UNIVERSITY OF INDONESIA

HAZARD ANALYSIS CRITICAL CONTROL POINT STUDY OF FOODS FOR 6-24 MONTHS OLD CHILDREN AND FOOD HANDLER'S PRACTICES IN BEKASI, WEST JAVA

THESIS

in partial fulfillment of the requirements for the degree of
Master of Science in Community Nutrition

LINA ROSPITA
0706171150

FACULTY OF MEDICINE UNIVERSITY OF INDONESIA
STUDY PROGRAM IN NUTRITION
MAJORING IN COMMUNITY NUTRITION

JAKARTA
July 2009

Author's Declaration of Originality

I hereby certify that I am the sole author of this thesis.
I certify that, to the best of my knowledge, my thesis does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people included in my thesis, published or otherwise, are fully acknowledged in accordance with the standard referencing practices

Name : **Lina Rospita**

NPM : **0706171150**

Signature : .....

Date : **July 2009**

APPROVAL PAGE

This thesis is submitted by

Name	:	Lina Rospita
NPM	:	0706171150
Study program	:	Nutrition
Thesis title	:	Hazard Analysis Critical Control Point study of foods for 6-24 months old children and food handler's practices in Bekasi, West Java

has been satisfactorily defended before the examiners and approved as partial fulfillment of the requirements for the degree of Master of Science in Community Nutrition, Study Program in Nutrition, Faculty of Medicine, University of Indonesia

EXAMINERS TEAM

Advisor 1 : Ir. Dwi Nastiti Iswarawanti, MSc. (.....)

Advisor 2 : Otte Santika, SP., MSc. (.....)

Examiner 1 : Lanita Somali, MSc., MSEd. (.....)

Examiner 2 : dr. Agustin Kusmayati, MSc. (.....)

Place : Jakarta

Date : June 16, 2009

PREFACE

The incidence of diarrhea was higher among children aged 6-24 months. Contamination of food by food-borne pathogens accounts for a substantial proportion of diarrhea disease among infants and young children, especially in developing countries. Most cases of food borne illness are preventable if food protection principles are followed from production to consumption. Given that it is currently impossible for food producers to ensure a pathogen free food supply, the home food preparer is a critical link in the chain to prevent food borne illness. Thus home food preparers need to know how to minimize the presence of pathogens or their toxins in food. A joint FAO/WHO Expert Committee on Food Safety recommended that studies using the HACCP (Hazard Analysis Critical Control Point) approach be carried out in homes, so that more information about the causes of food-associated hazards and preventive measures could be obtained. Such information could be used to focus in health and food safety program activities on the factors of greatest importance in causing food borne illness.

In Bekasi municipality in 2007, there were 26888 cases (12.54%) of diarrhea among under-five children reported to health centers. From 2003 to 2007 there has been 19 food poisoning cases occurred in school children, employee, and at the household level. According to Bekasi Municipality Health Office, some risk factors of food poisoning case occurrence are poor food hygiene, poor personal hygiene practice, lack of monitoring and control, and lack of inter-sectoral coordination.

In Indonesia, study on food for 6-24 months old children using HACCP approach has never been done. Therefore, it is necessary to conduct HACCP study and to assess food handlers' practices on food preparation and handling. This thesis is divided into six chapters which consisted of introduction (part 1), literature review (part 2), methodology (part 3), results (part 4), discussions (part 5), and conclusions and recommendations (part 6). In appendix, the manuscript of this thesis to be submitted to Bulletin of the World Health Organization is included.

ACKNOWLEDGEMENT

"...if you give thanks (by accepting Faith and worshipping none but Allah), I will give you more (of my Blessings)..." (Ibrahim: 7).

Thank God Allah SWT for all of Your Mighty, Grace, and Bless in every second of my life that has given to me. He gave me strength, patient, health and courage to get all of it done. Thank God for giving me great and supportive parents. Thank you for my beloved Mom and Dad for their hard work and sincerity. You have made me feel like I am the lucky girl. God also give me the very best people who had given me tremendous support during my study until finishing this thesis, which I am very pleased to thank them of their valuable and fruitful input, critics, comment, suggestion and other kind of supports.

