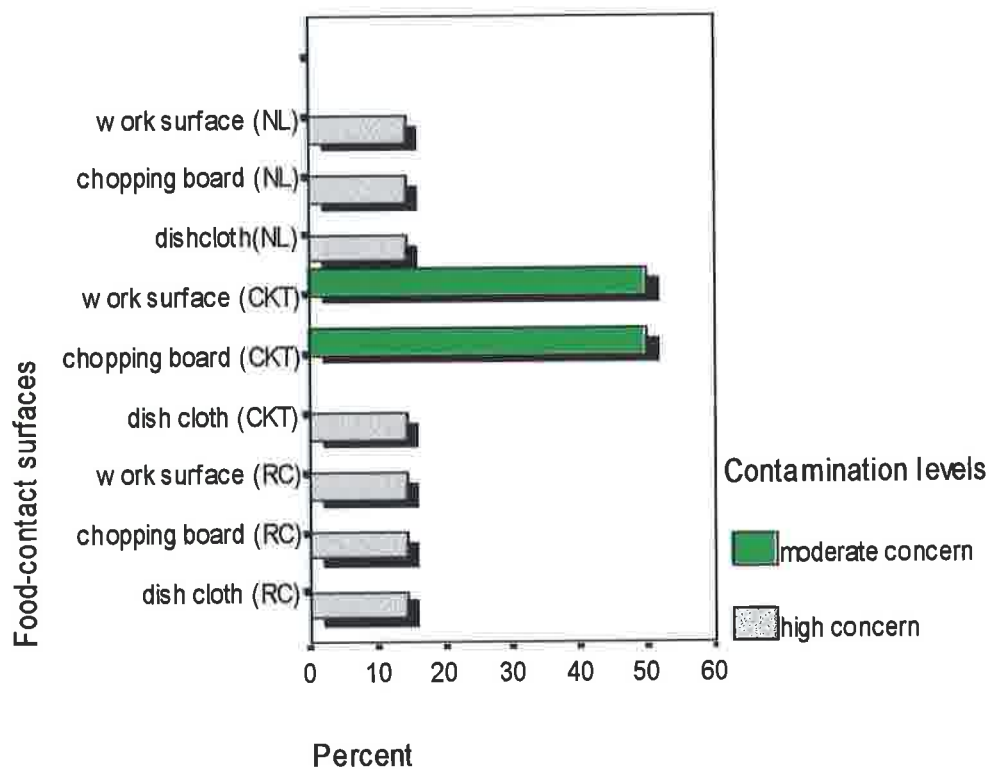
## 5.5 Summary of Results

The results for foodhandling practices (FHP) suggest strong support for hypothesis number one that cultural (ethnic) hawker foods in different environments are likely to exhibit different levels of risk concerns in FHP. The results for food-contact surfaces (FCS) showed only DC (dishcloth) to be of high concern in all the three ethnic hawkers. Therefore, weak support of the second hypothesis that cultural hawker foods in different environment situations are likely to exhibit different risk concerns in FCS is noted.

The overall picture from the risk assessment indicated that the FHP at Nasi Lemak (of ethnic Malay culture) stalls were assessed as posing higher risk concerns than Char Koay Teow (of ethnic Chinese culture) and Roti Canai (of ethnic Indian culture).

### 5.5.1 Food handling Practices (FHP):

**Cleaning and Cleanliness: Factors of Risk**

- Nasi Lemak stalls pose higher risk concerns than Roti Canai from the Cleaning and Cleanliness: Factors of Risk perspective.

**Personal Hygiene and Training: Factors of Risk**

- Overall, there is significant difference in risk concerns from the Personal Hygiene and Training: Factors of Risk perspective.

- CKT hawkers demonstrated better attitudes as food handlers than NL hawkers.

- RC hawkers demonstrated better attitudes towards "training" than NL and CKT hawkers.

**Temperature Control and Cross-Contamination: Factors of Risk**

- Overall, CKT hawkers demonstrated lower risk concern practices in temperature control and cross-contamination than NL and RC hawkers. Similarly, RC hawkers demonstrated better temperature control and cross-contamination practices than NL hawkers.

- CKT hawkers demonstrated better "cooking" practices than NL hawkers.

- CKT and RC hawkers demonstrated better "reheating" practices than NL hawkers.

## 5.5.2   Food-Contact Surfaces (FCS)

Overall, the results showed poor contamination of food-contact surfaces (WS, CB and DC) in general. However, comparison of results from the culture/ environment showed only significant difference (in scores) in the dishcloths.

**Work Surface (WS)**

- No significant difference between the culture groups pertaining to contamination levels of work surfaces was found.

**Chopping Board (CB)**

- No significant difference between the culture groups pertaining to contamination levels of chopping boards was found.

**Dish Cloth (DC)**

- Bacterial contamination differences were noted for dishcloths (DC). CKT dishcloths (DC) were assessed to have lower bacterial colonies than NL and RC. Similarly RC dishcloth had lower colony growth than NL.

# 5.6   DISCUSSIONS

*"Conclusions regarding the microbiology of cutting boards may depend greatly on how contamination and sampling are done, yet there are not standard methods for carrying out such experiments".*

Nese et al., 1994

In the last chapter, culture, environment, education and age were found to be important determinants of food safety knowledge and attitude scores. This chapter

presents additional dimension, besides the four IV [independent varialbe] of Chapter Four, such as foodhandling practices (FHP) of hawkers and culture/environment to link to food safety. The importance of the three variables (knowledge, attitudes and practices) in food safety are well documented. (Bryan, 1993; Howes et al., 1996; SSS [Scientific Status Summary], 1995).

The findings of this study highlight the cultural impact on foodhandling practices and food-contact surfaces of hawkers located in three different designated environments. The findings on FHP and FCS reinforce (with a view to validate) the findings that culture plays a significant role in the knowledge, attitudes (Chapter Four) and practices of hawkers.

The most salient finding in this study hinges on the persistent high risk concerns of FHP and FCS results of *Nasi Lemak*. To-date, there is no evidence of studies of hawkers in the same direction.

Overall, from the "Personal Hygiene and Training: Factors of Risk" standpoint, there is no difference between the culture groups. However, attitudes differ from the individual standpoint; CKT hawkers demonstrated better attitudes as foodhandlers than NL hawkers in terms of personal grooming, wearing protective clothing and hygiene practices. The same applies to RC food handlers who have demonstrated better attitudes towards formal, informal and periodic retraining to enhance their knowledge of food safety, foodborne illnesses and their prevention

than NL hawkers. Roberts (1980) and WHO (1997) have linked the training and education of food handlers and hawkers to hygienic practices. Knowledge of food handlers has been found to be imperative to personal hygiene in the prevention of cross-contamination (De Wit & Kampelmacher, 1988).

In terms of "Temperature Control and Cross-contamination: Factors of Risk", two culture groups (CKT and RC) have demonstrated better overall practices than NL hawkers. CKT hawkers are more conscious about temperature monitoring efficiency and operational control when preparing their food than NL hawkers. Similarly, CKT and RC hawkers demonstrated better practices with respect to temperature and process control when reheating food. Similar findings of improper foodhandling methods in ethnic Malay food in Kelantan (East Malaysia) have been reported (Desmarchier et al., 1994). Bean and Griffin (1990) have established the following links between food handling practices and foodborne illnesses reported incidences:

- Improper storage or holding temperature was the factor most often reported in *B. cereus* (94%), *C. perfringens* (97%), *Salmonella* (84%), *S. aureus* (98%), and group A. *Streptococcus* (100%) outbreaks.

- Inadequate cooking was implicated in outbreaks caused by *C. botulinum* (91%), *V. parahaemolyticus* (92%) and *Trichinella spirilis* (100%).

- Food from an unsafe source was another factor of concern in *Campylobacter* (67%).

- Personal hygiene was implicated in outbreaks caused by *Shigella* (91%).

The findings showed overall moderate to high concern in terms of risk (contamination) levels of food-contact surfaces (FCS). However, from the culture and environment perspective, the dishcloths of CKT hawkers were less contaminated. It was observed that CKT hawkers practise frequent rinsing of dishcloths (after each use) than NL and RC hawkers. The dishcloths of RC have (comparatively) lower bacterial colonies than NL hawkers. This study, as have others (Tebbutt, 1993; Tebbutts & Southwell, 1997) confirmed dishcloths as important reservoirs of bacteria hence increasing risks of cross-contamination. Environmental condition (surroundings) was implicated in the detection of different strains of bacteria (Tebbutts & Southwell, 1997) and its effect on the germination of *Bacillus cereus* spores have been reported (Giffel et al., 1995).

The findings highlight the habits of the food handlers of NL, CKT and RC. The findings also suggested an important link in a chain of adverse effect of the high-risk concern dishcloths (NL and RC). The high risk concern dishcloths denote a control point (CP) in the HACCP process; they could cause cross-contamination (through food handling, food-contact surfaces, equipment and food) if not

controlled at that point. Although CKT dishcloths were in the near medium risk concern, it was observed that neither of the three culture groups was in the habit of disinfecting nor bleaching their dishcloths. Farber & Hughes (1995) have highlighted the importance of keeping dishcloths clean to prevent harbouring large numbers of micro-organisms by washing and soaking dishcloths in dilute bleach or disinfectant.

It is no doubt that the method of determining risks (using dipslides) allowed an early detection of bacterial growth and likely product deterioration. Hence, this method allows preventive (early) measures to be taken to protect the public. This preventive method is analogous to the HACCP system of assessing hazards and helps to establish control systems that focus on prevention rather than relying mainly on end-product testing (Codex[5], 1997). The Pearson bivariate correlation, however, characterised no association between the FHP and FCS scores (at 48 hours). Similar findings have been noted in past related studies of Tebbutt and Southwell (1989) on risk assessment and microbiological qualities of foods in retail food premises (Tebbut and Southwell, 1989; Tebbutt and Midwood, 1990; Powells & Attwell, 1995).

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[5] The Codex Alimentarius is an international intergovernmental body that develops food-safety and commodity-composition standards (Wehr, H.M., 1996)

# STUDY 3
## The Food Safety Enforcement Questionnaire Study

# FOOD SAFETY PRACTICES
# AND KNOWLEDGE OF
# PUBLIC HEALTH CONTROL
# AUTHORITY

*"Education and time are the remedies
to overcome deterrent that is ageless
whenever a new idea is introduced".*
Bryan, 1993

# 6.1 INTRODUCTION

*"Good training may be an art, but development of training ought to be based on the scientific approach"*

Bryan, F.L.(1991)

Increased awareness of food safety issues by the general public, education of street food hawkers, greater sensitivity on the part of regulatory officials, and improved commitment of governments in rapidly expanding hawker food systems would help in achieving the overall goals of food safety (Parson, 1997). Hawker foods are "ready-to-eat" or prepared-on-demand foods for consumption on-site, or take-aways, prepared by ubiquitous small entrepreneurs (Toh and Birchenough, 1999; 2000). According to Desmarchier et al. (1993), the aetiology of food safety, its impact on public health, and epidemiology vary and the problems associated with it in developed countries can also be expected to emerge in developing countries.

The interplay of legislative, regulatory, scientific, social and political forces is evident in every issue pertaining to food safety. Food safety are increasingly featuring on the agenda for public policy making. Advances in science and technology will resolve some food safety concerns but other less recognised or previously unknown concerns will inevitably emerge. New scientific understandings, new advances in technology, new developments in international food markets, and changing perceptions and expectations among the many segments of the world's population will challenge existing laws and regulations (IFST, 1992).

An integrated approach involving all of the authorities dealing with the issue of improving food quality, safety and health risks of hawker foods has been advocated (FAO, 1997). It has been proposed that co-operation between the hawkers, local authorities, top foodservice management personnel and the local police should work together to help resolve these problems

It has been reported that Asian countries offering rich diversity in food production, marketing and cooking, have a relatively long history of having had recourse to the law to ensure the safety of food (Jayasuriya, 1994). The safety of food supply and preparation through a variety of laws, regulations, standards, guidelines and control measures are frequently documented (IFST [Institute of Food Science & Technology, UK], 1992; Hendon & Traill, 1993) It has been suggested, however, that the enforcement effort of regulatory agencies should be focused on working with establishments to prevent problems from occurring in the first place (IFST, 1992). Recommendations for the training of regulatory officials to include preventive measures in critical operations are well-documented (Jayasuriya, 1994; WHO, 1996).

There is increasing awareness about the importance of the HACCP system in developing countries. Malaysia, amongst other developing countries, has taken a regulatory approach to promote HACCP in the food safety system. The HACCP system was incorporated into the draft Food Hygiene Regulations in Malaysia in

1989, and in 1990 the HACCP system has been incorporated into the basic training curriculum for health inspectors ((Montarjemi et al, 1996).

.

Bryan suggested the use of epidemiological history of foods as an essential coefficient for setting up priorities.  According to Bryan, (1996), establishments identified as vehicles of foodborne illness should be given a high priority for preventive and control activities. Effective control of microbiological hazards is the keystone of food safety and quality control for food producers and regulatory agencies (Buchanan, 1995).

There have been reports of significant health risks in food establishments, especially those selling take-away foods (FAO, 1997; Audit Commission, 1990). Past and recent incidences and developments have indicated the need for thorough in-depth inspections by methods of determining health risks and on-site visual assessments of food establishments.  Indications are that standardised inspections to ensure a proper and fair assessment and comparison of determined factors pertaining to retail food activity are required (ACLAEW [Audit Commission for Local Authorities in England and Wales], 1990; Bryan, 1993; Weingold, 1994).

The focus of related studies carried out thus far has been targeted on culture, environment, education and age as important determinants of food safety knowledge and attitudes of hawkers (Chapter Four). Chapter Five, with the findings of high concern for foodhandling practices of hawkers and moderate to

high concerns of food-contact surfaces of hawkers, presented the link of culture/environment to food safety practices.

The findings of Chapter Four have shown that hawkers lack knowledge, attitudes and practices related to food safety, foodborne illnesses and their prevention. The findings of Chapter Five demonstrated that the high risk foodhandling practices and moderate to high risk food-contact surfaces of hawkers make the public vulnerable to foodborne illness from consumption of hawker foods. The study in this chapter, however, presents the control (practices and knowledge of the public health authority) aspects of hawker foods. It will attempt to provide a link between the public health control authority and the knowledge, attitudes and practices of hawkers in a holistic food safety approach.

## 6.2   HYPOTHESES

- Junior, Middle and Senior Health Inspectors (HIs) of DBKL are not likely to exhibit differences in food safety/HACCP/risk assessment Knowledge.

- Junior, Middle and Senior HIs of DBKL are not likely to exhibit differences in enforcement Practices.

- Educational background is not likely to influence the food safety/HACCP/risk assessment Knowledge of Junior, Middle and Senior HIs.

