

**DEVELOPMENT AND VALIDATION OF FOOD SAFETY AND
HYGIENE ASSESSMENT FORM AND THE KNOWLEDGE AND
PRACTICE OF FOOD SAFETY IN KOTA BHARU KELANTAN
PRESCHOOLS**

MOHD KHAIRUL ASHRAF BIN KHALID

UNIVERSITI SAINS MALAYSIA

2023

**DEVELOPMENT AND VALIDATION OF FOOD SAFETY AND
HYGIENE ASSESSMENT FORM AND THE KNOWLEDGE AND
PRACTICE OF FOOD SAFETY IN KOTA BHARU KELANTAN
PRESCHOOLS**

MOHD KHAIRUL ASHRAF BIN KHALID

Dissertation submitted in fulfilment in Partial Fulfilment

of the Requirement for the

Doctor of Public Health

(Occupational and Environmental Health)

September 2023

ACKNOWLEDGEMENTS

Bismillahirrahmanirrahim,

In the name of Allah, the Most Beneficent and the Most Merciful, Salutations upon His messenger, Prophet Muhammad S.A.W. (peace be upon him), his family, and companions. By the grace of Allah, I have finally completed this research.

I would like to thank my research project supervisor, Associate Professor Dr. Nik Rosmawati binti Nik Husain, and my co-supervisor, Associate Professor Dr. Wan Mohd Zahiruddin bin Wan Mohammad, Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia, for the continuous guidance, encouragement, and advice they have provided. Without their guidance, this research would not have been completed.

Special thanks and appreciation to my co-researchers, Puan Natrah binti Abu Bakar, Food Quality and Safety Unit, Kelantan State Health Department, and Puan Norazlin binti Idris, for their assistance, motivation, enthusiasm, and encouragement during the preparation of this study. Special thanks also to the respective directors of the social welfare departments of Putrajaya and Kelantan, managers of preschools, and preschool teachers that were involved throughout the study for their full cooperation during the data collection of this research, which was done smoothly.

Honourable mentions go to all lecturers, staff, and all my colleagues in the Department of Community Medicine throughout my 5 years at Universiti Sains Malaysia for their assistance and contribution towards this study. You all have been very supportive and helpful.

Lastly, I would like to thank my wife, Syairah binti Muhamad @ Hasnan, my children, Aiman Syakirin and Adam Syafi, and my family for their understanding and moral support throughout this thesis. Thank you for your continuous support and encouragement throughout my study.

This accomplishment would be impossible without them. Thank you

DECLARATION

I, Mohd Khairul Ashraf Bin Khalid , declare that the work presented in this thesis is originally mine. The information that has been derived from other sources is clearly indicated in the thesis.

Mohd Khairul Ashraf Bin Khalid

Student ID:P-UD 0050/19

Signed on ~~17th~~^{28th} September 2023

TABLE OF CONTENT

| | |
|--|------|
| TABLE OF CONTENT | 1 |
| LIST OF FIGURES | ix |
| LIST OF ABBREVIATIONS..... | x |
| LIST OF SYMBOLS | xi |
| LIST OF APPENDICES..... | xii |
| ABSTRAK..... | xiii |
| ABSTRACT..... | xvi |
| CHAPTER 1: INTRODUCTION | 1 |
| 1.1 Food safety..... | 1 |
| 1.2 Food poisoning in global..... | 1 |
| 1.3 Food poisoning in Malaysia..... | 2 |
| 1.4 Food poisoning in Kelantan for the general age group..... | 3 |
| 1.5 Food Poisoning in Kelantan for children \leq 6 years old and below..... | 4 |
| 1.6 The observation checklist for assessing the hygiene and sanitation of food preparation areas in preschools | 6 |
| 1.7 Problem statement..... | 8 |

| | |
|---|----|
| 1.8 Study rationale | 8 |
| 1.9 Research question | 9 |
| 1.10 Study objective | 10 |
| 1.10.1 General objective | 10 |
| 1.10.2 Specific objectives: | 10 |
| CHAPTER 2: LITERATURE REVIEW | 11 |
| 2.1 Knowledge of food safety, hygiene and sanitation..... | 11 |
| 2.2 Practice of food safety | 11 |
| 2.3 Hygiene level of food preparation areas..... | 12 |
| 2.4 Factors associated with the knowledge of food safety | 13 |
| 2.5 Factors associated with the practice of food safety | 13 |
| 2.6 Factors associated with hygiene of food preparation areas | 14 |
| 2.7 Observation checklist used in Malaysia to determine hygiene and sanitation levels of food preparation areas in preschool and food premises..... | 15 |
| 2.8 Observation checklist to determine the hygiene and sanitation level of food preparation areas in other countries | 16 |
| 2.9 Conceptual framework..... | 17 |
| CHAPTER 3: METHODOLOGY | 18 |

| | |
|---|----|
| 3.1. Research methodology for Phase 1:..... | 18 |
| 3.1.1 The proposed observation checklist for food preparation area for Phase 1..... | 20 |
| 3.1.2 Content validation and face validation | 21 |
| 3.1.3 Pilot study using the preliminary observation checklist..... | 21 |
| 3.1.4 Inclusion criteria for the pilot study..... | 21 |
| 3.1.5 Research tools | 22 |
| 3.1.6 Data collection | 22 |
| 3.1.7 Study flowchart..... | 23 |
| 3.2 Research methodology for Phase 2..... | 24 |
| 3.2.1 Research design | 24 |
| 3.2.2 Study duration..... | 24 |
| 3.2.3 Study location | 24 |
| 3.2.4 Study population..... | 24 |
| 3.2.5 Subject criteria | 25 |
| 3.3 Sample size estimation..... | 26 |
| 3.4 Sampling method and subject recruitment..... | 30 |
| 3.5 Research tools | 31 |
| 3.5.1 Research tool for Phase 2..... | 31 |

| | | |
|--------------------------------|--|----------------------|
| 3.6 | Data collection method in Phase 2..... | 32 |
| 3.7 | Data analysis in Phase 2..... | 33 |
| 3.7.1 | Data analysis for Objective 1..... | 33 |
| 3.7.2 | Data analysis for Objective 2..... | 33 |
| 3.7.3 | Data analysis for Objective 3..... | 33 |
| 3.7.4 | Data analysis for Objective 4..... | 33 |
| 3.8 | Operational definition..... | 34 |
| 3.9 | Study flowchart..... | 35 |
| CHAPTER 4: MANUSCRIPT ONE..... | | 36 |
| 4.1 | Abstract..... | 37 |
| 4.2 | Introduction..... | 38 |
| 4.3 | Methods..... | 40 |
| 4.4 | Ethical considerations..... | 42 |
| 4.5 | Results..... | 43 |
| 4.6 | Discussion..... | 5352 |
| 4.8 | Informed consent statement..... | 5655 |
| 4.9 | Data availability statement..... | 5655 |
| 4.10 | Acknowledgement..... | 5655 |