I would like to give an appreciation to all lecturers and board of SEAMEO TROPMED RCCN UI who gave me opportunity to study and doing research for my thesis. A very pleasant and deeply thankful to my advisors and resource person, Ir. Dwi Nastiti Iswarawanti, MSc., Otte Santika, SP. MSc., and Ir. Siti Muslimatun, MSc. PhD., for very fruitful advise, guidance, inspiration, knowledge and moreover for their patient to me since research proposal development until thesis writing.

Thank you for the University of Indonesia/DIPA that gave financial support in this research. Thank you also for PT TPS Food that has provided some gifts for the respondents of this study. Also to DAAD scholarship that funded my second years study in SEAMEO.

My appreciation goes to Prof. Soemilah Sastroamidjojo, MD., Ir. Umi Fahmida, MSc. PhD., dr. Rina Agustina, MSc., Andi Mariyasari Septiari, SP., MSc., and Inggrid Surono, PhD. as my examiner during proposal and pre-thesis examination and also to Dr. Ir. Judhiastuty Februhartanty, MSc., for the valuable inputs. I also dedicate my appreciation to library, computer room, education division and research division staffs as well as ICD staffs, who have assisted me during the study and thesis writing.

I am very grateful and thankful for hard work and help from my three lovely young enumerators (Mia, Vitri, and Lely) for their cheers, enthusiasm and spirit during data collection. Also to the driver, Pak Matun, who were so helpful during field activity and also always give motivation to me and the enumerators.

Appreciation and thanks to staff and cadres of health centers and health posts and also the local authorities that had participated in this research study. Moreover, big thanks to all food handlers who joined the study, for their willingness to enrolled in the study.

Thank you to my two classmates, Eriza and Yasmin, thank you for all joyfulness and good things that the three of us have spent together. Hopefully we can reach the very best of our futures. Last but not least, thank you to all my friends who has entertained me when I was going down. You always keep me in high spirit.

Jakarta, July 2009

Lina Rospita

PUBLICATION APPROVAL FOR ACADEMIC PURPOSES

As *civitas academica* of University of Indonesia, I hereby declare that:

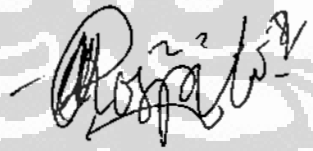
Name	: Lina Rospita
NPM	: 0706171150
Study Program	: Nutrition
Department	: Nutrition
Faculty	: Medicine
Publication form	: Thesis

for the benefits of science, I agree to bestow University of Indonesia a **non-exclusive royalty-free right** of my thesis entitled:

Hazard Analysis Critical Control Point study of foods for 6-24 months old children and food handler's practices in Bekasi, West Java

including all the attendants materials. With the non-exclusive royalty-free right University of Indonesia has the right to archive, reproduce as database, preserve, conserve and publish my thesis, as long as my name as the writer and owner of the thesis is fully acknowledged

Place : Jakarta
Date : July 2009



(Lina Rospita)

ABSTRACT

Name : Lina Rospita
Study Program : Community Nutrition
Title : Hazard Analysis Critical Control Point Study of foods for 6-24 months old children and food handler's practices in Bekasi, West Java

This cross sectional study aimed to develop HACCP data sheet and assess food handler's practices in Bekasi municipality. The study found 10 foods mostly consumed by 6-24 months old children were spinach soup, vegetable soup, cooked rice, *nasi tim*, biscuit, ready to eat rice porridge, instant porridge formula, fried *tempe*, fried fish, and egg omelet. The CCPs commonly found were cooking, holding, storing, reheating, purchasing, preparation, and addition of ingredients after heat treatment. Food handler's practices identified were not thoroughly cooking; not eating cooked food promptly; not reheating; not reading expiry date; not observing broken package; and improper hand washing.