# 6.3 METHODS

REMEMBER: *HACCP* is a tool -
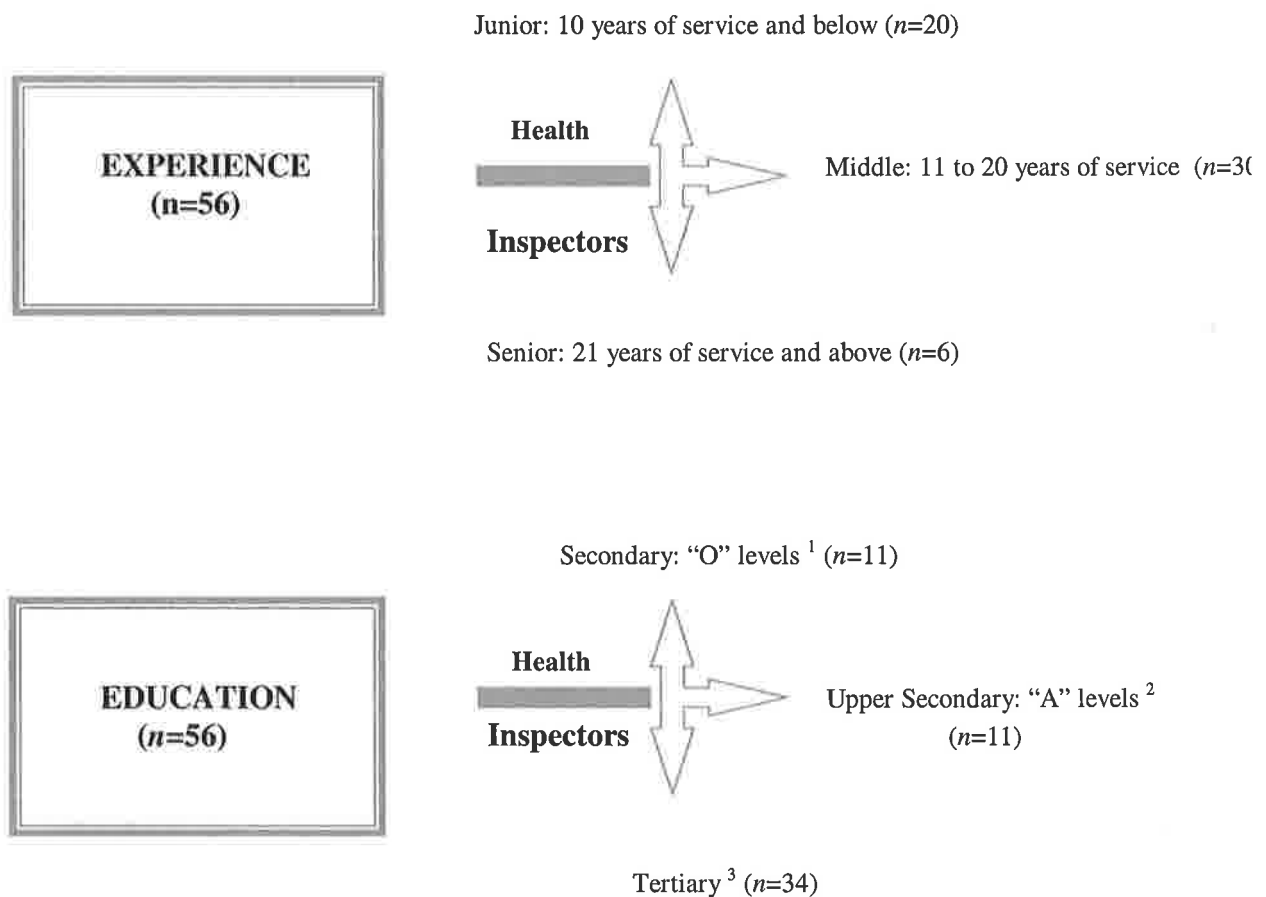add it to your tool bag.
FDA, 1997

Culture and environment, though significant in Study 1 and Study 2, are not significant in this study as all members of public health enforcement authority (Health Inspectors) of Kuala Lumpur are under the charge of DBKL (the same environment) and the Health Inspectors (HIs) are predominantly ethnic Malay (the same culture). This study uses Experience (junior or 10 years and below, middle or 11-20 years and senior or 21 years and above) and Education variables to address the hypothesis.

## 6.3.1   Sample Selection

Prior permission to conduct the questionnaire study on Health Inspectors of DBKL was obtained from the Mayor of Kuala Lumpur (Appendix 1).

A pre-determined sample size of 60 was taken from the Hawkers' ($n$=25) and the Health ($n$=35) Departments of the DBKL. The sample represents the total strength of HIs (Hawkers' and Health Departments) for Kuala Lumpur. Stratification of the sample was not necessary for this study; the HIs are predominantly ethnic Malays in the Dewan Bandaraya (City Hall, Kuala Lumpur (DBKL). The sample distribution (from a return rate of 93%) is presented in Diagram 9 ($n$=56) by Experience (junior, middle and senior) and Education (secondary, upper secondary and tertiary) of the Health Inspectors.

Diagram 9: **Sample Distribution according to Experience and Education of Health Inspectors of DBKL** (*n*=56)

Junior: 10 years of service and below (*n*=20)

```
┌─────────────────────┐
│ ┌─────────────────┐ │      Health
│ │                 │ │                      Middle: 11 to 20 years of service  (n=3(
│ │   EXPERIENCE    │ │   ─────────────
│ │    (n=56)       │ │      Inspectors
│ │                 │ │
│ └─────────────────┘ │
└─────────────────────┘
```

Senior: 21 years of service and above (*n*=6)

Secondary: "O" levels [1] (*n*=11)

```
┌─────────────────────┐
│ ┌─────────────────┐ │      Health
│ │                 │ │                      Upper Secondary: "A" levels [2]
│ │   EDUCATION     │ │   ─────────────           (n=11)
│ │    (n=56)       │ │      Inspectors
│ │                 │ │
│ └─────────────────┘ │
└─────────────────────┘
```

Tertiary [3] (*n*=34)

### 6.3.2   Research Questionnaire

The structured questionnaire (Appendix 7), preceded by a brief section on demography, contained 12 main constructs in two distinct areas of: (1) Food Safety Practices, and (2) Food Safety Knowledge. Questions pertaining to food

---

[1] "O" levels:  year five of secondary education.
[2] "A" levels:  pre-university education.
[3] Tertiary:  Higher education diploma and above.

safety, HACCP, risk assessment and public health enforcement were devised with due reference to findings highlighted in the past (George, 1990; Jayasuriya, 1994; Albrecht, 1995; Mederios et al., 1996), documented reports (FAO, 1995; 1997; WHO, 1996, 1997) and food safety/hygiene course books (Sprenger, 1996; RIPPH Royal Institute of Public Health and Hygiene, 1997).

### 6.3.3 Pre-Testing and Administering the Questionnaire

The structured questionnaire was reviewed by members of the academic and public health authorities in the UK and in Malaysia. The questionnaire was amended taking into consideration all pertinent and relevant feedback from the reviewers. The first phase of the pre-testing of the questionnaire (10 copies) was conducted on the Environmental Health Officers (EHOs) in the County Council, Pembrokeshire (Wales), UK. The purpose of this pre-testing was to get feedback on construct validity (appropriateness), clarity in the wording of items (to reduce "noise", hence enhancing reliability of responses) and for powerful context effects (to reduce wording bias). Amendments were made to the questionnaire where appropriate. The second phase of pre-testing (10 copies) of HIs took place in the Hawkers' Department, Kuala Lumpur for similar feedback but from the local context. It was carried out through a local co-ordinator with detailed instructions for the pre-testing. Regular monitoring through e-mail, fax and telephone was made from Cardiff to the local coordinator in Kuala Lumpur. Amendments to the questionnaires were made accordingly after the second pre-testing.

The administration of the questionnaire survey was conducted with the assistance of two senior HIs (one each in the Hawkers' and Health Departments). Due to the decentralised structure of the departments (Hawkers' and Health) and the "in-the-field" nature of the job, it was suggested and agreed upon between the authority and the author, that the distribution and collection of the questionnaires be carried out through these officers. Hence, the need for a covering letter to the questionnaires was not necessary as the two senior officers ((Health and Hawkers' Departments) were fully informed of the aims of the study and the permission to run the survey.

### 6.3.4   Data Analysis and Interpretation

Quantitative data were entered into a data editor and analyzed using SPSS. Significance was determined at the level of $p \leq .05$. Descriptive statistics using percentages, means and standard deviations were computed for use where appropriate.

The return rate for the questionnaire survey was 93%. In view of the limited population, data from the Hawkers' and Health Departments were grouped together, analysed and interpreted as one entity (HIs of DBKL). All questions requiring yes/no answers pertaining to Practices and all questions using a Likert scale pertaining to Knowledge were classified under General food safety Practices and Knowledge (Tables 9a and 9b) while all multiple-choice and true/false questions were classified under Specific food safety Practices and Knowledge.

Table 9a

*General Food Safety Practices Questions*:

1. Have you ever been involved in HACCP implementation?

2. Have you ever been involved in risk assessment?

3. Have you ever investigated an outbreak of food poisoning?

4. Do you attempt to determine risk factors in the prevention of outbreaks of illness from hawker foods?

5. Do you encounter any problems when enforcing Food Hygiene Legislation?

Table 9b.

*General Food Safety Knowledge Questions*:

1. How well do you think you understand *HACCP*?

2. How well do you think you understand risk assessment?

Each "yes" answer was given one point and each "no" answer, zero point for all "yes/no" Practices and Knowledge questions. For the Likert scale questions, each answer of "very well", "well", and "fairly well" was given a point and zero point for "just a little" and "unsure". The scoring schemes for the rest of the food safety Practices and Knowledge questions are as presented:

## Food Safety practices:

| Question No.* | per answer | Scoring maximum attainable |
|---|---|---|
| 4 | 1 | 5 |
| 6 | 1 | 10 |
| 7.2 | 1 | 8 |
| 8 | 1 | 1 |
| 10.1 | 1 | 1 |
| 10.2 | 1 | 1 |
| | | Total  26 |

* Numbers refer to questionnaire in Appendix 7.

## Food Safety knowledge:

| Question No *. | per answer | Scoring maximum attainable |
|---|---|---|
| 5.2 | 1 | 12 |
| 9 | 1 | 1 |
| 11 | 1 | 1 |
| 12 | 1 | 9 |
| | | Total  23 |

* Numbers refer to questionnaire in Appendix 7.

The analysis and interpretation of the data was carried out based on the experience and education variables of the total returned population ($n=56$) in two-tiered (macro and micro) versions (Diagram 10).

Diagram 10

# STAGES OF RESULTS PRESENTATION (*n*=56)



Hawkers' Department
(*n*=25)

**PUBLIC HEALTH AUTHORITY
(HEALTH INSPECTORS) – *n*=56**

**Dewan Bandaraya,
Kuala Lumpur**
(DBKL)

Health Department
(*n*=31)

*GENERAL* and *SPECIFIC*

- **FOOD SAFETY  PRACTICES**
- **FOOD SAFETY KNOWLEDGE**

*RESULTS*

- **OVERALL**
- **TOPICAL  CONSTRUCTS**
  (*n*=56)

by *Experience*

- Junior (*n*=20)
- Middle (*n*=30)
- Senior (*n*=6)

by *Education*

- Secondary (*n*=11)
- Upper secondary (*n*=11)
- Tertiary (*n*=34)
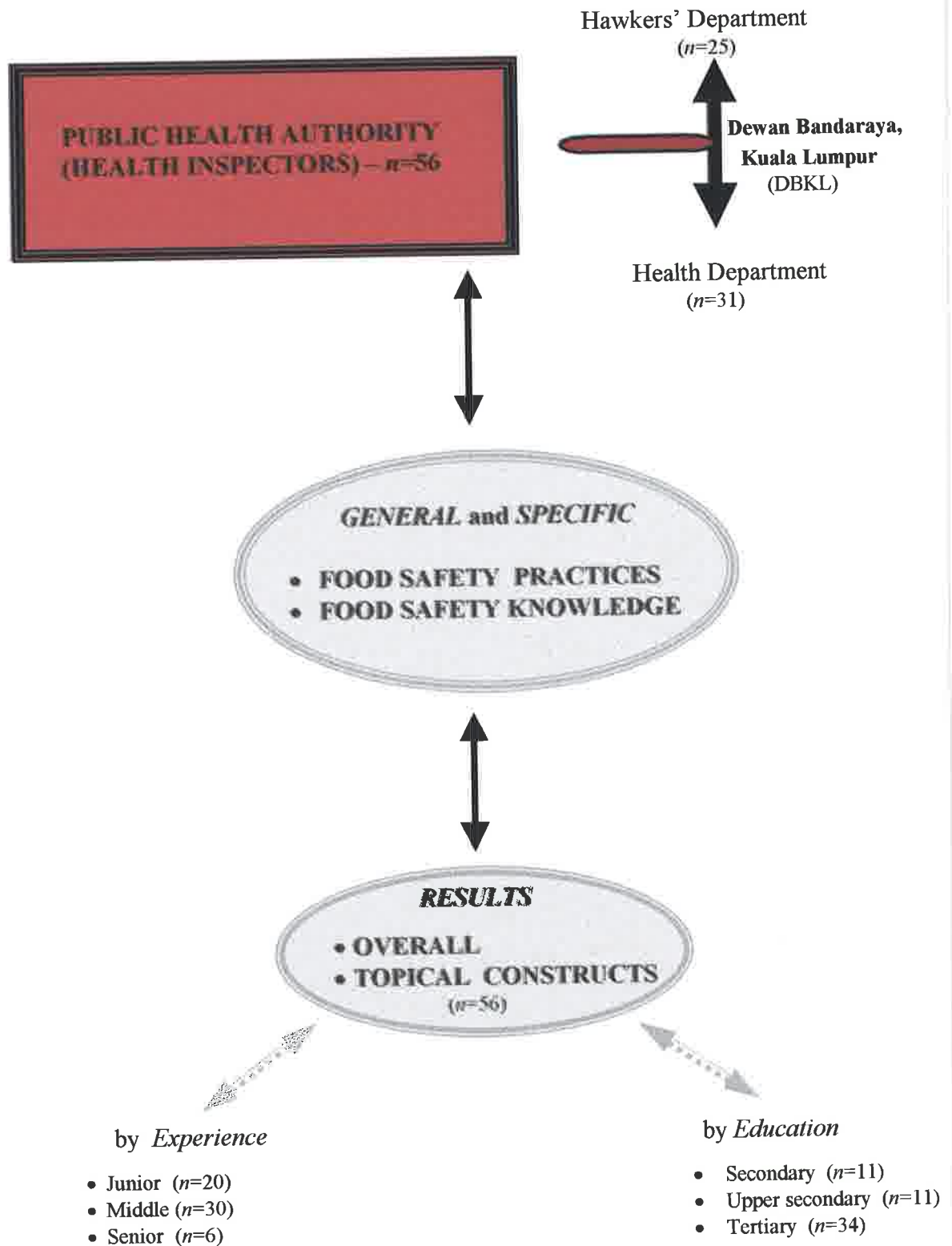
Mean scores and percentages of five true/false questions (General food safety Practices) were established and categorised. Mean scores and percentages for two Likert-scale (very well; well; fairly well; just a little; unsure) questions (General food safety Knowledge) were also established and categorised. The results pertaining to both categories were used for purposes of reliability testing of overall food safety Practices and Knowledge results.