| | |
|--|-----------------|
| 4.11 Conflicts of interest..... | 5655 |
| 4.12 References..... | 5756 |
| CHAPTER 5: MANUSCRIPT TWO | 5958 |
| 5.1 Abstract..... | 6059 |
| 5.2 Introduction..... | 6261 |
| 5.3 Methodology..... | 6564 |
| 5.3.1 Study design and participant..... | 6564 |
| 5.3.2 Research instruments | 6564 |
| 5.4 Data analysis | 6665 |
| 5.5 Ethical considerations | 6867 |
| 5.6 Results..... | 6867 |
| 5.6.1 Sociodemographic characteristic of preschool teachers | 6867 |
| 5.6.2 Knowledge of food safety among preschool teachers | 7069 |
| 5.6.3 Food safety practice among preschool teachers | 7271 |
| 5.6.4 Mean score for each item in the practice of food safety among preschool teachers..... | 7473 |
| 5.6.5 Knowledge and practice score of food safety score among preschool teachers | 7675 |

| | |
|--|----------------------|
| 5.6.6 Hygiene score of food preparation areas in preschools | 7675 |
| 5.6.7 Factors associated with knowledge food safety among preschool teachers | 7877 |
| 5.6.8 Factors associated with the practice of food safety among preschool teachers | 7978 |
| 5.6.9 Factor associated with hygiene level of food preparation area in preschool... | 8079 |
| <u>5.7 Discussion</u> | 8280 |
| 5.7.1 Sociodemographic | 8280 |
| 5.7.2 Knowledge of food safety among preschool teachers | 8381 |
| 5.7.3 Practice of food safety among preschool teachers..... | 8381 |
| 5.7.4 Hygiene of food preparation areas in preschools..... | 8482 |
| 5.7.5 Factors associated with knowledge of food safety among preschool teachers | 8583 |
| 5.7.6 Factors associated with the practice of food safety among preschool teachers | 8684 |
| 5.7.7 Factors associated with hygiene level of food preparation areas in preschool.. | 8785 |
| <u>5.8 Conclusion</u> | 9088 |
| <u>5.9 Limitation.....</u> | 9189 |
| <u>5.10 Acknowledgement</u> | 9290 |
| <u>5.11 References:.....</u> | 9391 |

CHAPTER 6: CONCLUSION [9593](#)

CHAPTER 7: REFERENCE [9795](#)

LIST OF TABLES

Table 3.1: Sample size calculation for Objective 126

Table 4.1: Content Validity Index for Domain 1 (Building and Facility) based on the relevancy rating of items by six experts44

Table 4.2: Content Validity Index for Domain 2 (Process Control) based on the relevancy rating of items by six experts46

Table 4.3: Content Validity Index (S-CVI) for Domain 3 (Food Handler) based on the relevancy rating of items by six experts46

Table 4.4: Face Validity Index of Domain 1 (Building and Facility) based on relevancy rating of items by ten PPKP raters [4948](#)

Table 4.5: Face Validity Index of Domain 2 (Process Control) based on relevancy rating of items by ten PPKP raters..... [5150](#)

Table 4.6: Face Validity Index (F-CVI) of Domain 3 (Food Handler) based on relevancy rating of items by ten PPKP raters [5251](#)

Table 4.7: Results of ICC Calculation in SPSS Using Mean-Rating, Absolute Agreement, 2-Way Mixed-Effects Model for the Building and Facility, Process Control and Food handler..... [5352](#)

Table 5.1: Part A: Sociodemographic characteristic of preschool teachers in Kota Bharu Kelantan [6968](#)

Table 5.2: Food safety knowledge among preschool teachers in Kota Bharu Kelantan [7170](#)

Table 5.3: Food safety practices among preschool teachers in Kota Bharu Kelantan..... [7372](#)

| | |
|---|----------------------|
| Table 5.4: Mean score of food safety practices among preschool teachers in Kota Bharu Kelantan | 7574 |
| Table 5.5: The knowledge and practice of food safety score among preschools teacher and hygiene score of food preparation area in preschool | 7675 |
| Table 5.6: The mean percentage score for the hygiene of food preparation areas in preschools in Kota Bharu Kelantan | 7776 |
| Table 5.7: Linear regression analysis shows the relationship between Knowledge score and its predictors | 7877 |
| Table 5.8: Linear regression analysis shows the relationship between Practice score and its predictors | 7978 |
| Table 5.9: Logistic regression analysis between factor associated with hygiene score of food preparation areas in preschools | 8079 |

LIST OF FIGURES

| | |
|--|----|
| Figure 1.1: Incidence and episodes of food poisoning in Malaysia, the year 2008 to 2018..... | 3 |
| Figure 1.2: Number of cases and incidence rate of food poisoning in Kelantan 2015- 2019 general age group | 3 |
| Figure 1.3: Number of cases and incidence rate of food poisoning within children ≤ 6 years old and below in Kelantan 2015- 2019..... | 4 |
| Figure 2.1: Conceptual framework of the study | 17 |
| Figure 3.1: Study flow chart for Phase 1 | 23 |
| Figure 3.2: Sample size calculation for Objective 2..... | 27 |
| Figure 3.3: Sample size calculation for Objective 3..... | 28 |
| Figure 3.4: Sample size calculation for Objective 4..... | 29 |
| Figure 3.5: Sampling method and subject recruitment for Phase 2 | 30 |
| Figure 3.6: Study flowchart for Phase 2 | 35 |

LIST OF ABBREVIATIONS

| | |
|------|--|
| CDC | Centre for disease control |
| FBD | Food-borne diseases |
| JKM | Department of Social Affairs |
| KPAS | Occupational and environmental safety and health |
| MCO | Movement Control Order |
| MLDG | Ministry of Local Government Development |
| MOE | Ministry of Education |
| MOH | Ministry of Health |
| WHO | World Health Organisation |

LIST OF SYMBOLS

| | |
|--------|------------------------|
| $>$ | More than |
| $<$ | Less than |
| $=$ | Equal to |
| \geq | More than and equal to |
| \leq | Less than and equal to |
| $\%$ | Percentage |

LIST OF APPENDICES

| | |
|------------|---|
| Appendix A | Proforma |
| Appendix B | Patient information sheet & consent (Phase 1) |
| Appendix C | Patient information sheet & consent (Phase 2) |
| Appendix D | Content validity form |
| Appendix E | Face validity form |
| Appendix F | Borang Pemeriksaan Dapur TASKA |
| Appendix G | Borang Pemeriksaan Premis Makanan Berasaskan Risiko (KKM) |
| Appendix H | Ethical approval Jawantakuasa Etika Penyelidikan Manusia (JEPeM) |
| Appendix I | Study approval by the Community Development Department (KEMAS), Ministry of Rural Development Malaysia |
| Appendix J | Study approval by Ministry of Education Malaysia |
| Appendix K | Thermometer Benetech GM320 |
| Appendix L | Lux meter, MonotaRO Digital Illuminator M101 |
| Appendix M | Publication of manuscript one |

**PEMBENTUKAN DAN PENGESAHAN BORANG PENILAIAN KESELAMATAN
DAN KEBERSIHAN MAKANAN SERTA PENGETAHUAN DAN AMALAN
KESELAMATAN MAKANAN DI PRASEKOLAH KOTA BHARU, KELANTAN**

ABSTRAK

Pengenalan: Kebersihan tempat penyediaan makanan di prasekolah adalah penting bagi memastikan makanan yang disediakan adalah selamat untuk dimakan oleh murid prasekolah. Perkara ini boleh dicapai dengan tahap pengetahuan dan amalan keselamatan makanan yang baik oleh pihak guru prasekolah. Borang pemeriksaan dapur prasekolah yang digunakan buat masa ini tidak pernah dinilai semula kandungannya semenjak dari tahun 2012. Oleh itu, penilaian semula terhadap kandungan borang pemeriksaan dapur prasekolah perlu dilakukan untuk memastikan perkara-perkara yang penting dan bersesuaian diperiksa semasa pemeriksaan tempat penyediaan makanan di prasekolah.