Keywords:
HACCP, food safety, knowledge, attitude, food preparation and handling practice, young children

ABSTRAK

Nama : Lina Rospita
Program Studi : Gizi Komunitas

Title : Analisa Bahaya Titik Kendali Kritis makanan anak usia 6-24 bulan dan praktek pembuat makanan di Bekasi, Jawa Barat

Studi *cross sectional* ini bertujuan untuk membuat lembaran data HACCP dan mengetahui praktek pembuat makanan di Kotamadya Bekasi. Hasil studi menemukan 10 makanan yang paling sering dikonsumsi oleh anak 6-24 bulan adalah sayur bening bayam, sayur sop, nasi, nasi tim, biskuit, bubur ayam, bubur instant, tempe goreng, ikan goreng, dan telur dadar dengan CCP yaitu pemasakan, pendinginan, penyimpanan, pemanasan ulang, pembelian, penyiapan, dan penambahan bahan setelah pemanasan. Praktek pembuat makanan yang diidentifikasi meliputi tidak memasak secara menyeluruh, tidak segera memakan makanan, tidak memanaskan makanan, tidak membaca tanggal kadaluarsa, tidak memeriksa kondisi kemasan ketika pembelian, dan tidak mencuci tangan dengan benar.

Kata kunci:
HACCP, keamanan pangan, pengetahuan, sikap, praktek penyiapan dan penanganan makanan, anak-anak

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BOD	:	Biological Oxygen Demand
CCP	:	Critical Control Points
COD	:	Chemical Oxygen Demand
Dinkes	:	*Dinas kesehatan*
FAO	:	Food and Agricultural Organization
FGD	:	Focus Group Discussion
HACCP	:	Hazard Analysis Critical Control Points
MSG	:	Mono Sodium Glutamate
Pemda	:	*Pemerintah daerah*
UK	:	United Kingdom
UN	:	United Nations
UNICEF	:	United Nations Children's Fund
USA	:	United States of America
USDA	:	United States Department of Agriculture
WHO	:	World Health Organization

OPERATIONAL DEFINITION

Contamination	:	The presence of (microbiological food borne pathogens) hazards in the food of 6-24 months old children.
Control measures	:	Any actions and activities in the food preparation and handling practices of 6-24 months old children that can be used to prevent or eliminate hazard or reduce it to an acceptable level.
Critical control points (CCPs):		A step of food preparation and handling for 6-24 months old children at which control can be applied to prevent or eliminate hazard or reduce it to an acceptable level where there will be no further steps in the process that could prevent, reduce, or eliminate the hazards.
Critical limits	:	The value that separates acceptability from unacceptability for each CCP of foods for 6-24 months old children.
Cross-contamination	:	The transfer of (microbiological food borne pathogens) hazards to food from other foods, water, equipment, food handler, and environment during 6-24 months old children's food preparation and handling.
Food handler's practices	:	The act of preparing and handling food for 6-24 months old children starting from purchasing of raw material to consumption.
HACCP study	:	A study of assessing food preparation and handling for 6-24 months old children by using 4 HACCP principles: conduct a hazard analysis, determine critical control points, establish control measures, and establish monitoring procedures.
Hazards analysis	:	The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety of food for 6-24 months old children by using literature review.

Hazards	:	Microbiological food borne pathogens possibly exist in the food during its preparation and handling that has significantly unacceptable level with the potential to cause an adverse health effect to 6-24 months old children.
Housing area respondents	:	Food handlers who lived in selected housing complex in Jatisampurna sub-district.
Monitoring procedures	:	Any activity in the food preparation and handling practices to ensure that each CCPs on foods for 6-24 months old children is always under control.
Rural area respondents	:	Food handler who lived in where there are still agricultural areas around their house surroundings in Jatiasih sub-district.
Slum area respondents	:	Food handler who lived around garbage disposal location in Bantargebang sub-district.

LIST OF APPENDICES

PART 1
INTRODUCTION

1.1. Background

Children aged 6-24 months are at the greatest risk of developing diarrhea from contaminated food and water[1]. Breast milk is supposed to be the main source of nourishment for children within their first month of life. The intake of breast milk reduces their exposure to food-borne pathogens, and the anti-infective properties of breast milk also provide some protection. At 6 months of age, the breast milk intake is no longer enough to meet their nutrient requirements, so high nutrient dense foods should be given, and children are thus exposed to complementary foods[2].