Macro level:

1. Overall mean scores in the two distinct areas of food safety Practices and Knowledge from the Experience (junior, middle and senior) perspective.

2. Overall mean scores in the two distinct areas of food safety Practices and Knowledge from the Education (secondary or "O" levels; upper secondary or "A" level; tertiary) perspective.

Micro level:

1. Mean scores for each topical food safety Practices construct from the Experience perspective.

2. Mean scores for each topical food safety Knowledge construct from the Education perspective.

The demographic data, presented in percentages, were used in the interpretation of food safety Practices and Knowledge. Tests of parametricity [4] of data for food safety Practices ($m$=14.7; SD=7.17)[5] and Knowledge ($m$=32.4; SD=7.10) were carried out using histograms to justify the use of the analysis of variance (ANOVA).

The analysis of variance (ANOVA) was used to test the food safety Practices and Knowledge of HIs. Levene's test of homogeneity of variance was carried out on overall food safety Practices and Knowledge scores using the Experience and Education variables. The homogeneity assumption ($p$>.05) of both Practices and Knowledge scores were generally not violated from the Experience and Education perspectives. However, only the Practices scores from the Experience perspective were below the probability level (Levene's test=.027). The ANOVA results were further treated using post-hoc multiple comparisons. Bonferroni corrections were used to determine the appropriate alpha value for post-hoc multiple comparisons.

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[4] Scores are from a normal distribution and they are able to pull on the mathematical properties of this distribution in distinguishing sets of data (Clegg, F., 1997).
[5] $m$: mean; SD: standard deviation

# 6.4  RESULTS

*"Epidemiological data is invaluable
in determining educational priorities"*
USDA, 1989

The maximum attainable scores for food safety Practices are 26 and 23 for food safety Knowledge. The results were based on experience (junior, middle and senior) and education (secondary, upper secondary and tertiary). Discussions are carried out on significant results.

### 6.4.1  Demographic background

The summary of the demographic background of the Health Inspectors is presented in Table 10.

## Table 10

**Demographic Background of Control Authority (n=56)**

| Length of service | Total (%) | n | Educational background | Total (%) | n |
|---|---|---|---|---|---|
| 10 years and below | 36 | 20 | Secondary education | 20 | 11 |
| 11-20 years | 53 | 30 | Upper secondary | 20 | 11 |
| More than 20 years | 11 | 6 | Tertiary | 60 | 34 |

| What category of hawker is under your charge? | Total (%) | n |
|---|---|---|
| Designated site | 24 | |
| Day/night market | 14 | |
| Kiosk | 7 | |
| By the roadside | 55 | |
| | — | 56 |

| Do you eat hawker food? | | | |
|---|---|---|---|
| | Yes | 100 | |
| | | — | 56 |

| Have you ever been ill from eating hawker food? | | | |
|---|---|---|---|
| | Yes | 41 | |
| | No | 59 | |
| | | — | 56 |

| How frequently has this happened to you? | | |
|---|---|---|
| Once in the past year | 43 | |
| Twice in the past year | 14 | |
| More than twice in the past year | - | |
| Unsure | 43 | |
| | — | 41 |

### 6.4.2 General Food Safety Practices and Knowledge Scores

- *General Food Safety Practices Profile:*

The mean scores of the five constructs pertaining to General food safety Practices of HIs from the Experience and Education perspectives are presented in Table 11a .

<u>Table 11a</u>

| Mean Scores for General Food Safety Practices | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Experience | | | | | | Education | | | | | |
| Junior | *n* | Middle | *n* | Senior | *n* | Secondary | *n* | U. Sec.* | *n* | Tertiary | *n* |
| *HACCP* practices | | | | | | | | | | | |
| 2.9 | 20 | 3.3 | 30 | 4.0 | 6 | 6.9 | 11 | 4.1 | 11 | 1.7 | 34 |
| Risk assessment practices | | | | | | | | | | | |
| 6.4 | 20 | 8.9 | 30 | 6.6 | 6 | 9.0 | 11 | 7.0 | 11 | 7.6 | 34 |
| Food poisoning investigation practices | | | | | | | | | | | |
| .65 | 20 | .73 | 30 | .67 | 6 | .36 | 11 | .64 | 11 | .82 | 34 |
| Prevention of outbreaks practices | | | | | | | | | | | |
| .70 | 20 | . 60 | 30 | .67 | 6 | .36 | 11 | .64 | 11 | .74 | 34 |
| Food Hygiene Legislation practices | | | | | | | | | | | |
| 1.1 | 20 | 4.6 | 30 | 1.3 | 6 | 1.5 | 11 | 1.0 | 11 | 4.1 | 34 |

- U. Sec.: Upper secondary

There was no significant difference between experience in General food safety Practices. However, significant differences were noted between Education and topical areas of HACCP (F= 15.5; df=2; $p$=.05); and food poisoning (F= 4.77; df=2; $p$=.05). Post-hoc multiple comparisons showed HIs with secondary

education are better versed in *HACCP* than HIs with tertiary education ($t$=.000; $p$=.05). Similarly, HIs with upper secondary education are better versed than HIs with tertiary education ($t$ =.041; $p$=.05) in HACCP. However, HIs with tertiary education are better versed in food poisoning than HIs with secondary education ($t$ =.011; $p$=.05).

- ***General Food Safety Knowledge Profile:***

The mean scores of the two constructs pertaining to General food safety Knowledge of HIs from the Experience and Education perspectives are presented in Table 11b.

Table 11b

| Mean Scores for General Food Safety Knowledge | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Experience | | | | Education | | | | |
| Junior | $n$ | Middle | $n$ | Senior | $n$ | Secondary | $n$ | U. Sec.* | $n$ | Tertiary | $n$ |
| • Knowledge of *HACCP* | | | | | | | | |
| 5.9 | 20 | 6.4 | 30 | 6.6 | 6 | 9.6 | 11 | 7.0 | 11 | 4.9 | 34 |
| • Knowledge of risk assessment | | | | | | | | |
| 9.0 | 20 | 8.7 | 30 | 9.3 | 6 | 11.0 | 11 | 9.6 | 11 | 7.9 | 34 |

There was no significant difference in General food safety Knowledge of HIs from the Experience perspective. However, significant differences were noted between Education and HACCP (F= 19.33; df=2; $p$=.05); and Education and risk assessment

(F= 7.0; df=2; $p$=.05). Post-hoc multiple comparisons showed HIs with secondary education demonstrated better knowledge of HACCP than HIs with an upper secondary school education ($t$ =.021; $p$=.05) and tertiary education ($t$=.000; $p$=.05). HIs with upper secondary education demonstrated better knowledge of risk assessment than HIs with tertiary education ($t$ =.031; $p$=.05). Similarly, HIs with secondary education demonstrated better knowledge of risk assessment than HIs with tertiary education ($t$=.002; $p$=.05).

The overall performance of HIs with different education background in General food safety Practices (Chart 13) and Knowledge (Chart 14) are summarised graphically.

<u>Chart 13</u>

**Overall General Food Safety Practices Scores**

**- Education Perspective (n=56)**



General practices scores

Chart 14

**Overall General Food Safety Knowledge Scores**

**- Education Perpsective (n=56)**
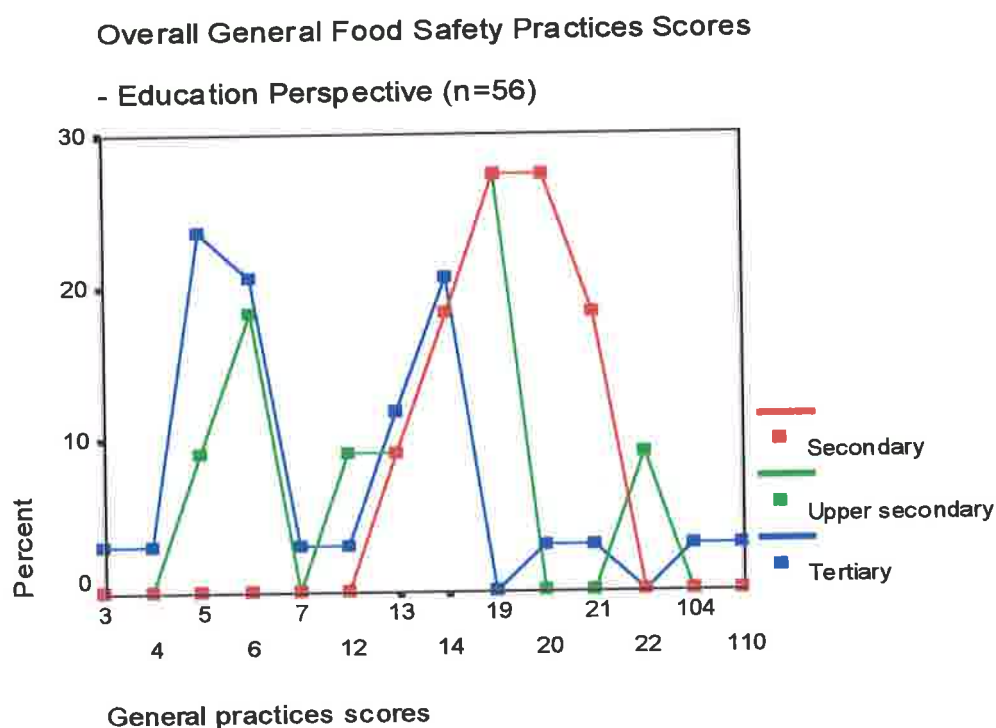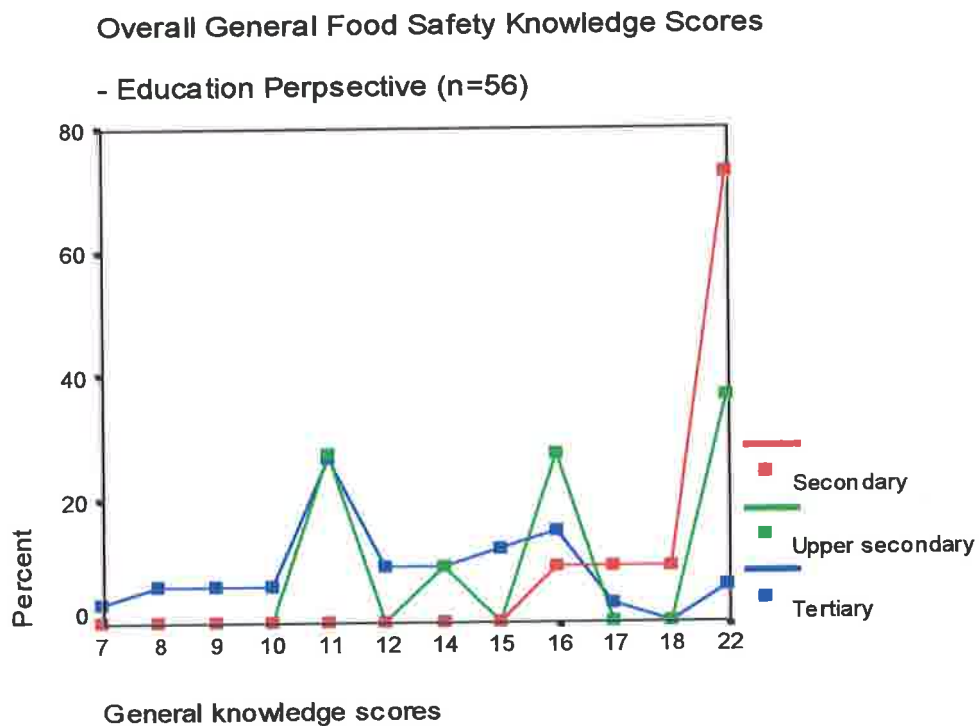


## 6.4.3 Macro Level

The overall Specific food safety Practices and Knowledge scores are presented in Charts 15a, 15b and 16a, 16b.

### *Specific Food Safety Practices and Knowledge*

There are no significant differences in Specific food safety Practices. Therefore, discussions will concentrate only on Specific food safety Knowledge.

- *Specific Food Safety Practices*

Mean overall food safety Practices scores of the sample ($n$=56) from the Experience and Education perspectives are presented in Tables 12.