Objektif: Objektif fasa pertama kajian ini adalah melibatkan pembentukan dan pengesahan borang pemeriksaan kebersihan dan sanitasi tempat penyediaan makanan di prasekolah. Objektif fasa kedua kajian ini adalah 1) untuk menilai tahap pengetahuan dan amalan kesihatan makanan di kalangan guru prasekolah dengan menggunakan soalan yang telah di sahkan, 2) untuk menilai tahap kebersihan tempat penyediaan makanan di prasekolah menggunakan borang pemeriksaan yang di bentuk dan di sahkan dari bahagian 1 kajian, dan 3) Untuk menilai hubungkait di antara tahap pengetahuan dan amalan keselamatan makanan guru prasekolah terhadap tahap kebersihan tempat penyediaan makanan di pra-sekolah.

Kaedah: Kajian ini telah di jalankan di daerah Kota Bharu Kelantan bermula dari bulan April 2021 sehingga Februari 2022. Fasa pertama kajian ini adalah pembentukan dan kesahan senarai

semak borang pemeriksaan tempat penyediaan makanan sekolah melibatkan 4 peringkat:

- 1) Pembentukan domain dan item daripada kajian terdahulu; 2) kesahan kandungan senarai semak oleh 6 pakar (menggunakan indeks kesahan kandungan peringkat item [I-CVI] dan indeks kesahan kandungan peringkat skala [S-CVI]); 3) Kesahan muka oleh 10 pakar (menggunakan indeks kesahan muka peringkat item [-FVI] dan indeks kesahan muka peringkat skala [S-FVI]); 4) Analisa kebolehpercayaan (menggunakan pekali korelasi antara kelas [ICC]). Seramai empat orang penilai melakukan analisis kebolehpercayaan di dua buah prasekolah. Fasa kedua kajian ialah kajian keratan rentas yang dijalankan di Kota Bharu Kelantan. Kajian melibatkan 70 buah prasekolah dan 70 guru prasekolah di Kota Bharu Kelantan. Kajian ini menggunakan borang soal selidik yang telah disahkan untuk menentukan pengetahuan dan amalan keselamatan makanan dalam kalangan guru prasekolah dan senarai semak pemerhatian yang telah disahkan untuk menilai kebersihan kawasan penyediaan makanan di prasekolah.

Keputusan: Fasa pertama kajian: Draf awal senarai semak mengandungi 3 domain dan 57 item: 1) bangunan dan fasiliti (10 subdomain dan 38 item); 2) kawalan proses (4 subdomain dan 12 item); dan 3) pengendali makanan (1 subdomain dan 7 item). Markah I-CVI untuk bangunan dan kemudahan, kawalan proses dan pengendali makanan masing-masing adalah 0.97, 1.00 dan 1.00, menunjukkan kerelevanan item yang baik. Nilai S-CVI ialah 1.0 untuk semua domain, menunjukkan perkaitan item yang baik. I-FVI melebihi 0.8 dan nilai S-FVI melebihi 0.9 untuk semua domain membayangkan bahawa peserta mudah memahami senarai semak. ICC untuk 3 domain digabungkan ialah 0.848 (95% CI 0.772–0.904). Senarai semak akhir yang disahkan terdiri daripada 3 domain dengan 57 item. Fasa kedua kajian: Kesemua peserta kajian dalam kajian ini adalah perempuan (100%) dengan purata umur 30 tahun ke atas (65.7%), dan majoriti daripada mereka menamatkan pendidikan di peringkat STPM/STPMV/Diploma (65.7%). Hampir kesemua peserta telah divaksin dengan vaksin anti-

tifoid (97.1%) dan menjalani latihan keselamatan makanan (97.1%). Purata skor min bagi pengetahuan keselamatan makanan dan amalan keselamatan makanan dalam kalangan peserta kajian ialah 71.6% (SD = 10.73) dan 86.1% (SD = 5.81) masing-masing. Purata skor min bagi kebersihan kawasan penyediaan makanan di prasekolah ialah 62.6% (SD = 9.86). Pengalaman kerja dikaitkan secara signifikan dengan pengetahuan keselamatan makanan dalam kalangan peserta kajian (AdjB 0.411; 95% CI: 0.031-0.612; p = 0.021). Latihan keselamatan makanan (AdjB 0.426; 95% CI: (0.021-0.633); p = 0.011) dikaitkan secara signifikan dengan amalan keselamatan makanan dalam kalangan peserta kajian. Skor kebersihan kawasan penyediaan makanan di pra-sekolah secara signifikan dikaitkan dengan pengalaman kerja (aOR 1.82; 95% CI: 1.6-2.2, p = 0.012) dan tahap pendidikan menengah (aOR 24.50, 95% CI: 1.2~~887~~-46.77; p = 0.031).

Kesimpulan: Senarai semak pemerhatian tempat penyediaan makanan di prasekolah yang baru dibangunkan adalah alat yang sah dan boleh dipercayai untuk menilai kebersihan dan sanitasi kawasan penyediaan makanan prasekolah. Pengetahuan dan amalan keselamatan makanan dalam kalangan guru prasekolah adalah baik, namun mereka gagal diterjemahkan kepada tahap kebersihan yang baik di kawasan penyediaan makanan di pra-sekolah. Tahap kebersihan pra-sekolah boleh dipertingkatkan dengan pemantauan berkala oleh pihak berkuasa kesihatan atau pentadbir prasekolah dan dengan pendidikan dan latihan keselamatan makanan secara berkala, terutamanya memberi tumpuan kepada mereka yang kurang pengalaman kerja, tidak pernah menghadiri kursus latihan keselamatan makanan, dan tahap pendidikan rendah.

Kata kunci: Pengetahuan, amalan, keselamatan makanan, kebersihan, sanitasi, kawasan penyediaan makanan, prasekolah, senarai semak, pengesahan, guru

**DEVELOPMENT AND VALIDATION OF FOOD SAFETY AND HYGIENE
ASSESSMENT FORM AND THE KNOWLEDGE AND PRACTICE OF FOOD
SAFETY IN KOTA BHARU KELANTAN PRESCHOOLS**

ABSTRACT

Introduction: The hygiene of the food preparation areas in preschool is essential to ensuring the food produced is safe to be consumed by the preschool students. This can be achieved by the preschool's teacher having good food safety knowledge and practise. However, the current checklist used in the inspection of the food preparation areas in preschools in Malaysia has not been revised since 2012. Thus, there is a need to improve the content of the checklist to ensure that all relevant parameters are covered during the preschool inspection.

Objective: Phase 1 of this study is to develop and validate an observation checklist for assessing the hygiene and sanitation of preschool food preparation areas. Phase 2 aimed to: 1) determine the level of knowledge and practise of food safety among preschool teachers using a validated questionnaire; 2) evaluate the hygiene level of the food preparation area in the preschool using the newly developed and validated checklist in Part 1 of this study; and 3) determine the association between the knowledge and practise of food safety among preschool teachers and the hygiene of food preparation areas in the preschool.