Food can be mishandled at any number of places during food preparation, handling and storage; and studies show that consumers have inadequate knowledge about measures needed to prevent food borne illness in the home. Contaminated raw foods, inadequate cooking, and consumption of food from an unsafe source were the factors most commonly associated with reported outbreaks of food borne illness in homes. The proportion of cases arising from food preparation practices in the home may be especially under-represented in outbreak statistics, due to many factors. However, studies have estimated that between 50% and 87% of reported food borne disease outbreaks have been associated with the home. Common mistakes identified include serving contaminated raw food, cooking/heating food inadequately, having infected persons handle implicated food and practice poor hygiene. However it is known that a part of food borne illnesses in the home result from eating foods from unsafe food preparation practices in the home[3] and also lack of awareness and understanding of home hazards and safe home practices. In the case of food poisoning in the home, respondents felt that they had a high control over the risk, associating the risk with a perceived low personal risk[4].

Contamination of food by food-borne pathogens accounts for a substantial proportion of diarrhea disease among infants and young children, especially in developing countries[5]. Food borne diseases remain responsible for high levels of

morbidity and mortality in the general population, but particularly for at-risk groups, such as infants and young children. Annually, 1.5 billion episodes of diarrhea occurred in under-five children in developing countries resulting in over 3 million deaths[6].

A study of 454 children in Eastern Nigeria showed that the incidence of diarrhea was higher among children aged between 6-24 months - the age range which coincides with the usual weaning period in the region[1]. In Bekasi municipality in 2007, there were 26888 cases (12.54%) of diarrhea among under-five children reported in health centers. From 2003 to 2007 there has been 19 food poisoning cases occurred in school children, employee, and at the household level. According to Bekasi Municipality Health Office, there are some risk factors of food poisoning case occurrence: poor food hygiene, poor personal hygiene practice, lack of monitoring and control, and lack of inter-sectoral coordination[7].

It is known that food borne illnesses are often not perceived as significant health problem by consumers, and even be considered a normal consequence. Mostly, consumers tended to ignore the role of food and food handling in the transmission of diarrhea disease and attributed their symptoms to other factors (i.e., indigestion). If consumers misperceive the nature and source of food borne illness, it would imply that they misjudge the frequency and would be less motivated to change behaviors related to food safety. This obviously has implications for any food safety education effort developed[3].

1.2. Problem statement and rationale of the study

The HACCP approach can be applied to food safety in homes as well as in food processing and food service establishments. A joint FAO/WHO Expert Committee on Food Safety recommended that studies using the HACCP approach be carried out in homes in developing countries, so that more information about the causes of food-associated hazards and preventive measures could be obtained. Developing countries were identified as a principal area of concern because home food-related illnesses have their highest incidence rates in these countries. Such information could be used to focus in health and food safety program activities on the factors of greatest importance in causing food borne illness[8] [4].

HACCP study should be combined with socio cultural and socioeconomic data to understand knowledge, attitude, and practices of caregivers in food safety and also socioeconomic barriers to the preparation of safe foods. Thus, combination of findings from HACCP study and socio cultural and economic studies could show the clear benefits in enhancing food safety and preventing food borne diseases because it can shed light on the needs of the caregivers and help formulate appropriate food safety education interventions[9]. This study should be also conducted in different settings (housing, rural, and slum areas) because those areas may have different characteristics in terms of facility and environment condition which made them have different risk of exposure to hazards. And also, children in rural and urban areas consumed significantly different type of food[10] which may have different critical control point.

There are no regulations for the preparation, handling, and storage of food in the home. Home food safety is controlled through the education of the consumer. There are number of studies that have identified the need for continued efforts toward educating consumers on the hazards of improper food handling. The need for enhanced food safety education has been known in developed countries with the launch of national initiatives to find ways to effectively educate consumers, especially the one who prepares food. The changing demographics and lifestyle, as well as emergence of resistant and exceptionally hazardous strains of food borne micro-organisms, create a situation that could lead to major outbreaks of life threatening food borne illness. People of all ages seem to think that they know how to handle food safely, but their self-reported food handling behaviors do not support this confidence[3].