Table 12.

| Mean Overall Scores for Food Safety Practices ($n$=56) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Experience | | | | Education | | | | |
| Junior $n$ | Middle $n$ | Senior $n$ | | Secondary $n$ | U. Sec.* $n$ | Tertiary $n$ | | |
| 15.6  20 | 13.7  30 | 16.3  6 | | 16.4  11 | 14.6  11 | 14.1  34 | | |

- U. Sec.: Upper Secondary

Chart 15a



**Overall Food Safety Practices Scores - Experience (n=56)**
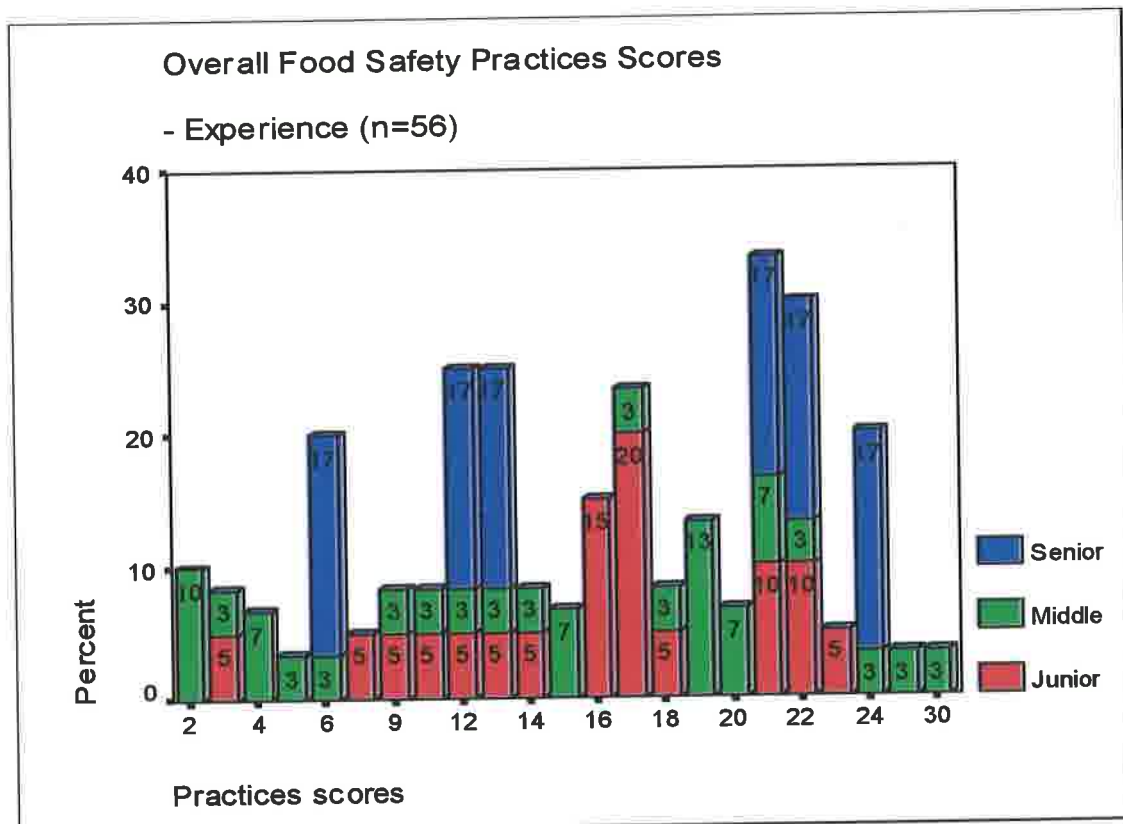
Senior: 21 years of service and above
Middle: 11-20 years of service
Junior: 10 years of service and below

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Overall Food Safety Practices Scores - Education Perspective (n=56)
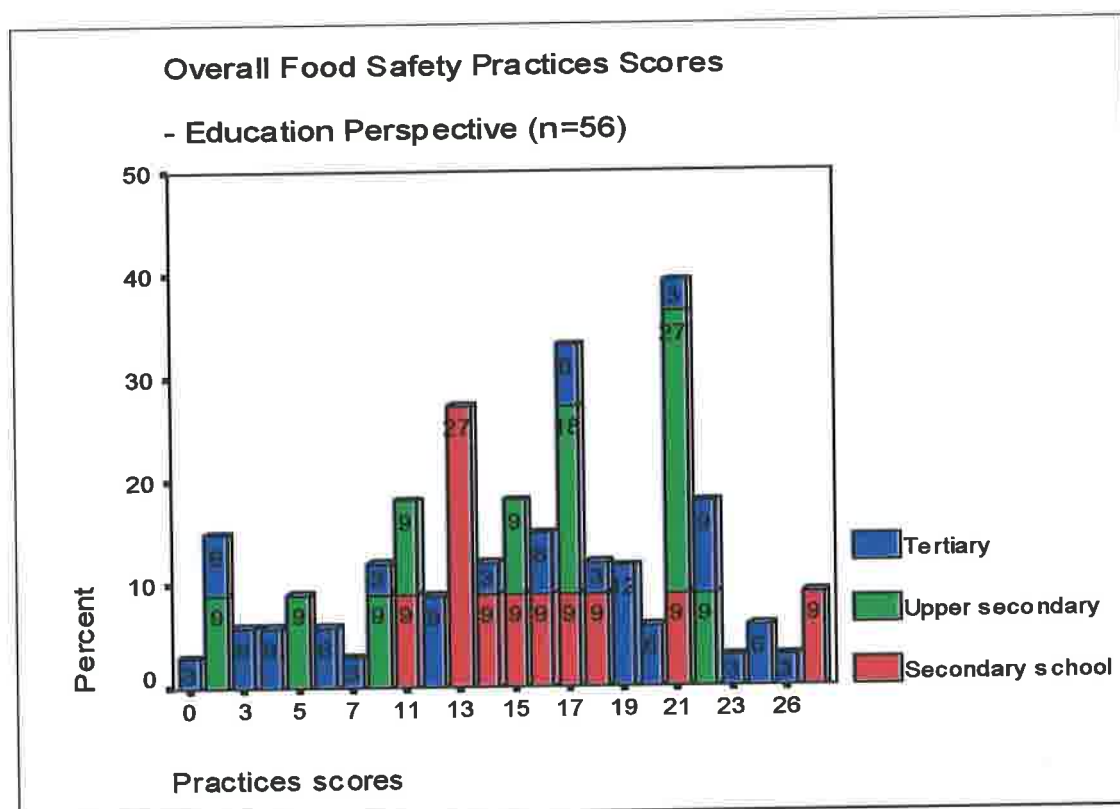
- **Specific Food Safety Knowledge**

There was no significant difference between Experience, Education and overall Specific food safety Knowledge of HIs.

Mean overall Specific food safety Knowledge scores of the sample (*n*=56) from the Experience and Education perspectives are presented in Table 13.

Table 13.

| Mean Overall Scores for Food Safety Knowledge (*n*=56) | | | | | |
|---|---|---|---|---|---|
| Experience | | | Education | | |
| Junior n | Middle *n* | Senior *n* | Secondary *n* | U. Sec.* *n* | Tertiary *n* |
| 17.4  20 | 16.8  30 | 18.5  6 | 19.4  20 | 17.9  30 | 16.2  6 |

Overall Food Safety Knowledge Scores - Experience (n=56)

Overall Food Safety Knowledge Scores - Education Perspective (n=56)
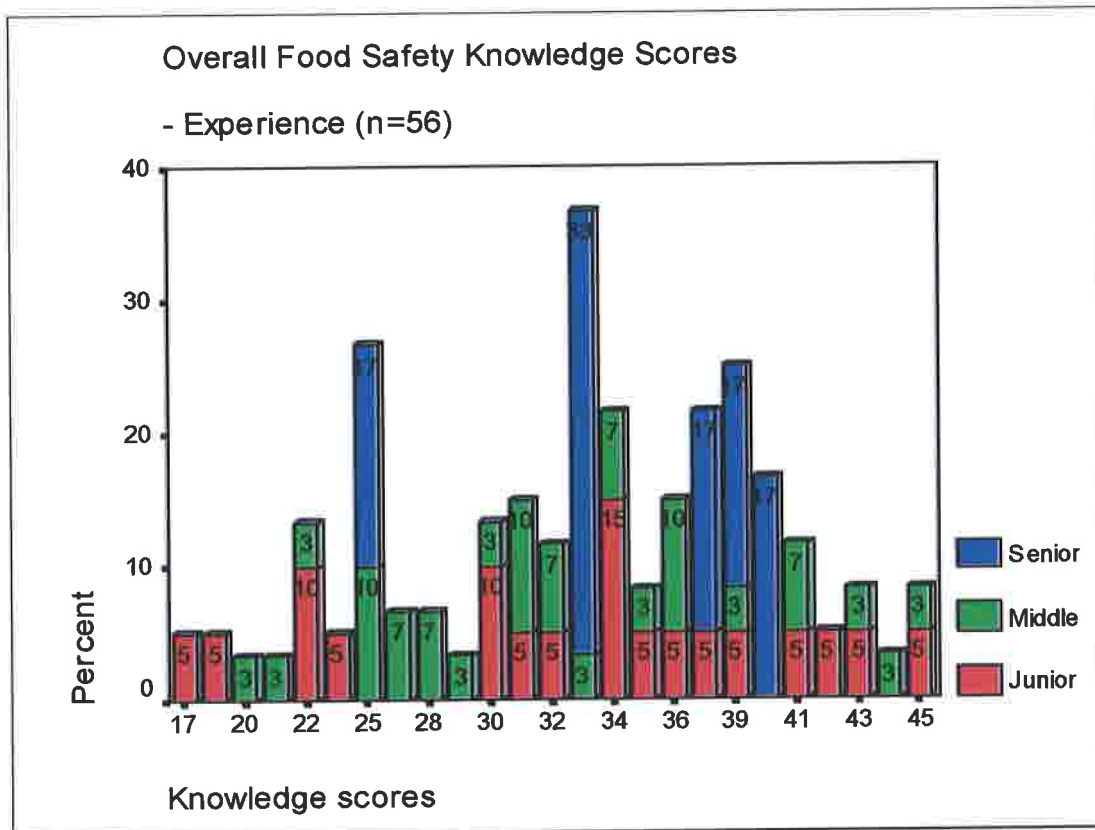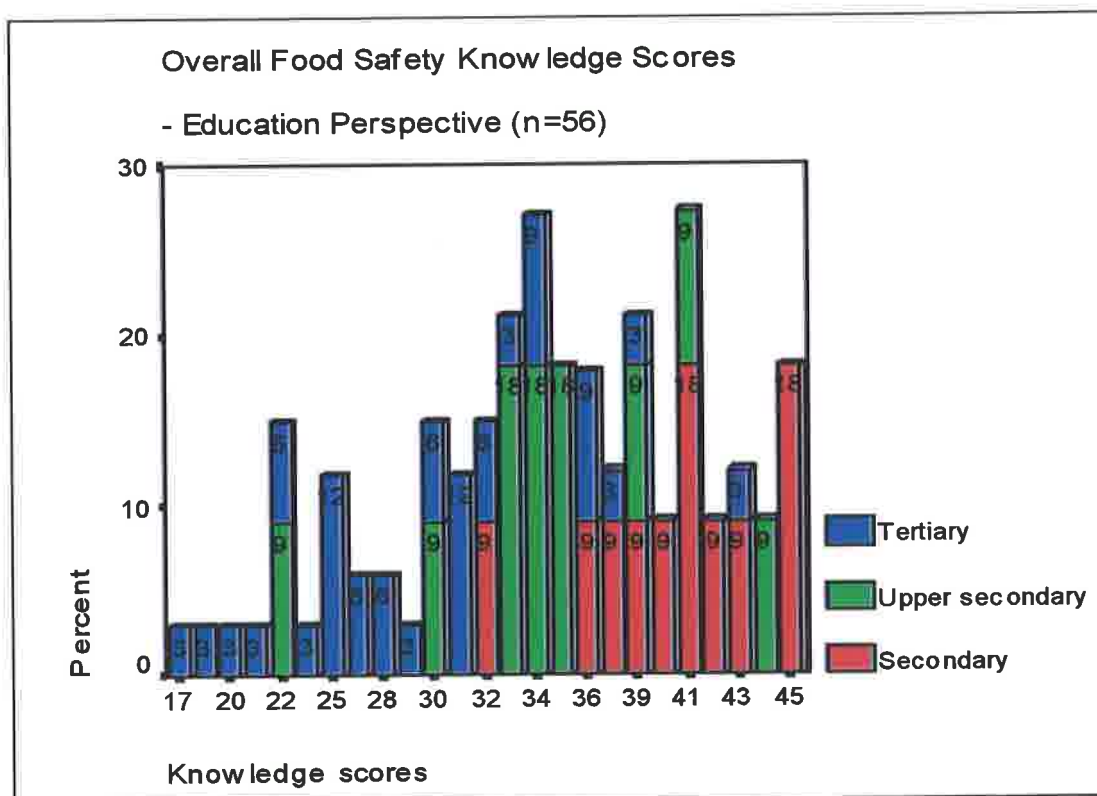
### 6.4.4    Micro Level

Significant differences were noted between Experience of HIs and a topical construct pertaining to "What is the main focus of the complaints" (F= 4.95; df=2; $p$=.05) – Chart 17.  Post-hoc multiple comparisons showed senior HIs are more knowledgeable of the main focus of public complaints about hawkers than junior ($t$= .018; $p$=.05) and middle ($t$= .010; $p$=.05) HIs.

<u>Chart 17</u>

Knowledge Scores for "main focus of public complaints about hawkers" - Experience (n=56).
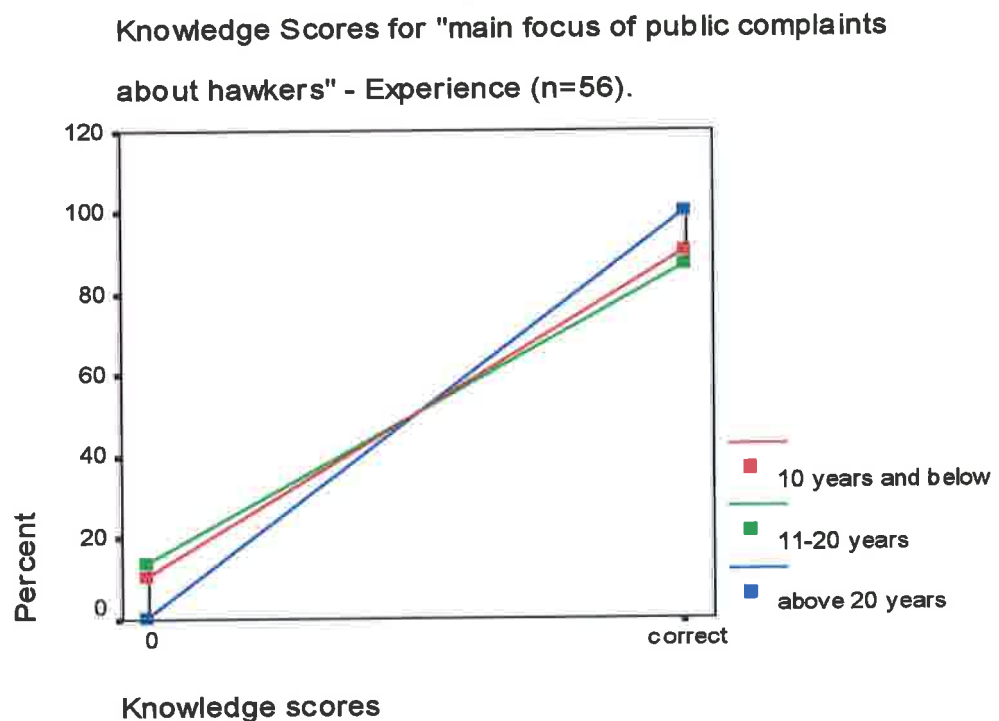
## 6.5   Summary of Results

**Demographic Profile**

- HIs in the middle experience (11-20 years) make up the dominant group (53%) of the studied population (*n=56*).

- More than half (61%) of the HIs have tertiary education.

- More than half (55%) of the HI population (*n=56*) are assigned to take charge of "by the roadside" category of hawkers.

- The entire studied sample (100%) are consumers of hawker foods.

- More than half (59%) have never been ill from eating hawker food.

- From the total sample of HIs who have fallen ill after eating hawker foods (*n=41*), more than half (57%) had been ill once (43%) and twice (14%) in the past year.