Methodology: The study was conducted in Kota Bharu, Kelantan, from April 2021 to February 2022. Phase 1 of the study involved the development and validation of the observation checklist, conducted in four stages: 1) the construction of domains and items from the existing literature; 2) content validation by six experts (using the item-level content validity index [I-CVI] and the scale-level content validity index [S-CVI]); 3) face validation by 10 experts (using the item-level face validity index [I-FVI] and the scale-level face validity index

[S-FVI]); and 4) reliability analysis (using the inter-correlation coefficient [ICC]). Four assessors performed the reliability analysis at two preschools. Phase 2 was a cross-sectional study conducted from April 2021 until February 2022. The study involved 70 preschools and 70 preschool teachers in Kota Bharu, Kelantan. This study used a validated questionnaire to determine preschool teachers' food safety knowledge and practises and a validated observation checklist to assess the hygiene of food preparation areas in preschools.

Results: Phase 1: The initial draft of the checklist contained three domains and 57 items: 1) building and facility (10 subdomains and 38 items); 2) process control (4 subdomains and 12 items); and 3) food handlers (1 subdomain and 7 items). The I-CVI scores for building and facility, process control, and food handlers were 0.97, 1.00, and 1.00, respectively, indicating good relevancy of items. The S-CVI value was 1.0 for all domains, showing good relevance of the items. The I-FVI above 0.8 and S-FVI above 0.9 for all domains imply that the participants easily understood the checklist. The ICC for the three domains combined was 0.848 (95% CI: 0.772–0.904). The final validated checklist consists of 3 domains with 57 items. Phase 2: All of the study participants in this study were female (100%) with an average age above 30 years old (65.7%), and the majority of them completed education at STPM/STPMV/Diploma levels (65.7%). Almost all participants were vaccinated with an anti-typhoid vaccine (97.1%) and underwent food safety training (97.1%). The average mean score for knowledge of food safety and practise of food safety among the study participants was 71.6% (SD = 10.73) and 86.1% (SD = 5.81), respectively. The average mean score for the hygiene of the food preparation areas in preschool was 62.6% (SD = 9.86). Work experience was significantly associated with food safety knowledge among study participants (AdjB 0.411; 95% CI: 0.031–0.612; $p = 0.021$). Food safety training (AdjB 0.426; 95% CI: 0.021–0.633; $p = 0.001$) was significantly associated with the practise of food safety among study participants. The hygiene score of the food preparation areas in preschool was significantly associated with work experiences

(AOR 1.82; 95% CI: 1.6–2.2; p = 0.012) and secondary education level (AOR 24.50; 95% CI: 1.287–46.774; p = 0.031).

Conclusions: The newly developed observation checklist is a valid and reliable tool for assessing the hygiene and sanitation of preschool food preparation areas. The food safety knowledge and practise among preschool teachers were good; however, they failed to translate into good hygiene levels in food preparation areas in preschools. The preschool hygiene level can be improved by regular monitoring by health authorities or administrators and by periodic food safety education and training, primarily focusing on those lacking work experience, never attending food safety training courses, and having low education levels..

Keywords: Knowledge, practice, food safety, hygiene, sanitation, food preparation area, preschools, checklist, validation, preschools, teacher

CHAPTER 1: INTRODUCTION

1.1 Food safety

Food safety is a fundamental aspect of public health that involves the handling, preparation, and storage of food to prevent contamination and the spread of foodborne illnesses. It encompasses a range of practises and procedures aimed at ensuring that food remains safe and suitable for consumption (World Health Organisation [WHO], 2015a). With the increasing globalisation of food trade and changes in food consumption patterns, the importance of food safety has become a global concern (Bilska and Kowalski, 2014). Food safety is guided by various principles and standards set by international organisations such as the World Health Organisation (WHO) and the Food and Agriculture Organisation (FAO). These organisations collaborate to establish guidelines for safe food production, distribution, and consumption. Additionally, many countries have their own regulatory bodies that oversee food safety practises and enforce regulations to protect consumers (World Health Organisation [WHO], 2020).

1.2 Food poisoning in global

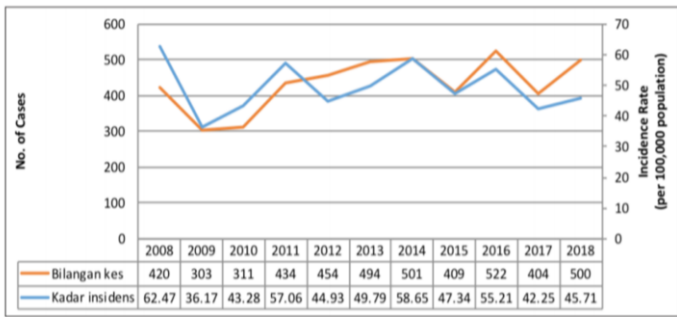
The World Health Organisation (WHO) has estimated that 1 in 10 people are infected by food contamination either by microbial or chemical agents, causing 600 million illnesses from food-borne diseases (FBD), 420,000 deaths, and the loss of 33 million healthy years of life around the globe (World Health Organisation [WHO], 2015a). Thirty per cent of these deaths occurred in children under the age of five,

making them the most vulnerable population group to FBD globally and a real global public health concern (Lake *et al.*, 2014).

Moreover, WHO reported that 24% of the disease burden can be attributed to environmental factors, and 36% of deaths in children are due to environmental contaminants (Lake *et al.*, 2014). The economic impact of FBD costs low- and middle-income countries about US\$110 billion in lost productivity and medical expenses each year, which could be avoided by adopting preventative measures that improve how food is handled from farm to fork (Preneuf and Zia Morales, 2018).

1.3 Food poisoning in Malaysia

— The incidence rate of food poisoning in Malaysia from 2008 to 2018 remained high, ranging from 36.17 to 62.47 per 100,000. Food poisoning cases range from 303 to 522 per year. In 2018, a total of 500 episodes of food poisoning were reported, an increase of 23% compared to 404 episodes in 2017. The number of school food poisoning episodes in 2018 increased slightly to 143 from 140 in 2017. Food poisoning in schools contributed 44.8% in 2017, compared to 39% in 2018. In 2018, out of 500 episodes of food poisoning, 143 (28.6%) occurred in Ministry of Education (MOE) schools, 51 episodes (10.2%) occurred in non-MOE schools, 70 episodes (14%) occurred in institutions other than schools, 124 episodes (24.8%) occurred at homes, and 112 episodes (22.4%) occurred in other localities (Ministry of Health Malaysia [MOH], 2018a), as shown in Figure 1.1. In 2019, food poisoning increased by 3.2%, with 516 food poisoning cases recorded, compared to 500 cases in 2018. 41% of food poisoning cases occurred in school, 29% (150 cases) in MOE schools, and 12% (66 cases) in non-MOE schools (NST, 2020).