So far, there has been no research regarding HACCP study at home on foods consumed by 6-24 months old children in Indonesia. Therefore, as part of a wider effort to develop a food safety promotion intervention for preventing childhood diarrhea, the study is necessary to be conducted in 3 sub-districts representing housing, rural, and slum areas in Bekasi municipality.

1.3. Research questions

1) What are the 10 foods mostly consumed by 6-24 months old children in Bekasi municipality?
2) How are the flow diagram of those food preparation and handling?
3) What are the hazards of those foods at each step of their preparation and handling?
4) What are the critical control points of those foods?
5) What are the control measures of those foods at each of their critical control points?
6) What are the monitoring procedures of those control measures?
7) How are the food handlers' practices on food preparation and handling related to HACCP study?

1.4. Objectives of the study

1.4.1 General objective

The general objective of the study is to develop HACCP data sheet of selected most consumed food and to investigate the food handlers' practices on food preparation and handling for children aged 6-24 months old in Bekasi municipality.

1.4.2. Specific objectives

1) To assess the 10 foods mostly consumed by 6-24 months in Bekasi municipality
2) To determine the flow diagram of those food preparation and handling
3) To determine the hazards of those foods at each step of their preparation and handling
4) To determine the critical control points of those foods
5) To determine the control measures of those critical control points
6) To determine the monitoring procedure for those control measures
7) To assess food handlers' practices on food preparation and handling related to HACCP study.

1.5. Conceptual framework of food handlers' practices on food preparation and handling

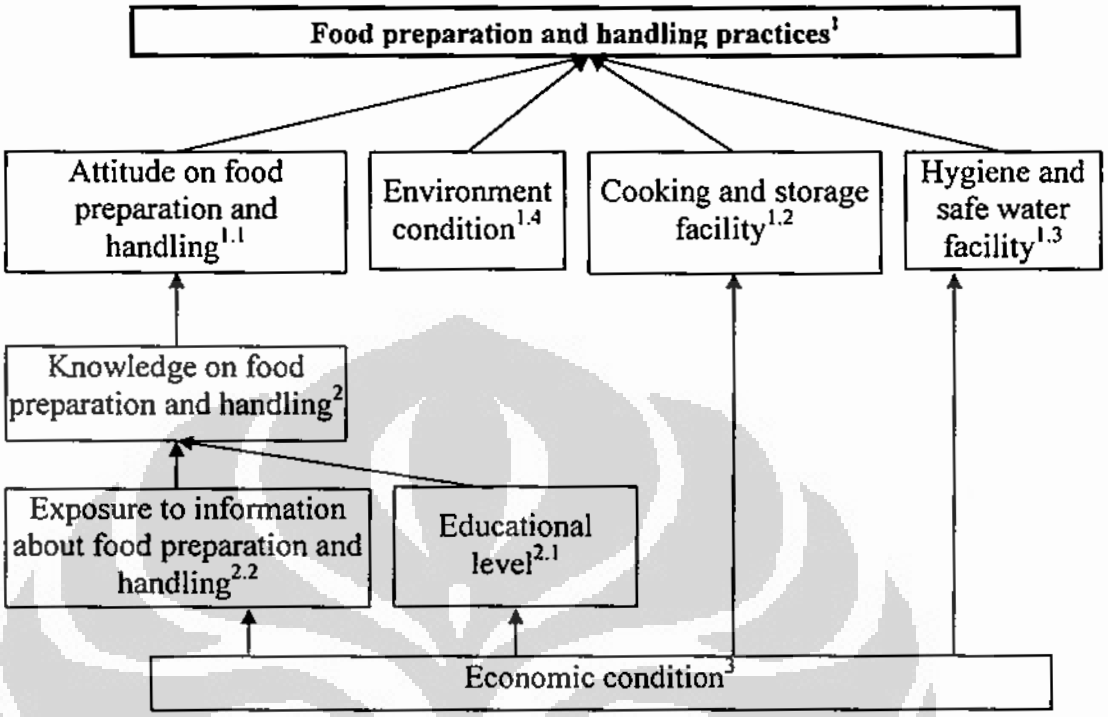


Figure 1.1. Conceptual framework of food handlers' practices on food preparation and handling