**General Food Safety Practices and Knowledge Scores.**

*General Food Safety Practices Profile:*

- HIs with secondary education have been more involved in HACCP implementation than those with tertiary education.

- HIs with upper secondary education have been more involved in HACCP implementation than those with tertiary education.

- HIs with tertiary education have been more involved in food poisoning investigations than those with secondary education.

- HIs with tertiary education are more involved in the investigations of food poisoning outbreaks than those with upper secondary education.

- His with secondary education have been more involved in risk assessment than those with tertiary education.

- His with upper secondary education have been more involved in risk assessment than those with tertiary education.


*General Food Safety Knowledge Profile:*

- HIs with secondary education are more knowledgeable of *HACCP* than those with tertiary education.

- HIs with upper secondary education are more knowledgeable of HACCP than those with tertiary education.

- HIs with secondary education are more knowledgeable of risk assessment than those with tertiary education.

- HIs with upper secondary education are more knowledgeable of risk assessment than those with tertiary education.

*Specific Food Safety Knowledge Profile:*

- Senior HIs are more knowledgeable on the main focus of public complaints about hawkers than Junior HIs and Middle HIs.

- Junior HIs are more knowledgeable on the main focus of public complaints about hawkers than Middle HIs.

## 6.6 DISCUSSION

"No HACCP system is an island"
Owen-Griffiths, (1999)

In terms of General food safety Practices, the findings highlight that involvement in *HACCP* implementation was more confined to HIs of lower education background (secondary and upper secondary education). A dissimilar response pattern is noted for investigations of food poisoning outbreaks; HIs with secondary and upper secondary education background are implicated by the data to be less field-oriented than HIs with tertiary education.

The findings from the General food safety Knowledge perspective showed better knowledge of HACCP from HIs with secondary and upper secondary education than those with tertiary education. A recent paper suggested that "no HACCP system is an island" (Owen-Griffiths, 1999). The HACCP system "is an on-going plan, which requires revalidation and review of modification" (NACMCF National Advisory Committee on Microbiological Criteria for Foods, 1994). Hence, HACCP knowledge may be easily compromised with a lack of application. In the context of risk assessment, HIs with secondary education demonstrated better knowledge of risk assessment than their counterparts with tertiary education. Risk assessment is an extension of HACCP. Risk assessment is the science of understanding hazards, how likely they are to occur, and the consequences if they do occur (Sanders, 1999). Hence a similar reasoning that knowledge improves with frequency of application may apply to risk assessment. This makes the assumption that HIs with lower educational background are more likely to be employed "on-the-ground" doing HACCP and risk assessment or have been involved longer with HACCP/risk assessment implementation.

This assumption is supported by a correlation between Practices and Knowledge. A Pearson bivariate coefficient (2-tail) characterised an association ($r$= .413; $p$=.01) between food safety practices and knowledge of the control authority. The findings highlight the importance of a marriage of application (practices) and concept (knowledge) especially for field-oriented types of jobs. The scatterplot

(Chart 18) shows the interdependency of the two variables (practices and knowledge).

Chart 18

Correlation between Food Safety Practices and Knowledge (n=56)
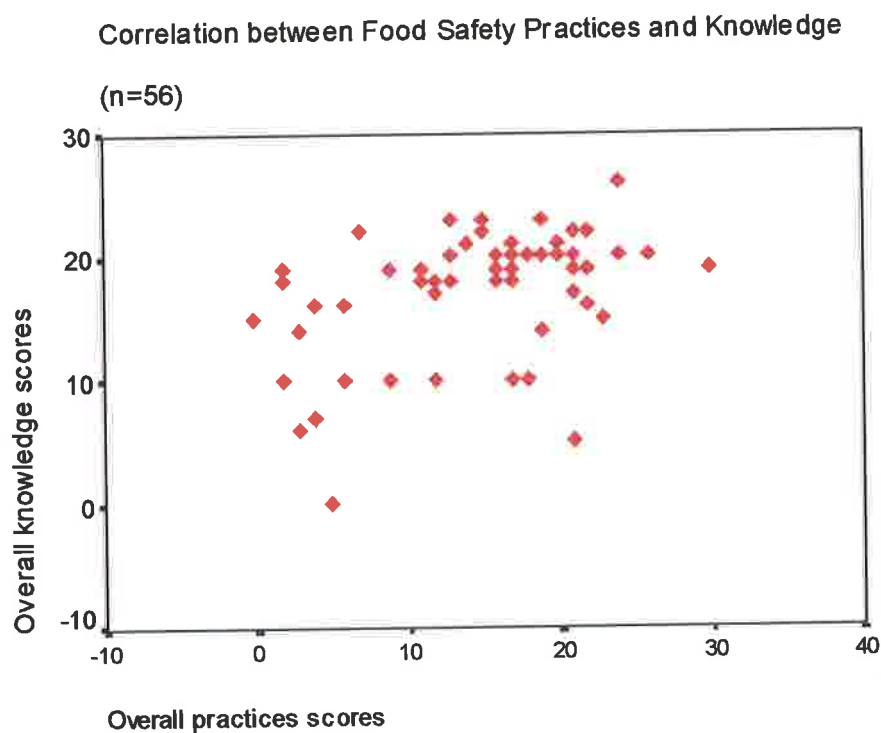


A cross-reference of responses pertaining to self-reported knowledge of HACCP (84% correct) and risk assessment (84% correct) was carried out and compared to responses to "HACCP is designed as a zero tolerance concept (85% correct)" and "risk assessment is designed as a zero tolerance concept" (82% correct) for purposes of reliability of the responses. The findings suggest the self reported responses to be consistent, hence reliable.

The food safety knowledge profiles of the control authority revealed senior HIs to be more abreast on the focus of public complaints about hawkers than junior and middle HIs. It would not be wrong to deduce that the findings suggest that on-the-ground control personnel (junior and middle experience) are less knowledgeable of public or consumers' needs than the seniors who are viewed more as the administration-oriented control personnel. Senior HIs (or the supervisory and management HIs) are more directly involved in the receipt and monitoring of complaints and the collation of data.

Overall, the findings provided useful information concerning the gaps in food safety Practices and Knowledge of the control authority and the relative influence of Experience and Education. Given the present situation of Practices and Knowledge gaps, how is the future implementation of control of food safety, foodborne illnesses and their prevention likely to take shape? What measures are in store to overcome the current discrepancies? The questionnaire may be self-reporting, nevertheless the experiences of the respondents are not perceived values but actual research evidence relevant to this study and the lack of epidemiological data.

This questionnaire study of the control authority highlights the actual short-comings in the staff resources relating to food safety, foodborne illnesses and their control. The present findings provide valuable indicators in addition to the earlier findings (a total of 6 main studies and two secondary studies were carried out by the author) on food safety knowledge, attitudes and practices of hawkers. Whilst

the earlier findings spelled out room for improvement for hawkers, this study provides additional information on the control aspect within the hawker micro-industry with a view to protecting the public from health hazards arising from consumption of hawker foods.

The findings of an inverse relationship between Education and Practices and Knowledge suggest the existence of an unknown intervening variable. What is this variable? The findings suggest a shift has taken place from an initial simple to a more complex structure. Therefore, based on the findings on this study, it is recommended that a further hypothesis be explored into the relationship between Experience and Education of the control authority.

The findings of this questionnaire study of Control Authority Health Inspectors in Kuala Lumpur revealed inter-contextual factors related to the public health control of hawker foods. The total studied population, besides being the control authority for hawkers, are consumers of hawker foods. The findings further suggest an awareness of the importance of epidemiological implications to the respondents, having experienced adverse effects from consumption of hawker foods. Hence, this should reinforce heuristically HIs understanding of food safety, foodborne illnesses and their control.

# SUMMARY, CONCLUSIONS

# and

# RECOMMENDATIONS

*"There is no way to take thinking out of knowledge or the struggle out of thinking"*
Reicks, M. et al. (1994)

## 7.1  SUMMARY

This thesis on "The Evaluation and Control of Food Safety in Hawker Foods in Kuala Lumpur" comprised six primary studies and two secondary studies. A holistic approach to the research was reflected by hybrid (combined) research methods (structured interviews, visual and laboratory assessments and a structured questionnaire survey) in an effort to meet the needs of a wide spectrum thesis.   The overall aim of the study was to establish a link between the knowledge, attitudes and practices of hawkers and the control of food safety, foodborne illnesses and their prevention. Laboratory findings (levels of contamination) were used in an attempt to validate the findings on hawkers' practices (FHP via FCS to food safety).

The significant findings of the six primary studies and two secondary studies were crystallised and presented under three distinct studies (Study 1, Study 2 and Study 3).

**Study 1:** (mapping of hawker activities, assessing hawkers' knowledge and attitudes on food safety, foodborne illnesses and their prevention) This study concentrated on establishing hawkers' profiles specific to KL. This study used four independent variables (IV) of culture, environment, education and age as likely determinants of food safety knowledge and attitudes.

The demographic profile constructs of this study were based on 12 distinct areas of significance in terms of general demography, details of food types, number of items sold per hawker, income from hawking, employment opportunities in the hawking micro-industry, hawker location (category), type of ownership and training and/or courses attended. 30 main constructs, using summated or close-ended schedules, were used to determine the knowledge of hawkers on food safety, foodborne illnesses and their prevention. 13 structured attitude items, using Likert rating scales, were included in the structured interview schedule to assess the attitudes of hawkers.

The findings of the mapping activities revealed a multi-cultural, multi-category, male dominated hawker micro industry with income levels comparable to professional groups. The hawkers in KL reflected a good cross-section of age groups (below 20 to above 50 years) and educational backgrounds (no formal education, primary education and secondary education).

In **Study 1**, the findings did not support the null hypothesis ("Hawkers from different cultural (ethnic) background are not likely to demonstrate differences in food safety/hygiene knowledge and attitudes"). The findings showed cultural (ethnic) differences in the knowledge of food safety, foodborne illnesses and their prevention in the topical areas of cross-contamination and maintenance of equipment, utensils and premises. From the age perspective, the findings supported the hypothesis ("Junior adults are not likely to demonstrate better knowledge and attitudes than senior adults"). Hawkers, regardless of age,

demonstrated similar knowledge and attitudes. There was no strong support for the hypothesis ("Educational backgrounds of hawkers are not likely to influence knowledge and attitude scores"). Ethnic Malays and ethnic Indians with better background education were found to have demonstrated better knowledge than ethnic Chinese only (2 out of 30 constructs) in the topical areas of cross-contamination and equipment, utensils and premises. From the attitude standpoint, hawkers with lower and upper secondary education demonstrated better attitudes than those with no formal education. However, there were no significant difference in attitudes between hawkers with primary education and those with secondary education. The findings from the environment perspective supported the hypothesis ("Hawkers in different locations and categories are not likely to demonstrate differences in food safety/hygiene attitudes and knowledge"). Hence, environment has not been shown to impact on the knowledge and attitude scores of hawkers.

Structured interviews are time and cost-intensive. The interview per hawker lasted between 1 to $1\frac{1}{4}$ hours, depending on how busy the hawkers were and their level of understanding of the questions. Hawkers with their non-stop business schedule do not pay full attention to questions and choice of answers provided; questions and multiple-choice answers have to be repeated several times and answers clarified. Although efforts were made on-site to try and have a sample as representative as possible of the actual make-up of the hawker population of KL, random sampling of participants could not be done in advance as the interview was conducted on "willing to participate" hawkers only. The

interview schedule was constructed in three of the most frequently used languages (Bahasa Malaysia, Mandarin and English).

There are shortcomings in using structured interviews in terms of what to ask and how best to formulate the "interviewee-friendly" questions (items) and record the responses. Sensitive issues related to religion, culture and politics were avoided.

**Study 2**: This study assessed the likely risks posed by the foodhandling practices (FHP) and food-contact surfaces (FCS) of hawkers. The FHP study (using 13 main constructs) took into account visual and measurable evidence whilst the FCS, using dipslides, provided the levels of contamination (qualitative aspect) of work surfaces (9 WS), chopping boards (9 CB) and dishcloths (9 DC) of *nasi lemak* (NL), *charkoay teow* (CKT) and *roti canai* (RC) hawkers. The feedback from the piloting suggested that 9 hawkers (3 NL, 3 CKT and 3 RC) and 27 FCS (9 WS, 9CB and 9 DC) for risk assessments would be representative samples of FHP and provide good repeats for FCS. The findings of FHP supported the investigative hypothesis ("Cultural hawker foods in different environments are likely to exhibit different levels of risk concerns in FHP"). However, the findings of FCS suggest weak support for the investigative hypothesis ("Cultural hawker foods in different environments are likely to exhibit different risk concerns in FCS"). The findings suggest differences in the contamination levels of DC; lower bacterial counts were noted in the dishcloths of ethnic Chinese than those of the ethnic Malays and ethnic Indians.

The Pearson bivariate correlation characterised no association between foodhandling practices (FHP) and food-contact surfaces (FCS) scores. Similar findings of no association have been noted in previous related studies using risk and microbiological assessments on retail food premises in the UK (Tebbutt and Southwell, 1989; Tebbutt and Midwood, 1990; Powells & Attwell, 1995).

This risk assessment or audit process, however, is an arduous and time-consuming process. Each assessment took 45 minutes to complete. The second assessment, using dipslides with triphenyltetrazolium chloride (TTC) to obtain food samples on food-contact surfaces, which measures contamination levels (after incubating for 48 hours) is equally time-consuming and requires precision in recording the results. In addition to this, it is expensive due to the high cost of the dipslide and the incubator.

**Study 3**: This study concentrated on the control aspects of hawkers and food safety, foodborne illnesses and their prevention. The findings of this study provided: (1) useful information to complement the findings relating to hawkers' knowledge, attitudes and practices, and (2) a link between the control aspect and the safety of hawker foods. The study, using structured questionnaires with 12 main constructs, looked into the practices (enforcement) and knowledge of the control authority in the DBKL. The return rate of the questionnaire was 93% ($n$=56). The HI sample reflected a mix of Junior (10 years of service and below) HIs ($n$=20), Middle (11 to 20 years of service) HIs ($n$=30) and Senior (21 years of service and above) HIs ($n$=6) with educational backgrounds ranging from

secondary school to tertiary education. The surveyed sample (*n*=60) was fully representative of the varied experience and education backgrounds of the KL food safety enforcers.