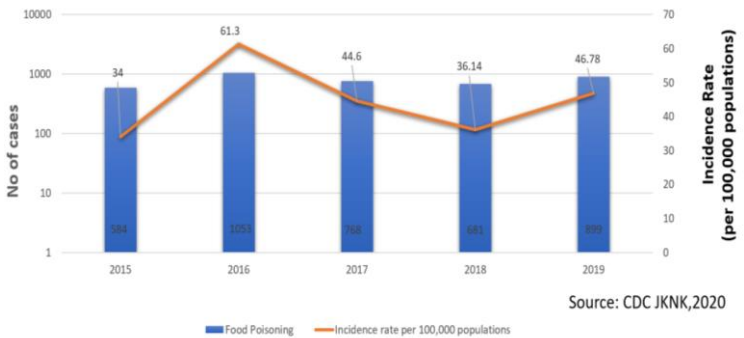


Source : Disease Control Division, MOH

Figure 1.1: Incidence and episodes of food poisoning in Malaysia, the year 2008 to 2018 (MOH, 2018)

1.4 Food poisoning in Kelantan for the general age group

The incidence rate of food poisoning in Kelantan from 2015 to 2019 ranged from 34 to 61.3 per 100,000 people, as shown in Figure 1.2. The number of food poisoning cases for a similar period ranged from 584 to 1053 cases per year. In 2019, the incidence rate for food poisoning was 46.78 per 100,000 population, and the total number of food poisoning cases was 899 (Kelantan State Health Department [KSHD], 2020).



Source: CDC JKKN, 2020

Figure 1.2: Number of cases and incidence rate of food poisoning in Kelantan 2015-2019 general age group.

1.5 Food Poisoning in Kelantan for children ≤ 6 years old and below

The incidence rate of food poisoning involving the group under or equal to 6 years old ranged from 0.5 to 3.2 per 100,000 in 2015 to 2019, as shown in Figure 1.3. The number of cases is increasing from 8 to 61 from 2015 to 2018 (Kelantan State Health Department [KSHD], 2020).

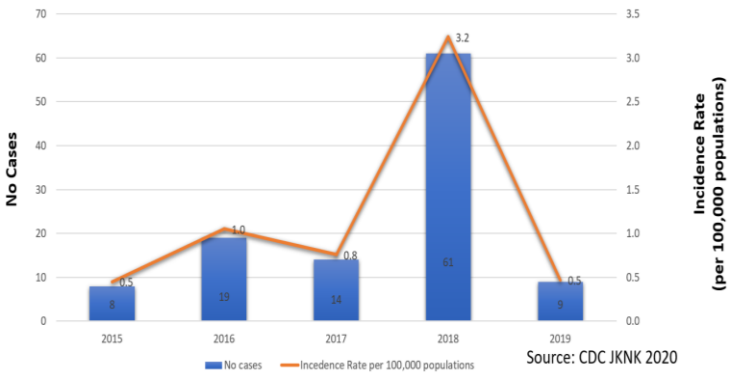


Figure 1.3: Number of cases and incidence rate of food poisoning among children ≤ 6 years old in Kelantan 2015- 2019

The hygiene level of the kitchen is the most critical aspect that should be given attention because it will reflect the safety of the food to be consumed (Abdul *et al.*, 2015). Food-borne bacteria can grow on most kitchen surfaces, like cutting boards, cloth, sinks, cleaning sponges, and knives (Kusumaningrum *et al.*, 2003). This may cause cross-contamination of food if those items are not properly cleaned and food handlers neglect the correct way of food preparation (Mattick *et al.*, 2003). Thus, it is important for food handlers to always practise good hygiene to ensure food safety from production to consumption (Dudeja *et al.*, 2017).

The main reason for food-borne illness in Malaysia is unsanitary food handling procedures, which contribute to 50% of the cases (Ministry of Health Malaysia

[MOH], 2007). Storage temperatures are important in determining food products' microbial activity and shelf life (Aung and Chang, 2013). Thus, food preparation in advance, inappropriate ways of cooling, and insufficient temperature during reheating of food may cause microbial growth and food poisoning (Beumer and Kusumaningrum, 2003). In addition, a new employee without work experience in the foodservice industry might cause food-borne illness due to mishandling and a lack of knowledge (Abdul-Mutalib *et al.*, 2012). Improper cooking, temperature abuse during food storage, cross-contamination between cooked and uncooked foods, poor sanitation, and hygiene, and using unsafe water and raw materials are the handling factors associated with food-borne disease (Khan *et al.*, 2017).

A study on KAP of food safety among 112 food handlers at Universiti Kebangsaan Malaysia (UKM) shows that only 46.6% performed safe practises, such as wearing uniforms, aprons, caps, and suitable covered shoes; not smoking, coughing, sneezing, or wearing jewellery; washing hands with soap; and wearing gloves during food preparation (Abdullah Sani and Siow, 2014). A study on knowledge of hygiene among food handlers at Universiti Pertanian Malaysia (UPM) shows that they have a moderate level of knowledge of temperature control, cross-contamination, food poisoning, and personal hygiene (Nor Khaizura *et al.*, 2015). A study on KAP of food safety culture among government hospital kitchen employees shows that the majority have a moderate to a good level of knowledge on hand and personal hygiene but a poor attitude towards sanitising kitchen equipment and utensils and a moderate level of practise on time and temperature control (Abdul Rashid *et al.*, 2020). A study on food safety knowledge in school districts in India shows that food handlers have poor knowledge of food safety (Nuzhat Sultana, 2018).

The main legislation regulating food safety is the Food Act of 1983. This act and the Food Regulations came into force in October 1985. It aims to protect the public

against food-related hazards and fraud and promote safe, high-quality food preparation, handling, distribution, sale, and consumption (Food Safety & Quality Division, MOH, 2011). Every year, the Occupational and Environmental Safety and Health (KPAS) unit will inspect the preschool requested for inspection by the Department of Social Welfare (JKM), Ministry of Women Development, Family, and Community Malaysia. The inspection will be done by the KPAS officer using "Borang Pemeriksaan Taska" (TASKA-1/VIP/KKM/1/2013) (Appendix F). After the inspection of the hygiene and sanitation level of the premises and the vaccination status of food handlers is done, the letter of approval for preschool operation will be issued by the KPAS unit. In 2020, around 30 preschool premises were inspected in the district of Kota Bharu. The lack of inspections is due to many premises being closed during the MCO. In 2019, around 100 preschool premises were inspected by the KPAS unit, PKD Kota Bharu (Kelantan State Health Department [KSHD], 2020).

1.6 The observation checklist for assessing the hygiene and sanitation of food preparation areas in preschools

_____ The current observation checklist used in the observation of the preschool food preparation area uses the "Borang Pemeriksaan Taska" (TASKA-4/KPAS/KKM/1/2012) (Appendix F). The current checklist only consists of two domains and six items. The first domain is the kitchen and food preparation area, with three items: (i) floor, wall, and ceiling hygiene (slippery or non-slippery floor and clean or dirty), (ii) sink hygiene (clean or dirty and equipped with soap or no soap), and (iii) fridge hygiene (clean or dirty and functioning or not functioning). The second domain is food handler, with three items: (i) food source (cooked on-premises or bought from outside premises), (ii) anti-typhoid vaccination status (yes or no), and (iii) food

handling course status (yes or no). This checklist was released in 2012, and no revision has been done since then (Ministry of Health Malaysia [MOH], 2012).

Several parameters in the observation domain were not measured in the "Borang Pemeriksaan Taska" and required monitoring. For example, the building hygiene domain, proper lighting, and ventilation levels were not assessed in the existing form (de Almeida *et al.*, 2014). The food preparation process control, encompassing aspects like food cooling methods and storage temperatures, was also not addressed in the current observation form. The most common reasons for food-borne poisoning cases are inadequate cooling (one or more days between preparation and consumption) and improper heating practises (Park *et al.*, 2017; Yabanci and Sanlier, 2007).