1.6. Fact and hypothesis matrix

Table 1.1. Facts and hypothesis matrix of food handlers' practices on food preparation and handling

No	Variables 1	Variables 2	References
1-1.1	food preparation and handling practices	Attitude on food preparation and handling	Nielsen et al., 2001 Ahmed et al., 2001
1-1.2	food preparation and handling practices	Cooking, eating and storage facility	Motarjemi, 2000; Clayton et al., 2002
1-1.3	food preparation and handling practices	Hygiene and safe water facility	Motarjemi, 2000; Clayton et al., 2002
1-1.4	food preparation and handling practices	Environment condition	Motarjemi et al., 1993; Bryan, 1992
1.1-2	Attitude on food preparation and handling	Knowledge on food preparation and handling	Nielsen et al., 2001 Ahmed et al., 2001
2-2.1	Knowledge on food preparation and handling	Educational level	Motarjemi et al., 1993

No	Variables 1	Variables 2	References
2-2.2	Knowledge on food and personal hygiene	Exposure to information about food preparation and handling	Motarjemi et al., 1993
1.2-2.1	Cooking, eating and storage facility	Educational level	Ehiri et al., 2001
2.1-3	Educational level	economic condition	UNICEF, 2000
2.2-3	Exposure to information about food preparation and handling	economic condition	Motarjemi et al., 1993
1.2-3	Cooking, eating and storage facility	economic condition	Motarjemi et al., 1993
1.3-3	Hygiene and safe water facility	economic condition	Motarjemi et al., 1993

PART 2
LITERATURE REVIEW

2.1. The importance of HACCP study of foods for 6-24 months old children

Safe complementary feeding means that foods are hygienically stored and prepared, and fed with clean hands using clean utensils and not bottles and teats. Care must be taken in preparing a child's food at home to ensure that the food is prepared and stored safely[11]. Complementary foods should be clean and safe. When preparing complementary foods it is important to make sure that all utensils are clean. It is recommended to spoon-feed complementary food from a cup or bowl. It is not recommended to give the food in a feeding bottle. If complementary foods are not kept in refrigerator, it is recommended to feed them within 2 hours of preparation. Good complementary foods are clean and safe, meaning no pathogens (i.e. no disease-causing bacteria or other harmful organisms)[12].

Infants and young children are very susceptible to food borne diseases and, if they consume contaminated foods, are likely to contract infections or intoxications leading to illness and often death. While food borne diseases may be caused by either chemical or biological agents, those of biological origin are responsible for a considerable proportion of diarrhea diseases. Numerous studies have shown that foods (including drinking water) prepared under unhygienic conditions are frequently heavily contaminated with pathogenic agents and are a major risk factor in the transmission of diseases, especially diarrhea diseases[5] [9] [13].

During unhygienic food preparation and storage there is a risk of cross-contamination as well as an opportunity for pathogenic bacteria to multiply. There are 2 errors in food preparation that increase the risk because they permit the survival and growth of pathogens to disease-causing levels. The first is preparation of food several hours before consumption combined with its storage at ambient temperatures favors growth of pathogens or formation of toxins or both. The second is insufficient cooling of foods or subsequently, inadequate reheating of food to reduce or eliminate pathogens[9].

To address these errors in hygienic practices there is a need to apply the Hazard Analysis Critical Control Point (HACCP) strategy. This strategy identifies hazards associated with different stages of food preparation and handling, assesses the relative risks, and identifies points where control measures would be effective[9]. The HACCP approach has been useful in defining hazards and ranking risks in the home and could be used as a mechanism for improving consumer awareness of both home hazards and safe home practices[4].