The demographic findings highlighted a predominantly middle experience (11-20 years) group of HIs with more than half (61%) having tertiary background education and more than half (55%) having responsibility for hawkers by the roadside. The affirmation of HIs as consumers of hawker foods (100%) and their experience of foodborne illnesses provided an additional dimension to their understanding (heuristically) and responses to food safety, foodborne illnesses and their prevention. There were differences in knowledge between Junior and Senior and Middle and Senior HIs in the topical area of the main focus of public complaints about hawkers. Hence, the findings did not support the hypothesis ("Junior, Middle and Senior Health Inspectors of DBKL are not likely to exhibit differences in food safety/ HACCP and risk assessment knowledge"). The findings strongly supported the hypothesis ("Junior, Middle and Senior HIs of DBKL are not likely to exhibit differences in enforcement practices"). No support for the third hypothesis ("Educational background is not likely to influence food safety/HACCP/risk assessment knowledge of Junior, Middle and Senior HIs") was found related to General Food Safety Practices and Knowledge of HIs. An inverse relationship was found whereby as education increases, practices and knowledge scores decrease. The findings suggest an unknown intervening variable which requires further research into the areas of practices and knowledge.

Some of the shortcomings arising from the use of questionnaires are the construction of questions. The process is not only time-consuming but requires care in phrasing questions clearly and unambiguously, such that the respondent is in no doubt which answer to give. The ideal is that all respondents will interpret an item in the same way. The quality of responses and the response rate are beyond the control of the constructor.

## 7.2    CONCLUSIONS

A culmination of findings from the 6 studies (Study 1, Study 2 and Study 3) has brought yet another chapter of wealth for research. The six studies altogether under the umbrella of "The Evaluation and Control of Food Safety in Hawker Foods in Kuala Lumpur" have expanded the dimension of the current understanding of hawkers and their knowledge, attitudes, practices and control relating to food safety, foodborne illnesses and prevention.

The findings have also filled the recognised research gap (George, 1990) of linking regulatory control and preventive parameters (including laboratory validation) to safer hawker foods. It is imperative to mention that a study of this width and depth required commitment, diligence, patience and a respect for the hawkers and local cultures in order to achieve the desired results. Furthermore, the success of the research was assisted by the fact that the author carried out all of the research herself in her own native country. Hence, aside from the support and co-operation from the authority and hawkers, the interviews and risk assessments were carried out in a congenial situation (a situation unaffected by

"noise" and/or other extraneous variables), and relatively free from the potential problems associated with the placebo effect (the respondent's knowledge that s/he is under observation, will affect the study) [1]. The presence of the author at the on-site structured interviews and assessments of foodhandling practices (FHP) and food-contact surfaces (FCS) did not perturb the hawkers. The hawkers were relaxed and on no occasion expressed doubts or suspicions in the author.

The study of hawker foods using the risk assessment methods (FHP and FCS) is the first challenge study of its kind in Malaysia or even in the region. This study also provides an option for the Malaysian local authority to incorporate the FHP and FCS methods into the current surveillance of foodborne illnesses. The risk assessments or audits allow the assessor to explore at length the practices of hawkers, the environment and equipment in a real life situation (naturalistic environment). This on-site visual (with researcher immersion) study delivered richer (as in actual) information, which is an added advantage when interpreting the data and provided information to cushion scant epidemiological data.

The findings have shown the impact of culture and environment on hawkers' profile (derived from mapping activities), the knowledge and attitudes towards food safety, foodborne illnesses and their prevention. Whilst studies have been made on the impact of environment on knowledge of food handlers (Albrecht, 1995), this study provides vital information on specific food handlers (hawkers).

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[1] Kumar, R. (1999). Research Methodology. A Step-By-Step Guide for Beginners. SAGE Publications.

This study has also taken a step further in bridging a research gap by showing topical areas where culture and environment differences in knowledge and attitudes are prevalent, and the viability of preventive methods via risk and laboratory assessments (FHP and FCS) and hawker control (enforcement). The study has succeeded in its attempt to establish new baseline information and evaluative techniques to control the safety of hawker foods in Kuala Lumpur. The methodology can also be replicated for use in hawker situations globally.

The study has highlighted the knowledge levels of ethnic groups (Malays, Chinese and Indians) pertaining to food safety. It has identified yet another new dimension in the hawker profile whereby hawkers in Kuala Lumpur have been shown to be predominantly formally educated (71%). The emergence of educated hawkers supercedes past reports (WHO, 1996) that hawkers are uneducated. The findings have also unveiled a definite pattern showing ethnic Malay and Indian hawkers with higher background education than ethnic Chinese. This suggests that whilst the hawker micro-industry has attracted ethnic Malay and Indians from a wider background education spectrum, only the lower background education Chinese are attracted to hawking (Chart 19).

Chart 19

**Breakdown (%) of Education of Culture Groups**

**(n=99)**



**Educational Levels**
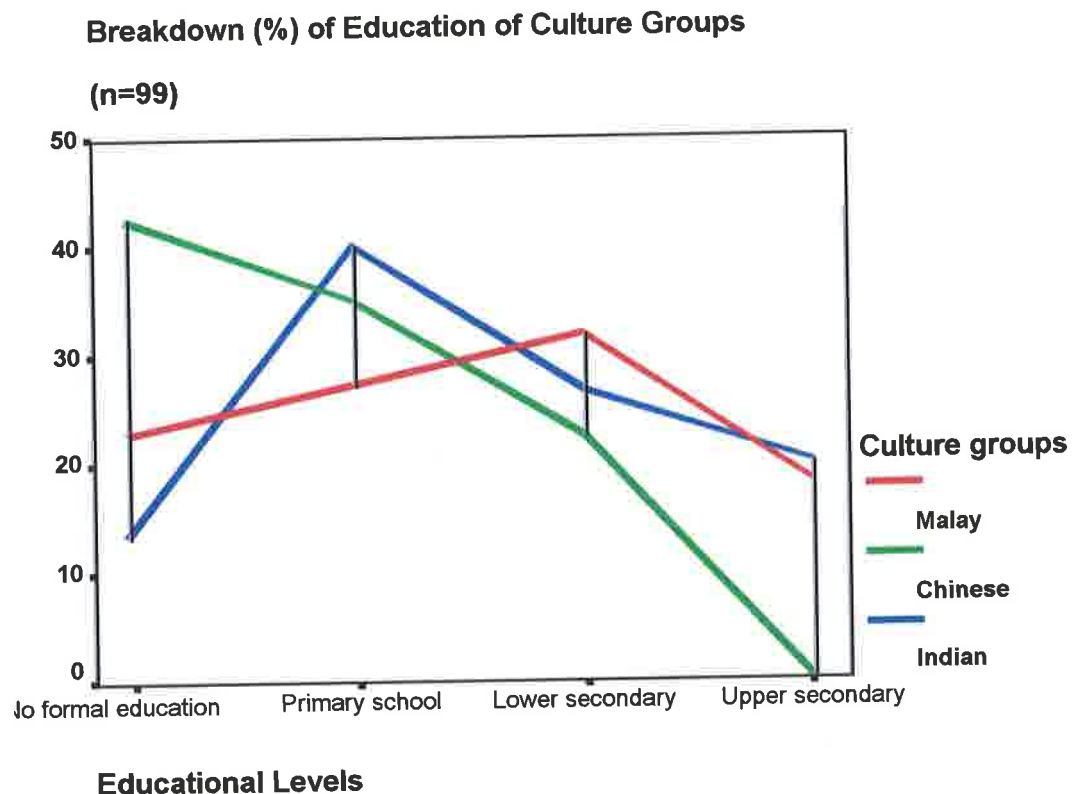
The study has clearly identified the inter-dependency of knowledge and attitudes. Attitudes of hawkers improve with higher knowledge scores. By the same token, hawkers with better background education demonstrated better food safety knowledge. Hence, ethnic Malays and Indians with better background education obtained better knowledge and attitude scores. The findings of this study have highlighted education as an integral factor contributing to the knowledge and attitudes of hawkers. The findings have echoed Howes et al. (1996) who found that knowledge scores decreased significantly in foodhandlers with difficulties in reading and understanding.

The FHP and FCS findings of this thesis have provided useful risk information for the three popular ethnic foods. This information sets the stage for use as baseline data for future replication of studies locally and internationally in the risk assessment of hawker foods. The findings of high concern in foodhandling practices (FHP) and moderate to high concern in food-contact surfaces (FCS) demonstrate a need for food safety/hygiene knowledge in hawkers. The study reinforces earlier findings (Chapter Four) of a lack of knowledge and attitudes of hawkers in Kuala Lumpur. The study on FHP and FCS suggest the importance of researcher immersion. This particular study demonstrates that relatively small samples do not necessarily impair the research findings so long as the correct methodology is utilised. The findings strongly support Coolican's (1994) contention that "the simple truth is that a truly representative sample is an abstract ideal unachievable in practice".

Conversely, the findings of Study 1 and Study 2 beg the questions:

(1) Is background education the sole contributory factor behind the lack of knowledge and attitudes in hawkers? The findings showed that the knowledge differences were in two topical areas only (cross contamination and equipment, utensils and premises) and only ethnic Indians demonstrated better attitudes towards food safety than ethnic Chinese.

(2) What are the specific differences in culture that have contributed to the differences in the knowledge, attitudes and practices of hawkers?

The control link to this study has highlighted short-comings in the control of food safety and foodborne illnesses. The findings suggest an inverse relationship exists between education and practices and knowledge of HIs. HIs with higher educational backgrounds have not demonstrated better knowledge than those with lower educational backgrounds. The findings suggest the existence of an unknown variable. The following factors may contribute to the inverse relationship:

(1) The lack of in-the-field exposure of HIs with tertiary education (administration-oriented),

(2) The cultural factor as HIs are predominantly ethnic Malays, and

(3) The years of experience. HIs with secondary education join the enforcement services earlier than those with tertiary education, hence are more experienced than HIs with tertiary education.

Whilst earlier findings have spelled out room for improvement of hawkers in terms of knowledge, attitudes and practices, the findings on the HIs have provided information on the control of the hawker micro-industry with a view to protecting the public from health hazards arising from consumption of hawker

foods. Abdussalam and Kaferstein (1994) have suggested education and not punishment for the hawkers. This study complements their call by proposing that training/education should begin with the enforcers to ensure proactive and committed food control within the hawker micro-industry. The training should incorporate current practical issues and developments (e.g. HACCP and risk assessment) in addition to theoretical concepts.

The findings of this study, whilst confined to the hawker micro-industry, could form the basis for a hawker model and methodology (database) for use in future follow-up studies on hawker foods and industry worldwide.

It is hoped that the information obtained from this research, whilst specific to the hawker industry in KL, will be of wider applicability to Malaysia and other countries. This would be of importance, given the exponential growth in the number of people involved ($\cong$ 200,000 in Malaysia) in the micro-industry in many countries and whose cultures embrace food hawking.

## 7.3    RECOMMENDATIONS

The six studies of hawkers presented in Study 1, Study 2 and Study 3 have reaped bountiful and valuable findings pertaining to current issues of food safety, foodborne illnesses and their prevention in the hawker micro industry in Kuala Lumpur.    To-date, no studies have made such a breakthrough into the determinants of hawkers' knowledge, attitudes and practices and linked the variables to the control arm of public health. The overall findings of this study

now set the stage for further studies of hawkers and hawker foods. The recommendations, based on the findings, are as follows:-

1. Training appears to be the primary factor to bridge the gap between the knowledge, attitudes and practices of hawkers and the provision of safe foods. It is imperative that hawkers be given compulsory courses on an on-going basis (training and retraining) as food handlers are prone to incalcating bad habits over a period of time after each training and/or retraining.

2. Free courses/training should be conducted for the hawkers.

3. Incentives such as food safety/hygiene awards, reduced income tax, priority for low cost housing and educational scholarships for children should be made available to hawkers to encourage their participation in training courses and reward their efforts in producing safe hawker foods.

4. Courses for hawkers should be interesting and illustrative in nature in order to meet the levels of comprehension and the cultural background of the hawker audience. Courses using pictograms, comic strips, demonstrations and video

presentations instead of the "chalk and talk" types would be the most appropriate for hawkers.

5. High risk concerns are noted in the FHP and medium to high risk concerns in the FCS of hawkers. Regular and committed monitoring by the public health authorities into the hygiene practices of hawkers should be undertaken.

6. Periodic risk and contamination assessments of high risk hawker foods using standardised procedures (for preventive purposes) should be carried out in order to protect the public from health hazards. Samples of high concern hawker foods should be sent for laboratory analysis in order to determine the bacterial strains.

7. A requirement to undertake approved training courses before entering employment should be introduced for public health control personnel. Courses should include practical and current issues pertaining to food safety, foodborne illnesses and their prevention.

8. Senior, Middle and Junior members of the public health control authorities should be regularly exposed to current trends and developments in food safety and control e.g. by

attending conferences and organised talks by guest speakers. This should be part of a programme of continuing professional development.

9. The implication of this study suggests that hawker food safety conditions cannot be isolated from local environmental conditions. Hence, this provides justification for extending the responsibilities of HIs to include environmental issues.

10. This hawker micro industry offers growth potential in terms of the national economy, public health, cultural heritage, employment opportunities and tourism. Further research into the social cost and benefits of the hawker industry in order to explore the extent of its current and potential national and social contribution would be invaluable.

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# APPENDICES

# APPENDIX ONE

# DEWAN BANDARAYA KUALA LUMPUR

JABATAN PENGURUSAN ORGANISASI
BAHAGIAN PENGURUSAN SUMBER MANUSIA
Tingkat 23-24
Bangunan DBKL
Jalan Raja Laut
50350 Kuala Lumpur

Rujukan Kami : DBKL/PSL 5/1#11/79 Bhg.12A          Tarikh :  9 Mei 1997.

Rujukan Tuan :

Puan Poh See Toh,
c/o Department of Food & Consumer Science,
University of Wales Institute Cardiff,
Colchester Ave.,
Cardiff,
CF3 7XR,
United Kingdom.

Puan,

**PERMOHONAN MENDAPATKAN KEBENARAN DAN BANTUAN
MENJALANKAN PENYELIDIKAN PERINGKAT PH.D "THE
EVALUATION AND CONTROL OF FOOD SAFETY IN HAWKER
FOOD IN KUALA LUMPUR, USING A HACCP APPROACH**
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Dengan hormatnya saya diarah untuk merujuk surat puan
bertarikh 25.3.97 mengenai perkara tersebut di atas.

2.    Sukacita dimaklumkan pihak Pengurusan Dewan Bandaraya
Kuala Lumpur bersetuju membenarkan puan membuat penyelidikan
tentang "The Evaluation and Control of Food Safety in Hawker
Food in Kuala Lumpur, Using a HACCP Approach".

3.    Bagi tujuan tersebut, pihak puan bolehlah menghubungi
Jabatan Kesihatan dan Jabatan Pengurusan Penjaja dan
Perniagaan Kecil DBKL untuk mendapatkan butir lanjut.

Sekian, dimaklumkan.

" BERKHIDMAT UNTUK NEGARA "

" BERSEDIA MENYUMBANG, BANDAR RAYA CEMERLANG "

Saya yang menurut perintah,

(HAJI SHAFIE BIN AHMAD)
Bahagian Sumber Manusia,
Jabatan Pengurusan Organisasi,
b.p. Datuk Bandar Kuala Lumpur.