The food handler's domain that is not being observed includes food safety practises and the use of personal protection during food preparation. Hygienic practises such as wearing clean and protective clothes, effective hand washing, and the use of gloves are crucial steps in preventing food contamination and further preventing the spread of infectious disease (Angelillo *et al.*, 2001). The other domains that need to be observed are the availability of food preparation equipment or utensils, the separate food preparation area, the food storage area, garbage management, and restrooms for staff. (de Almeida *et al.*, 2014; Yabanci and Sanlier, 2007).

1.7 Problem statement

The preschool period is a very crucial time in a child's life. Children spend most of their time around 10 hours per day and serve at least three times daily in preschool. Children in preschool are 2.3–3.5 times more likely to experience food poisoning than children cared for in their own homes (Lu *et al.*, 2004). Children under five are the most vulnerable group affected by food-borne diseases (Lake *et al.*, 2014). The children are also at higher risk for foodborne disease and possibly dying due to immature immune systems and their lack of protective immunity (Devleesschauwer *et al.*, 2018). A study by Nuzhat Sultana (2018) in Beed India shows that most preschool food handlers were unaware of general knowledge and hygiene practises to follow during food preparation. Currently, there is no regular monitoring of the hygiene and sanitation of the food preparation areas in preschools in Kelantan done by the authority. The inspection of the preschool will only be done once per year by the KPAS unit following a request made by the Department of Social Welfare Department, Malaysia, for the preschool that needs to renew its annual operating licence and for the newly opened preschool that is applying for an operating licence (Ministry of Health Malaysia [MOH], 2012).

1.8 Study rationale

— There is limited data available concerning the knowledge and practise of food safety among preschool teachers in Malaysia, and limited studies related to the hygienic conditions of food preparation areas have been done in the preschools of Malaysia. Since preschool children cannot control their food safety, it is crucial to ensure that their food is prepared in hygienic surroundings and served safely by preschool teachers or food handlers. With the number of food poisoning cases still

high in Malaysia, there is a need to perform a study regarding the level of knowledge and practise of food safety among preschool teachers and the hygiene and sanitation level of food preparation areas in the preschool. The results obtained from this study can provide baseline data on hygiene and sanitation in food preparation areas in the preschools of Kelantan and data on the level of knowledge and practise of food safety among preschool teachers in Kelantan. This study can also be replicated in other states of Malaysia to provide baseline data at the national level regarding the hygiene and sanitation of food preparation areas in preschools and the level of knowledge and practise of food safety among preschool teachers. Hopefully, further steps can be taken later to improve the hygiene and sanitation levels of the food preparation areas of preschools and the level of knowledge and practise of food safety among preschool teachers in Malaysia.

1.9 Research question

1. What is the level of hygiene of the food preparation area in preschools of Kelantan?
2. What is the level of knowledge and practice of food safety among preschool teachers in Kelantan?
3. What is the relationship between the level of knowledge and practice of food safety among the preschool teachers and the level of hygiene in the food preparation area in preschool Kelantan?

1.10 Study objective

1.10.1 General objective

To study the hygiene and sanitation of food preparation areas within preschools and the knowledge and practise of food safety among preschool teachers in Kelantan.

1.10.2 Specific objectives:

Phase 1:

1. To develop and validate the observation checklist assessing the hygiene and sanitation of the food preparation area in preschools.

Phase 2:

2. To determine the hygiene score of the food preparation areas in preschools using a newly developed observation checklist in Kota Bharu, Kelantan.
3. To determine the knowledge and practise of food safety among the preschool teachers in Kota Bhru, Kelantan.
4. To determine the relationship between knowledge and practise of food safety among preschool teachers and the hygiene score of the food preparation areas of preschools in Kota Bharu, Kelantan.

CHAPTER 2: LITERATURE REVIEW

2.1 Knowledge of food safety, hygiene and sanitation

—According to the study done in Beed, India, the knowledge of food handlers on food safety and hygiene practices is lacking during food preparation in preschool kitchens (Nuzhat Sultana, 2018). Another study involving 392 kindergartens in Korea shows that the mean score of food service hygiene knowledge was 76.29%, and the lowest score was personal hygiene. This study suggested that food service employees require more education and training to improve their knowledge of proper personal hygiene practises (Lee *et al.*, 2012). There are limited studies regarding the knowledge of food safety involving preschoolers in Malaysia at the moment. Lack of food safety knowledge is one factor causing foodborne outbreaks among food service workers. Common faults include serving polluted raw food, improper cooking and cooling time, reheating foods, and prolonged serving time after being cooked (Medeiros *et al.*, 2001; Sharif *et al.*, 2013). Poor food safety knowledge and skills will cause unsafe food handling practises and cross-contamination in food service establishments (McGill *et al.*, 2015; Rahman *et al.*, 2012). Previous studies showed a lack of food safety knowledge regarding temperature regulation, personal hygiene, and cross-contamination prevention (Afolaranmi *et al.*, 2015; Jianu and Goleţ, 2014).

2.2 Practice of food safety

—A study in a children's care centre in North and South Carolina showed low compliance —with hygiene practises in the food preparation area. Only 25% (7 out of 25 observations) —wore gloves when preparing food. Only 3.5% (5 out of 142) performed all steps of proper handwashing as proposed by WHO (Chen, 2013).

Another study done among food handlers in a primary school in Hulu Langat, Malaysia, shows that the food handlers did not practise proper handwashing procedures, did not wear gloves properly during food preparations, and did not practise contamination prevention (Tan *et al.*, 2013). However, limited studies have been done on the practise of food safety among preschool teachers in Malaysia. An intervention study done among the food handlers in primary schools in Kota Bharu shows that the food safety training did not significantly improve personal hygiene practises. The same study also indicates that training had a significant influence on food handlers' practises in relation to food safety and hygiene but had little impact on the environmental sanitation practise score. The study also shows a low behavioural score on raw food handling (Nik Rosmawati *et al.*, 2016).

2.3 Hygiene level of food preparation areas

An assessment study of hygienic conditions in 87 nursery school kitchens in Ankara, Turkey, shows that 24.1% rated as inadequate, 65.5% (57) acceptable, and 0.3% as good. Another study done in Columbia regarding hygiene habits and environments in children's care homes shows that most bacteria growth (36% or 254 isolations from 699 total) is found in the kitchen areas (Lesmes *et al.*, 2017). A study done in the kindergartens in Macedonia showed a lack of expert or trained staff in managing food quality, the cooking equipment is inadequate, the hygienic and sanitation habits were poor, and the bacteria was found high in kitchen air (54 CFU/L air) (Bilska and Kowalski, 2014). There is limited study found regarding the hygiene and sanitation of food preparation areas in preschools in Malaysia. A study done regarding food safety training on food handlers in primary schools in Kota Bharu shows that the training did not improve the use of sanitiser agents for cleaning the cooking equipment and food contact surface areas (Nik Rosmawati *et al.*, 2016).