2.2. Safe food preparation and handling practices

Cleanliness is a major factor in preventing food borne illness. Even with food safety inspection and monitoring in producers, the consumer's role is to make sure food is handled safely after it is purchased. Everything that touches food should be clean. There are some steps to help prevent food borne illness by safely handling food in the home. One of them are hand washing. The importance of hand washing cannot be overemphasized. This simple practice is the most economical, yet often forgotten way to prevent contamination or cross-contamination. In the practice, hands should be always washed with warm, soapy water for 20 seconds before and after preparing and handling food; before serving or eating food; before and after handling leftovers; after using the bathroom; after changing a diaper; after tending to a sick person; after blowing nose, coughing, or sneezing; and after handling pets. If hands have any kind of skin abrasion or infection, clean disposable gloves should be always used and hands (gloved or not) should be washed with warm, soapy water[14] [15].

All surfaces that come in contact with raw meat, poultry, fish, and eggs before moving on to the next step in food preparation should be thoroughly washed with hot, soapy water. Other surfaces, such as faucets and counter tops should be kept clean by washing with hot, soapy water. Paper towels or clean cloths should be used to wipe up kitchen surfaces or spills. A solution of 1 tablespoon of unscented, liquid chlorine bleach per gallon of water may be used to sanitize surfaces and utensils. It is recommended to only put food on clean surfaces[14] [15].

Knives, cutting boards, forks, spoons and plates should be used in clean condition. Cutting boards, dishes and utensils should be washed with hot, soapy water after they come in contact with raw meat, poultry, eggs and seafood or after preparing each food item and before going on to the next item. They should be also rinsed and aired or pat dried with clean paper towels. If possible, one cutting board should be used for fresh produce and a separate one for raw meat, poultry, and seafood. Cutting boards can be sanitized with a solution of 1 tablespoon of unscented, liquid chlorine bleach per gallon of water. The surface should be flooded with the bleach solution and allowed to stand for several minutes; the surface should be rinsed and aired or pat dried with clean paper towels. Non-porous acrylic, plastic, glass, and solid wood boards can be washed in a dishwasher (laminated boards may crack and split). Even plastic boards wear out over time. Once cutting boards become excessively worn or develop hard-to-clean grooves, it should be replaced. Either wood or a nonporous surface cutting board such as plastic, marble, glass, or pyroceramic may be chosen. Nonporous surfaces are easier to clean than wood[14] [15].

Same platter and utensils that held the raw product should not be used to serve the cooked product. Any bacteria present in the raw meat or juices can contaminate the safely cooked product. Cooked products should be served on clean plates by using clean utensils and clean hands. When using a food thermometer, it is important to wash the probe after each use with hot, soapy water before reinserting it into a food. Pets, household cleaners, and other chemicals should be kept away from food and surfaces used for food. When picnicking or cooking outdoors, it is recommended to take plenty of clean utensils. It is also recommended to pack clean, dry, and wet and soapy cloths for cleaning surfaces and hands[14] [15].

Cold food such as meat and poultry should be purchased last, right before checkout, when shopping. Raw meat and poultry should be separated from other food in the shopping cart or bag. To guard against cross-contamination which can happen when raw meat or poultry juices drip on other food, packages of raw meat and poultry should be put into plastic bags. Canned goods should be free of dents, cracks or bulging lids. Refrigerated or frozen items should be purchased after

selecting non-perishables. Meat or poultry in packaging that is torn or leaking should be never chosen. Food that has been past the expiration dates should not be bought[16].

It is recommended to go home directly from the grocery store. It is also recommended to take a cooler with ice for perishables. At home, meat and poultry should be placed in the refrigerator immediately. Fresh, pre-stuffed whole birds should be clean first before put it in the refrigerator. Raw meat, poultry, fish, and their juices should be kept away from other food. Juices from raw meat, poultry or seafood should not come in contact with cooked foods or foods that will be eaten raw, such as fruits or vegetables. Raw meat, poultry, and seafood should be put in containers or sealed plastic bags that is recommended for the freezer to prevent their juices from dripping onto other foods in the refrigerator. Raw eggs should be stored in their original carton and refrigerated as soon as possible. The temperature of refrigerator and freezer should be checked with an appliance thermometer. The refrigerator should be at 40°F (4.44°C) or below and the freezer at 0°F (-17.78°C) or below. Fresh poultry, fish, ground meats, and variety meats should be frozen within 2 days; other beef, veal, lamb, or pork, within 3 to 5 days. These short, but safe, time limits will help keep refrigerated food from spoiling or becoming dangerous to eat. Because freezing keeps food safe indefinitely, recommended storage times are for quality only[16].