# DEWAN BANDARAYA KUALA LUMPUR

**JABATAN PENGURUSAN PENJAJA DAN PERNIAGAAN KECIL**

CA 110 Tingkat 4,
Bangunan City Square (Crown Princess Hotel), Jalan Tun Razak,
50400 Kuala Lumpur. Peti Surat 11022.

Rujukan Kami: ( 56 )dlm. DBKL JP. 87/01/61          Tarikh: Safar 1418
                                                    / Julai 1997

Rujukan Tuan:

Kepada Penjaja-Penjaja

**Kebenaran Membuat Kajian Peringkat Ph.D"**
**The Evalvation and Control Of Food Safety In**
**Hawker Food In Kuala Lumpur - Puan Poh See Toh**
**Daripada University Of Wales Institute Cardift**

Saya dengan hormatnya menarik perhatian tuan-tuan kepada perkara
di atas.

2.          Sukacita saya memohon kerjasama daripada tuan-tuan agar
membantu Puan Poh See Toh bagi menjayakan penyelidikan beliau di
gerai tuan-tuan.

Sekian, terima kasih.


**"BERKHIDMAT UNTUK NEGARA"**

**"BERSEDIA MENYUMBANG BANDARAYA CEMERLANG"**


Saya yang menurut perintah,


( ISMAIL BIN STAPA )
Jabatan Pengurusan Penjaja
Dan Perniagaan Kecil.
b.p. Datuk Bandar Kuala Lumpur.


Is/wt

# APPENDIX TWO

# CATEGORIES OF HAWKERS IN KUALA LUMPUR:-

1. **Designated Sites**





2. **DAY / NIGHT MARKETS**

**3.** **KIOSK**

**4.** **By the roadside**

# APPENDIX THREE

# STRUCTURED INTERVIEW SCHEDULE

# D•E•M•O•G•R•A•P•H•I•C•S

1. **What is your ethnicity ?**

   | | | | | |
   |---|---|---|---|---|
   | Malay | ❑ | Indian | ❑ | |
   | Chinese | ❑ | Others | ❑ | Please specify : [_____] |

---

**2. i. Does the person in-charge own the business?**

   Yes ❑    No ❑

**ii. Is the person in-charge male or female ?**

   Male ❑    Female ❑

---

**3. i. Are you the owner or an employee ?**

   Owner ❑    Employee ❑

**ii. If you are the employee, what is your approximate gross monthly salary ?**

   | | | | |
   |---|---|---|---|
   | Below RM 500 | ❑ | RM 901 - RM 1100 | ❑ |
   | RM 500 - 700 | ❑ | RM 1101 - RM 1300 | ❑ |
   | RM 701 - 900 | ❑ | RM 1301 - RM 1500 | ❑ |

   Other, please specify :

---

4. **To which age group do you belong?**

   | | | | |
   |---|---|---|---|
   | Below 20 years | ❑ | 31 - 40 years | ❑ |
   | 21 -30 years | ❑ | 1 -50 years | ❑ |
   | | | Above 50 years | ❑ |

5. **What type of ownership is the hawker business ?**

   Single ❏          Family ❏          Not known ❏

6. i. **Is food hawking the owner's only business ?**

   Yes ❏          No ❏          Not known ❏

ii. **What is the average income per month from the food hawking business?**

| | | | |
|---|---|---|---|
| Below       RM500.00 | ❏ | RM2,000.00 - RM 2,999.00 | ❏ |
| RM500.00 -   RM999.00 | ❏ | Above        RM 3,000.00 | ❏ |
| RM1,000.00 - RM 1,999.00 | ❏ | Not known | ❏ |

7. i. **Is this a licensed hawker business ?**       Yes ❏    No ❏

   ii. **Number of employees at this stall.**

8. **What is the level of your education ?**

| | | | |
|---|---|---|---|
| No formal education | ❏ | Upper secondary school | ❏ |
| Primary school | ❏ | Tertiary education | ❏ |
| Lower secondary school | ❏ | | |

9. **How many types of food item/s are you selling ?**

| | | | |
|---|---|---|---|
| Single item only | ❏ | 5-8 items | ❏ |
| 2-4 items | ❏ | More than 8 items | ❏ |

10. **How long have you been involved in the hawker business ?**

| | | | |
|---|---|---|---|
| Less than 1 year | ❏ | 11 to 15 years | ❏ |
| 1 to 5 years | ❏ | 16 to 20 years | ❏ |
| 6 to10 years | ❏ | more than 20 years | ❏ |

11. **What are your average working hours per week ?**

| | | | |
|---|---|---|---|
| Less than  20  hours | ❏ | 41 - 50  hours | ❏ |
| 21 - 30  hours | ❏ | 51 - 60  hours | ❏ |
| 31 - 40  hours | ❏ | 51 - 60  hours | ❏ |

12. i.     **Have you attended any courses / training on :-**

| | YES | NO |
|---|---|---|
| Running a small business | ❏ | ❏ |
| Food hygiene / Food safety | ❏ | ❏ |
| Food preparation skills | ❏ | ❏ |
| Other course related to food hawking | ❏ | ❏ |

Please provide details :

12. ii.  **Location of the hawker:**

| | | | | | |
|---|---|---|---|---|---|
| 1. | By the roadside | ❏ | 3. | Designated hawker site | ❏ |
| 2. | Market place | ❏ | 4. | Kiosk | ❏ |

If  no. 4,  please state the locations :

# STRUCTURED INTERVIEW (KNOWLEDGE-BASED) OF HAWKERS IN KUALA LUMPUR, MALAYSIA

Thank you for your cooperation and assistance in completing this questionnaire.

Please listen attentively to the questions and answers provided and tell me which you think is the correct answer.

1. The temperature inside the refrigerator should be at or below

| | | | |
|---|---|---|---|
| 15° C | ☐ | -18° C | ☐ |
| 4° C | ☐ | -30° C | ☐ |

2. When is it particularly important to clean food contact surfaces ?

| | | | |
|---|---|---|---|
| Once a day | ☐ | After preparing cooked foods | ☐ |
| When it looks dirty | ☐ | After handling raw foods | ☐ |

3. i. Do you think it is important for foodhandlers to wash their hands before handling food and after using the toilet?

Yes ☐      No ☐

If No, go to Question 4.

ii. If so, why do you think it is important ?

| | | | |
|---|---|---|---|
| So that they do not smell | ☐ | To impress the customers | ☐ |
| To maintain a clean image | ☐ | To prevent food from being contaminated | ☐ |

4. **What is the temperature danger zone for food storage ?**

| | | | |
|---|---|---|---|
| 65 - 83° C | ❑ | 12 - 75° C | ❑ |
| 5 - 63° C | ❑ | 30 - 82° C | ❑ |

5. **Which of the following is the recommended action for dealing with food that has passed the "Expiry"** (Sell by/Used by/Best before) **date ?**

| | | | |
|---|---|---|---|
| Alter the Expiry date | ❑ | Sell it at a reduced price | ❑ |
| Can be used if it looks and smells good | ❑ | Throw it away | ❑ |

6. **Which of the following, most commonly, causes foodborne illness ?**

| | | | |
|---|---|---|---|
| Toxic paints. | ❑ | Environmental pollution | ❑ |
| Insect repellent | ❑ | Germs | ❑ |

7. **Which of the following organisms are likely to be involved in foodborne illness?**

| | | | |
|---|---|---|---|
| Yeast | ❑ | Molds | ❑ |
| Bacteria | ❑ | Diatoms | ❑ |

8. **How should the indoor storage of refuse be handled ?**

| | |
|---|---|
| Placed near to the food preparation area for easy access | ❑ |
| Placed near the door in the food rooms and cleared at frequent intervals | ❑ |
| Placed outside the preparation room and cleared at frequent intervals | ❑ |
| Placed inside the food store | ❑ |

9. **Is there any Legislation which covers the preparation and service of food?**

| | | | |
|---|---|---|---|
| Yes | ❑ | No | ❑ |

If Yes, name it _____

10. **What is the best method of removing flies ?**

| | | |
|---|---|---|
| Swatting the flies on food ☐ | Using disinfectant | ☐ |
| Spraying with insecticides ☐ | Installing fly electrocutors | ☐ |

11. i. **Do you think pests are a problem to hawkers ?**     Yes ☐    No ☐

    ii. **Why should pests not be allowed into food premises ?**

| | | |
|---|---|---|
| To prevent annoying customers ☐ | To prevent the spread of disease | ☐ |
| To prevent having to feed them ☐ | To prevent having to kill them | ☐ |

12. **What do you understand by the term "cross-contamination "?**

When two animals cross-breed with one another. ☐
When toxic chemicals get into food. ☐
When germs from raw food are transferred to cooked food ☐
When the numbers of foodborne illness are increasing ☐

13. **Where should mobile and temporary premises be sited ?**

Near to garbage areas where it is convenient to throw leftovers. ☐
In a construction site where labourers need food. ☐
Along a busy road and nearby offices. ☐
In a prescribed hawker site. ☐

14. **What action can be taken by the enforcement officer if food stalls are unhygienic and substandard ?**

Vendor can be prosecuted, fined and licence revoked ☐
Relocate the vendor ☐
Advise customers not to patronize the vendor ☐
Accept a bribe and take no action ☐

15. **What must you do with the leftovers of <u>reheated</u> food ?**

Cool it and freeze. ☐          Discard it even though it may look good. ☐
Give it to the poor later on ☐          Keep it covered in the refrigerator. ☐

16. **Which of the following does <u>not</u> protect food from contamination ?**

Keeping foods covered wherever possible ☐
Cleaning working surfaces with disposable cloths ☐
Handling cooked foods with tongs ☐
Handling raw foods with tongs ☐

17. **Which of the following does adequately prevent bacterial growth ?**

Placing large items of hot foods in the refrigerator ☐
Placing small items of cooked foods in the refrigerator ☐
Leaving food at ambient temperature ☐
Putting heated foods back into the oven to cool down ☐

18. i. **Please refer to the illustration and answer the following questions :**
( Indicate your answer by the corresponding letter. e.g. ☑ )

**Q.** Where would you store a raw chicken ?
☐

**Q.** Where would you store a cheese cake ?
☐

**Q.** Where would you store cooked meat if the two previous items were also stored in the fridge ?
☐



8
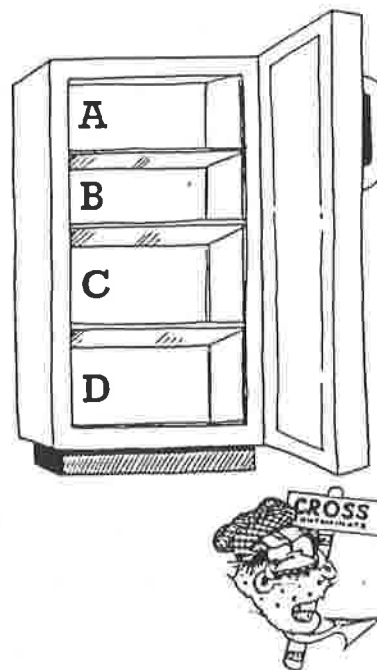
ii.     Raw food should be stored below cooked food in the refrigerator.

                        True        ☐           False       ☐

19.     Serving cooked meats on the same container that held the raw meat, without washing it :

                        Makes food poisoning more likely to occur          ☐
                        Makes food poisoning less likely to occur          ☐
                        Makes no difference to the risk of food poisoning  ☐
                        Can affect the taste of the food.                  ☐

20 i.   Is it necessary to wear  clean specialist clothing during food preparation ?

                        Yes         ☐           No          ☐

ii.     If  Yes,   why is it necessary ?

        Food is protected from you          ☐       To attract more customers        ☐
        You are protected from injury       ☐       Your own clothes do not get dirty ☐

21 i.   What is Salmonella spp.?

        Name of an animal           ☐       Name of a germ        ☐
        Name of a human being       ☐       Name of a plant       ☐

ii.     What type of microorganism causes the cholera outbreak in Selangor, Malaysia in 1993 ?

        E. coli VTEC                ☐       Aflatoxin             ☐

        Vibrio cholerae 0139        ☐       Toxoplasma gondii     ☐

9

22. **Which of the following statements about food handling practices contribute to foodborne disease ?**

        A. inadequate reheating
        B. buying food from an unsafe source
        C. mixing leftovers with freshly cooked foods
        D. inadequate refrigeration
        E. contaminated processed foods

| | |
|---|---|
| Statement A & C | ❑ |
| Statement B & D | ❑ |
| Statements A & B | ❑ |
| All of the above | ❑ |

23 i. **Does a food handler with a cut finger pose a risk of causing foodborne illness ?**

        Yes  ❑        No  ❑

ii. **Which bacteria may be a potential problem with cuts / wounds ?**

| | | | |
|---|---|---|---|
| Salmonella sp. | ❑ | Clostridium botulinum | ❑ |
| Bacillus cereus | ❑ | Staphylococcus aureus | ❑ |

iii. **What should a foodhandler do if he/she has a cut or is sick ?**

| | |
|---|---|
| Take medicine and continue working | ❑ |
| Stay away from work until well (fully recovered) | ❑ |
| Avoid cooking but help in serving the food | ❑ |
| It is perfectly alright to continue working because nobody knows | ❑ |

24. **Does refrigeration kill all dangerous bacteria that may be present in food ?**

| | |
|---|---|
| No, but it keeps foods cool so that harmful bacteria do not multiply. | ❑ |
| Most of the bacteria are killed at low temperatures. | ❑ |
| It kills all of them. | ❑ |
| On the contrary, it promotes growth. | ❑ |

25. **You have been using a cutting board for raw meats and poultry. How should you clean it ?**

Wash with detergent in water ❑                Rinse it in water ❑

Wipe over with a disinfectant ❑               Wash with detergent and then
                                                               disinfectant / sanitiser ❑

26. **At temperatures above 80° C, food poisoning bacteria :-**

Multiply rapidly ❑                             Die ❑

Grow slowly ❑                                 Remain dormant ❑

27. **In ideal conditions, some bacteria divide every :-**

2-5 minutes ❑                                 45-60 minutes ❑

10-20 minutes ❑                               90-120 minutes ❑

28. **In which of the following parts of the body can food poisoning bacteria be found ?**

Ears and nose only ❑                          Ears, nose and intestines ❑

Ears, nose and hands ❑                        Ears, nose, hands and intestines ❑

29 i. **Can you explain the meaning of "high risk" food ?**     Yes ❑     No ❑

ii. **Which of the following matches your definition ?**

Foods that cause tooth decay ❑               Foods that spoil easily ❑

Foods that support the growth of
              pathogenic bacteria ❑          Foods may contribute to
                                                        heart disease ❑

iii. **Which of the following is a "high risk" food ?**

| | | | |
|---|---|---|---|
| Dried mushrooms | ❑ | Beef curry with coconut milk | ❑ |
| Pickled mango | ❑ | Plain bread | ❑ |

**30.** **Which of the following would you consider to be the most hazardous ?**

| | |
|---|---|
| Using a refrigerator with an inside temperature of 5° C | ❑ |
| Ensuring food reaches a temperature of 80° C in cooking. | ❑ |
| Storing high risk food for 24 hours at a temperature of between 37°C and 63°C. | ❑ |
| Storing corned beef for three days at a temperature of 4°C. | ❑ |

# STRUCTURED INTERVIEW (ATTITUDE-BASED) OF HAWKERS IN KUALA LUMPUR, MALAYSIA

Please listen attentively and indicate your answer of either a STRONGLY AGREE (SA) ; AGREE (A) ; UNSURE (U) ; DISAGREE (D) ; or STRONGLY DISAGREE (SD) to each of the following statements.