2.4 Factors associated with the knowledge of food safety

Currently, there is a lack of study on assessing the factors associated with food safety knowledge among preschool teachers. A study done among 85 food handlers at the University of Kuala Lumpur shows that level of education, working experience, and food safety handling course are associated with knowledge of food safety (Lee *et al.*, 2017). Another study was done among 440 food handlers in a school feeding programme in the district of Mpumalanga, South Africa, which shows that level of education and duration of work were associated with knowledge of food safety (Sibanyoni *et al.*, 2017). This study is supported by a study done among 166 food handlers in the school of Camari, Brazil, which shows that the level of education is associated with knowledge of food safety (Soares *et al.*, 2012). A study involving 172 food handlers in a school kitchen in the Santo, Brazil, district showed that knowledge of food safety is associated with greater work experience (da Vitória *et al.*, 2021).

2.5 Factors associated with the practice of food safety

According to a study by Lee (2018) done in Gyeongnam, Korea, multiple factors influence the hygiene practise in the small daycare centre. The factors include registration with the government, the length of the food handler's working experience, the age of the food handler, and the maximum number of people the food handler serves. This study is supported by another study done to assess employee food hygiene and nutrition awareness and performances in a childcare centre, which shows that the person with a low score for food hygiene practice was the employer with an employment history of less than one year and an age less than 30 years old. The people who had a high score for food hygiene practise were the employees with cooking licences (Park *et al.*, 2011).

According to an integrative review study done in 2020, hygiene practises are influenced by internal and external variables (Lee and Seo, 2020). The internal variables are the variables that influence behaviour at the individual level, such as food safety knowledge, attitude, risk perception, self-efficacy, and optimistic bias, which are associated with hygiene practices (Rossi *et al.*, 2017; Young *et al.*, 2018). The external variables influencing hygiene practise at the organisation level are the characteristics of food premises and the organisation's hygiene conditions. Food premise characteristics include operation size, financial constraints, and the maximum number of meals produced (Ungku Fatimah *et al.*, 2014; Rossi *et al.*, 2017; J. H. Lee, 2018). The organisation's hygiene conditions include a food safety management system, food culture, food handlers' training expertise, and legal requirements (Lee and Seo, 2020).

2.6 Factors associated with hygiene of food preparation areas

— A study done among food handlers in eateries in India shows that low levels of education, a lack of proper training, and a lack of regular reinforcement are associated with poor hygiene in food preparation areas (George *et al.*, 2018). Personal hygiene practises are important in order to produce safe food for consumers. Examples of personal hygiene practises include the hand hygiene of kitchen personnel, which is important and the most simple and effective in preventing food poisoning (Al-Shabib *et al.*, 2016). A recent study in Turkey shows that regular hygiene training and monitoring at intervals will improve the knowledge and awareness of hygiene among food handlers and thus prevent contamination and foodborne diseases from occurring (Doan *et al.*, 2020).

2.7 Observation checklist used in Malaysia to determine hygiene and sanitation levels of food preparation areas in preschool and food premises

— The current observation checklist that is being used to assess the hygiene and sanitation of food preparation areas in preschool is the "Borang Pemeriksaan TASKA" (TASKA-4/KPAS/KKM/1/2012) (Appendix F). The observation checklist consists of six domains, which are floor, wall, and ceiling hygiene (yes, no), sink hygiene and availability of soap (yes, no), refrigerator hygiene (clean or dirty), functioning (yes, no), source of food (prepared within the premises, ordered, or bought), food handler anti-typhoid injection (yes, no), and food handler attended food handling courses (yes, no). Each "yes" answer was given 1 point, and "no" answer was given 0 points. Then the total points were added up to the total marks obtained (Ministry of Health Malaysia [MOH], 2012).

The other observation checklist used to assess hygiene and sanitation of food premises is known as "Borang Pemeriksaan Premis Makanan Berasaskan Risiko" (Borang KKM-PPKM-209 pindaan 2018), which consists of fourteen domains (Appendix G). The domain consisted of: 1) process control (cooking temperature, storage temperature); 2) building (floor, wall, ceiling, lighting, airflow); 3) food handler (vaccination, food safety practise, personal protection, training); 4) cooking equipment; 5) cooking utensils; and 6) food preparation area. 7) food storage area; 8) water supply; 9) drainage system and piping system; 10) sanitation facility; 11) trash management/waste product; 12) food transportation and delivery; and 13) pest control. 14) premise cleaning and maintenance. The checklist scoring uses demerits scoring, where the current score will deduct the previous year's score. Then, the total percentage obtained will be graded as A (86-100%), B (71-85%), C (51-70%), and

50% and below will be categorised as "not clean", no grade will be given. (Ministry of Housing and Local Government Malaysia [MHLG], 2014).

2.8 Observation checklist to determine the hygiene and sanitation level of food preparation areas in other countries

___The observation checklist used for the assessment of hygiene conditions in a nursery school's kitchen in Turkey consists of seven domains. The domains consist of food preparation, menu planning, equipment and utensil hygiene, dishwashing hygiene, restroom hygiene, and personnel hygiene education (Yabancı and Sanlier, 2007). The other study involving the assessment of hygiene and sanitation in Brazilian public school food service used five domains. The domain being observed consisted of the physical, plumbing, and wiring conditions of the food preparation areas, the availability of equipment and utensils, food handlers, processes and procedures, and food service cleaning (de Almeida *et al.*, 2014). The third study done in South Korea used four domains to assess the preschool's hygiene and sanitation of the food preparation area. The 4 domains consisted of individual sanitation, food ingredient sanitation, production process sanitation, facility equipment sanitation, and sanitation of kitchen utensils (Park *et al.*, 2017).

2.9 Conceptual framework

Two factors were included in this study, the school's factor and the teachers' factor. The school's factors consist of the number of teachers and students, food preparation equipment, serving and storage, kitchen area, storage area, trash area, cleaning schedule, and pest control schedule. The teacher's factors consist of age, gender, race, marital status, education level, working duration, training, and income. These school and teacher factors are believed to be associated with the knowledge and practise of food safety among preschool teachers and may affect the hygiene and sanitation status of the food preparation areas in the preschool. Refer to Figure 2.1.

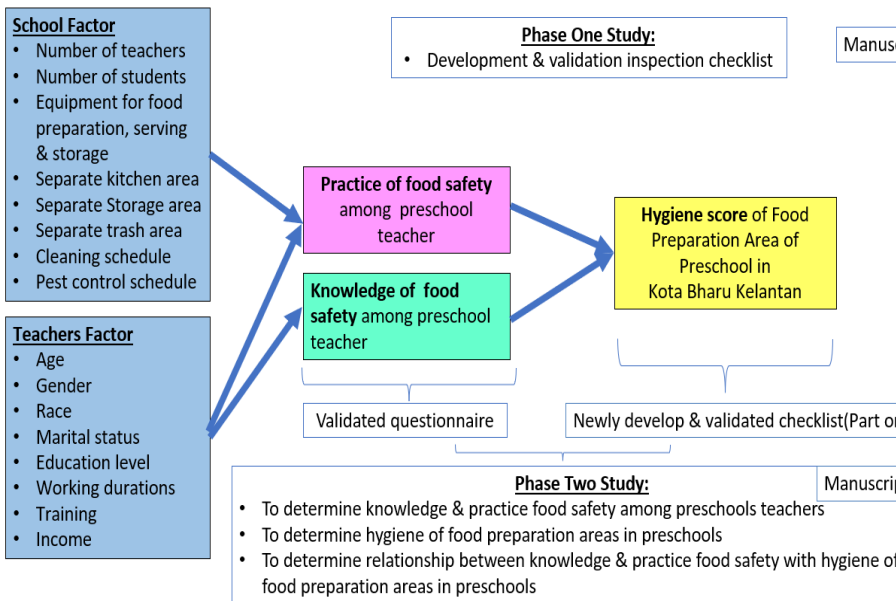


Figure 2.1: Conceptual framework of the study

CHAPTER 3: METHODOLOGY

This study was conducted in the district of Kota Bharu, Kelantan, from April 2021 to February 2022. The study was divided into two phases. Phase 1 of the study involved the development of an observation checklist to assess the hygiene and sanitation of food preparation areas in the preschools, which was tested in the pilot study. The study population for phase 1 involved preschools in the district of Kota Bharu, Kelantan. Phase 2 of the study was a cross-sectional study using two tools: a validated questionnaire to determine the knowledge and practice of food safety among preschool teachers and the newly developed observation checklist to assess the hygiene and sanitation of preschools in Kelantan (developed in phase 1). The study population for phase 2 involved 70 preschools and 70 preschool teachers.

3.1. Research methodology for Phase 1:

Phase 1 of the study involves the development of an observation checklist to assess the hygiene and sanitation of the food preparation area in the preschool. The development of the observation checklist was divided into four stages, which are:

1. Stage 1: Conducting and synthesising a literature review

A thorough literature review was conducted to search for past research on the hygiene and sanitation of food preparation areas in preschools through a few databases, including Scopus, ScienceDirect, ProQuest, and PubMed. Item generation was conducted based on discussion with supervisors and literature review findings, either in the form of quantitative or qualitative studies related to the hygiene and sanitation of food preparation areas in preschool.

2. Stage 2: Content validation

Six expert panels were involved: 1 public health physician, 1 food safety officer, 1 non-communicable disease officer, 1 preschool manager, and 2 preschool teachers. The panel analysed and clarified the importance of each domain and item and provided a score for each item.

3. Stage 3: Face validation

Ten expert panels were involved: 1 occupational and environmental specialist, 1 non-communicable disease specialist, 1 environmental health officer, 1 food quality and safety officer, 3 preschool managers, and 3 preschool teachers. The researchers' understanding and method of filling out the checklist form were assessed.

4. Stage 4: Pilot study

The newly developed checklist was piloted among four assessor respondents in two preschools, with these respondents representing health, safety, and environmental officers from the Ministry of Health Malaysia. The study's feasibility was assessed, whether the scale was clear or not, and without obvious errors.

3.1.1 The proposed observation checklist for food preparation area for Phase 1

The observation checklist was divided into two parts:

Part A: Preschool information: school name, location, number of preschool teachers and students

Part B: Observation checklist of hygiene and sanitation with 3 domains and further classified into:

A. Building and facility:

The items in the building and facility consisted of the food preparation area hygiene, food preparation area, food storage area, fridge hygiene, sink hygiene, cooking equipment and utensils, garbage storage area, water supply, toilet hygiene, and water disposal/drainage area.

B. Process control:

The items in the process control included the organization chart of the food preparation area, process control during food preparation, food preparation hygiene, and pest/rodent control measures.

C. Food handler:

The items covered in the food handler domains consisted of the medical checkup status, typhoid vaccination status, attendance of food safety courses, wearing proper and clean attire, clean nails, not wearing jewelry during food preparation, and cleaning hands before and after food handling.

Each item had three answer options ("not satisfied", "satisfied", and "very satisfied"). For the "not satisfied" answer, 0 marks were given, "satisfied" received 1 mark, and "very satisfied" received 2 marks. The observation checklist was written in the Malay language.

3.1.2 Content validation and face validation

Six expert panels validated the content of the observation checklist. The content validation was measured using item-level content validity index (I-CVI) and scale-level content validity index (S-CVI) methods. 10 expert panels validated the face validation. The face validation was measured using the item-level face validation index (I-FVI) and the scale-level face validation index (S-FVI).

3.1.3 Pilot study using the preliminary observation checklist

For the pilot study in Phase 1, two preschools were selected for the assessment of hygiene and sanitation of food preparation areas in preschools in Kota Bharu by four assessors from the Ministry of Health using the preliminary observation checklist. Permission to conduct the pilot study was obtained from the Community Development Department (KEMAS), the Ministry of Rural Development Malaysia, and the Department of Planning and Educational Research, Ministry of Education Malaysia.

3.1.4 Inclusion criteria for the pilot study

The inclusion criteria for the selection of the preschools in this pilot study were:

- i) Preschool in Kota Bharu operated within the study and was registered with the Ministry of Education and Department of Social Welfare, Ministry of Women's Development, Family, and Community Malaysia.

- ii) The preschools prepared food within their compounds at least twice daily for their children.

3.1.5 Research tools

The developed observation checklist from Phase 1 of the study was used to assess the hygiene and sanitation of the food preparation area. The thermometer was used to measure the storage temperature, while the lux metre was used to measure the lighting.

3.1.6 Data collection

A briefing was given to the preschool managers involved in the study, and written consent was obtained prior to the assessment of the food preparation area in the preschool. The preliminary observation checklist was used to assess the hygiene and sanitation of the preschool food preparation areas. A thermometer was used to measure food storage temperature, and a lux metre was used to measure lighting. The data from the checklist form was entered into Microsoft Excel and transferred into SPSS for descriptive analysis.

3.1.7 Study flowchart

The study flowchart Phase 1 of the study is shown in Figure 3.1.

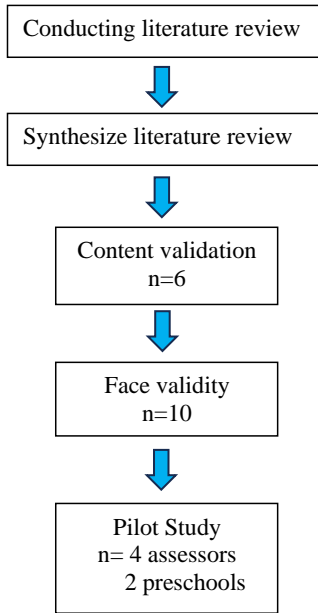


Figure 3.1: Study flow chart Phase 1

3.2 Research methodology for Phase 2

3.2.1 Research design

A cross-sectional study

3.2.2 Study duration

This research started in April 2021 and continued until February 2022

3.2.3 Study location

This study was conducted in the district of Kota Bharu, Kelantan. Kota Bharu served as the capital city of Kelantan, with a population of 363,000 as of 2022 (Department of Statistics Malaysia [DOSM], 2022). The total count of preschools in Kelantan registered with the Ministry of Education of Malaysia and the Department of Social Welfare (JKM) under the Ministry of Rural Development was 1701 preschools (JKM, 2021; MyGOV, 2021). These preschools had been categorised into six different types: Pra-Sekolah Kebangsaan, Pra-Sekolah Kebangsaan Jenis Cina (SJKC), Tadika Perpaduan, Tadika KEMAS, Tadika PASTI, and private preschools (such as Little Caliph and Brainy Bunch). For this study, only three of these categories were chosen, specifically Tadika KEMAS, Tadika PASTI, and private preschools.

3.2.4 Study population

The reference population was the preschools and preschool teachers in Kelantan. The source population was the preschools and preschool teachers in Kota Bharu, Kelantan, available during the study duration and registered with the Ministry of Education and Department of Social Welfare, Ministry of Women Development, Family, and Community, Malaysia.