Your kind cooperation is very important for the success of this study and is most appreciated.

THANK YOU

|  | SA | A | U | D | SD |
|---|---|---|---|---|---|
| 1. I am concerned with keeping up with careful hygiene practices. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2. I worry about keeping cooked and raw foods separately. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3. Keeping food equipment clean is a priority for you. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4. It is a good idea to contact the Local Authority for information on hygiene and food safety awareness. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5. Once food is cooked, it does not matter when it is served. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6. Government should give food safety a higher priority. | ☐ | ☐ | ☐ | ☐ | ☐ |

|  | SA | A | U | D | SD |
|---|---|---|---|---|---|
| 7. Hawkers should be very careful where they buy their raw foods. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 8. Hawker food poses no risk to health. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 9. As long as the food tastes good, I am happy to sell it. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 10. Customers are interested in food safety. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 11. Hawkers are not supposed to be responsible for food safety. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 12. There are too many regulations for me to understand food safety. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 13. Not enough attention is given to keeping food at the right temperature. | ❑ | ❑ | ❑ | ❑ | ❑ |

# APPENDIX FOUR

## RELIABILITY ANALYSIS USING THE CRONBARD'S ALPHA

| | Attitude Statements | Corrected item - Total Correlation | Alpha if item deleted |
|---|---|---|---|
| 1. | I am concerned with keeping up with careful hygiene Practices | .3926 | .5705 |
| 2. | I worry about keeping cooked and raw foods separately. | -.1103 | .6401 |
| 3. | Keeping food equipment clean is a priority for you. | .2581 | .5830 |
| 4. | It is a good idea to contact the Local Authority for information on hygiene and food safety awareness | .1765 | .5944 |
| 5. | Government should give food safety a higher priority. | .4246 | .5555 |
| 6. | Hawkers should be very careful where they buy their raw foods. | .3033 | .5753 |
| 7. | Customers are interested in food safety. | .3212 | .5653 |
| 8. | Not enough attention is given to keeping food at the right temperature. | -.1250 | .6498 |
| 9. | Once food is cooked, it does not matter when it is served. | .4692 | .5215 |
| 10. | Hawker food poses no risk to health | .2980 | .5691 |
| 11. | As long as the food tastes good, I am happy to sell it. | .2965 | .5693 |
| 12. | Hawkers are not supposed to be responsible for Food safety. | .5542 | .5043 |
| 13. | There are too many regulations for me to understand food safety. | .1343 | .6013 |

# APPENDIX FIVE

| No. | Attitude Statements | Agreement % | Disagreement % | Unsure % |
|---|---|---|---|---|
| | **OVERALL RESPONSES (%) OF HAWKERS TO ATTITUDE STATEMENTS (n=99)** | | | |
| | **Positive Statements:** | | | |
| 1. | I am concerned with keeping up with careful hygiene practices. | 98 | 0 | 2 |
| 2. | I worry about keeping cooked and raw foods separately | 76 | 7 | 17 |
| 3. | Keeping food equipment clean is a priority for you | 97 | 1 | 2 |
| 4. | It is a good idea to contact the Local Authority for information on hygienic and food safety awareness | 70 | 13 | 17 |
| 5. | Government should give food safety a higher priority. | 91 | 3 | 6 |
| 6. | Hawkers should be very careful where they buy their raw foods | 90 | 0 | 10 |
| 7. | Customers are interested in food safety | 86 | 7 | 7 |
| 8. | Not enough attention is given to keeping food at the right temperature | 59 | 15 | 26 |
| | **Negative Statements:** | | | |
| 9. | Once food is cooked, it doesn't matter when it is served. | 27 | 58 | 15 |
| 10. | Hawker food poses no risk to health | 43 | 37 | 20 |
| 11. | As long as the food tastes good, I am happy to sell it | 59 | 25 | 16 |
| 12. | Hawkers are not supposed to be responsible for food safety | 15 | 74 | 11 |
| 13. | There are too many regulations for me to understand food safety | 72 | 13 | 15 |

# APPENDIX SIX

## RISK ASSESSMENT

**Scoring :**

| | | | | | |
|---|---|---|---|---|---|
| Very good | : | 5 points | Poor | : | 2 points |
| Good | : | 4 points | Unacceptable | : | 1 point |
| Acceptable | : | 3 points | | | |

**Overall Rating :**

High concern : ($\angle$ 120 points)

Medium concern : (120 - $\angle$160 points)

Low concern : ($\geq$ 160 points )

## DIPSLIDE READING

**Reading** (Scientific Values) :

| | | | | |
|---|---|---|---|---|
| Very slight growth | : | $10^3$ | Heavy growth : | $10^6$ |
| Slight growth | : | $10^4$ | Very heavy growth : | $10^7$ |
| Moderate growth | : | $10^5$ | | |

**Overall Rating (per case) :**   Based solely on ratings of this study and as recommended by Griffiths, W.E. (1978). No pre-determined /recommended levels of risk were found in other studies in the past.

| | | |
|---|---|---|
| High concern | : | ($10^6$ and $10^7$) |
| Medium concern: | | ($10^5$) |
| Low concern | : | ($10^3$ and $10^4$) |

# APPENDIX SEVEN

# QUESTIONNAIRE SURVEY OF CONTROL AUTHORITY (HAWKER FOODS ) IN KUALA LUMPUR

**Please read the questions carefully and respond to them.**

**This questionnaire will only take 10 minutes of your time. All responses will be treated with the strictest confidence.**
**Your effort, cooperation and support will contribute towards the success of this study.**

## Section A:   DEMOGRAPHICS

**How long have you worked as a member of the Control Authority** (√ one only)**?**

| Length of service: | |
|---|---|
| Less than 5 years | ❏ |
| 5 - 10 years | ❏ |
| 11 - 15 years | ❏ |
| 16 - 20 years | ❏ |
| 21 - 25 years | ❏ |
| 26 - 30 years | ❏ |
| More than 30 years | ❏ |

Other, please specify :

| Education: | |
|---|---|
| Secondary school | ❏ |
| Upper secondary | ❏ |
| Tertiary | ❏ |
| Post graduate | ❏ |

Other, please specify :

**What category of hawker is under your charge ?** (√ where applicable)

| | |
|---|---|
| Static | ❏ |
| Market (wet) | ❏ |
| Open space (private) / kiosk | ❏ |
| Night market | ❏ |
| Temporary permit | ❏ |

Other, please specify :

**Do you eat hawker food ?**

Yes ❑   No ❑

**Have you ever been ill  from eating hawker food ?**

Yes ❑   No ❑

**How frequently has this happened to you ?** (√ one only )

Once in the past year ❑   **More than twice in the past year** ❑
Twice in the past year ❑   please specify : ▢
Unsure ❑

<u>**Section B:   FOOD SAFETY PRACTICES AND KNOWLEDGE**</u>

1. **i. Are you familiar with the *HACCP*** (Hazard Analysis Critical Control Point ) **concept ?**

Yes ❑   No ❑

| If  No, go to Question  4. |

**ii. How did you come across *HACCP* ?** ( √  where applicable )

By chance ❑       **Heard about it from my superiors** ❑

Attended courses/seminar/       **Read about it** ❑
conference ❑

Other, please specify :

2

**iii.** **How well do you think you understand *HACCP* ?** (√ one only )

| | | | |
|---|---|---|---|
| Very well | ❑ | Fairly well | ❑ |
| Well | ❑ | Just a little | ❑ |
| | | Unsure | ❑ |

**iv.** **Have you ever been involved in  HACCP implementation ? : -**

Yes ❑          No ❑

**2.  i. Are you familiar with Risk Assessment and its application to food  ?**

Yes ❑          No ❑

If No,  go to Question  3.

**ii. How did you come across  Risk Assessment ?** (√ where applicable)

| | | | |
|---|---|---|---|
| By chance | ❑ | Heard it from my superior | ❑ |
| Attended courses/seminar/ conference | ❑ | Read about it | ❑ |

Other, please specify :

**iii. How well do you think you understand Risk Assessment** (√ one only) **?**

| | | | |
|---|---|---|---|
| Very well | ❑ | Fairly well | ❑ |
| Well | ❑ | Just a little | ❑ |
| | | Unsure | ❑ |

iv. **Have you ever been involved in Risk Assessment ?**

Yes ❑            No ❑

3. **Have you ever investigated an outbreak of food poisoning ?**

Yes ❑            No ❑

If No, go to Question 5.

4. **How is the investigation normally carried out ?** (√ where applicable )

By interviewing patients ❑        By interviewing the vendor ❑

By inspecting the site ❑        By taking samples of the food for

By interviewing the food handlers ❑            microbiological analysis ❑

Please feel free to add any additional information :

5. i. **Do you attempt to determine risk factors in prevention of the outbreaks of illness from hawker foods ?**

Yes ❑    No ❑

**5. ii. From your experience and knowledge, what percentage of reported foodborne illnesses in Kuala Lumpur involves the following food handling practices ?** (√ where applicable )

| | 5-10 % | 11-20 % | 21-30 % | 31-40 % | 41-50 % | >50** % |
|---|---|---|---|---|---|---|
| Preparation too far in advance | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Storage at ambient temperature | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Inadequate cooling | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Inadequate reheating | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Undercooking | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Inadequate thawing | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Cross-contamination | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Consumption of raw food | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Improper warm holding | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Use of leftovers | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Extra large quantities prepared | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| Buying from an unsafe source | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

** please indicate the percentage

5

## 6. What are the important functions of a Health Inspector ?
( Rank 1 - 10 where 1 is the best )

Inspection, sampling and seizure ❑

Issuance of Improvement Notices and Certificates of
`` Compliance ❑

Obtaining and enforcing Prohibition and Destruction Orders ❑

Ensuring product safety and fitness for consumption ❑

Reducing possible sources of contamination entering the
food environment ❑

Monitoring conditions and hygienic operations
within the food environment ❑

Ensuring compliance with relevant legislation ❑

Establishing the effectiveness of control procedures ❑

Offering professional guidance and preventive advice ❑

Checking on the validity of hawker / business licence ❑

Other, please specify :

---

7. i. Do you encounter any problems when enforcing the Food Hygiene
Legislation ?

Yes ❑                    No ❑

If No, go to Question 10.

ii.   **What are the problems you encounter when enforcing the Food Hygiene Legislation ?** (√ where applicable)

Hawkers are not receptive to change ❑   Hawkers are generally not educated ❑
Hawkers cannot understand instructions ❑   Hawkers don't see it as important ❑
Hawkers are abusive and hard to handle ❑   Hawkers are unwilling to invest money ❑
Hawkers have no time to learn ❑   Hawkers think it is someone else's
  responsibility ❑

| Other, please specify : |
|---|
|  |

8.   **How often does City Hall receive complaints about hawkers from the public** (√ one only) **?**

| | | | |
|---|---|---|---|
| Less than 10 / week | ❑ | 31 - 40 /week | ❑ |
| 11 - 20 / week | ❑ | 41 - 50 /week | ❑ |
| 21 - 30 /week | ❑ | More than 50 /week | ❑ |

9.   **What is the main focus of the complaints ?** (√ one only)

| | | | |
|---|---|---|---|
| Unhygienic practices of hawkers | ❑ | Unruly behaviour of hawkers | ❑ |
| Pest infestation at hawker sites | ❑ | Blocked drains from hawker foods leftover | ❑ |
| Noise level from hawker activities | ❑ | Unsanitary premises and Surroundings | ❑ |
| Location of hawker sites | ❑ | Accumulation of garbage | ❑ |

| Other, please specify : |
|---|
|  |

**10. i.** On average, how many <u>summonses</u> do you issue per week to hawkers for violation of food safety / hygiene regulations ? (√ one only)

| | | | |
|---|---|---|---|
| Less than 10 | ❑ | 31 - 40 | ❑ |
| 11 - 20 | ❑ | 41 - 50 | ❑ |
| 21 - 30 | ❑ | More than 50 | ❑ |

**ii.** What percentage of these summonses lead to prosecution (√ one only) ?

| | | | |
|---|---|---|---|
| Less than 10 % | ❑ | 31 - 40 % | ❑ |
| 11 - 20 % | ❑ | 41 - 50 % | ❑ |
| 21 - 30 % | ❑ | More than 50 % | ❑ |

**11.** Which of the following is likely to pose the greatest threat to food safety over the next 5 years (√ one only) ? :-

| | | | |
|---|---|---|---|
| *Salmonella* in general | ❑ | *Campylobacter jejuni* | ❑ |
| *E. coli* VTEC | ❑ | *Listeria monocytogenes* | ❑ |
| *Staph aureus* | ❑ | *Clostridium perfringens* | ❑ |
| *Vibrio parahaemolyticus* | ❑ | Mycotoxin | ❑ |

Other, please specify :

**12.** Please indicate by a tick (√ ) a <u>True</u> or <u>False</u> against the following statements :-

|  | **True** | **False** |
|---|---|---|
| HACCP is designed as zero tolerance concept | ( ) | ( ) |
| Risk Assessment is designed as zero tolerance concept | ( ) | ( ) |
| Health inspectors are guided by a two-tier system of Chill Control (8° C and 4° C) | ( ) | ( ) |
| Health Inspectors are guided by a Hot Holding Temperature (63° C) | ( ) | ( ) |
| Disinfecting surfaces is an effective method of decontamination | ( ) | ( ) |
| The "chalk and talk" food hygiene courses are suitable for food handlers. | ( ) | ( ) |
| Epidemiological investigations give the best data for leads regarding the transmission of foodborne diseases. | ( ) | ( ) |
| "Dial temperature" is a better device for food testing than the probe. | ( ) | ( ) |
| Cleaning surfaces is an effective method of decontamination. | ( ) | ( ) |