Food should be taken out from the refrigerator only when it will immediately be used. Food should be kept in the coolest place possible and never left in direct sun. When traveling, food should be packed right from the refrigerator into the cooler immediately before leaving home. Beverages should be packed in one cooler and perishables in a separate cooler. It is not recommended to open the lid too often which lets cold air out and warm air in. An insulated cooler with sufficient ice or ice packs should be used to keep food at 40°F (4.44°C) or below. The cooler should be kept out of the direct sun by placing it in the shade or shelter. Some foods that need to stay cold include: sandwiches or salads made with meat and poultry; tuna and egg salad; milk, cheese, and yogurt; peeled or cut fruits and vegetables[16].

For canned foods, in general, high-acid canned food such as tomatoes, grapefruit, and pineapple can be stored on the shelf for 12 to 18 months. Low-acid canned food such as meat, poultry, fish, and most vegetables will keep 2 to 5 years if the can remains in good condition and has been stored in a cool, clean, and dry place. It is recommended to avoid extreme heat or cold which can be harmful to canned goods. Cans that are dented, leaking, bulging, or rusted should be discarded[16].

Food should be always cooked thoroughly to a safe minimum internal temperature. It is recommended to avoid interrupted cooking. The cooked food should be never refrigerated partially to later finish cooking. Meat and poultry products must be cooked thoroughly the first time and then they may be refrigerated and safely reheated later. A meat thermometer should be used to determine if meat or poultry has reached a safe internal temperature. It should be checked in several spots to assure that a safe temperature has been reached and that harmful bacteria like *Salmonella* and certain strains of *E. coli* have been destroyed. The safe minimum internal temperature for beef, lamb, and veal steaks, roasts and chops is 145 °F (62.78°C). All poultry- whole, pieces or ground, should reach a safe minimum internal temperature of 165 °F (73.89°C). Ground beef, including hamburgers, all cuts of pork, should reach a safe minimum internal temperature of 160 °F (71.11°C). Eggs should be always cooked before eating them. When cooked, eggs should be firm, not runny[16]. Hot food should be held at 140 °F (60°C) or warmer. Cold food should be held at 40 °F (4.44°C) or colder. Perishable food should not be left out more than 2 hours at room temperature (1 hour when the room temperature is above 90 °F (32.22°C) [15].

Any food left out at room temperature for more than 2 hours (1 hour if the temperature was above 90 °F (32.22°C)) should be discarded. Leftover should be placed in to clean, shallow, covered containers and promptly put in the refrigerator or freezer for rapid cooling. The refrigerator should be kept at 40°F (4.44°C) or below. The cold leftovers can be used only within 4 days of storage. Leftovers should be reheated to 165°F (73.89°C) or until hot and steamy. It is recommended to never taste a food to determine if it is safe. If in doubt, it is recommended to throw it out. Foods should be always kept off the floor and

separate from cleaning supplies. Fruits and vegetables should be rinsed with running tap water before eating. If eating away from home, it is recommended to find out if there's a source of clean water. If not, it is recommended to bring water for preparation and cleaning[16].

The color of meat and poultry

Color is important when meat and poultry are purchased, stored, and cooked. The color of meat and poultry can change as it is being stored at retail and in the home. When safely stored in the refrigerator or freezer, color changes are normal for fresh meat and poultry. Change in color alone does not mean the product is spoiled. Color changes are normal for fresh product. With spoilage there can be a change in color—often a fading or darkening. In addition to the color change, the meat or poultry will have an off odor, be sticky or tacky to the touch, or it may be slimy. If meat has developed these characteristics, it should not be used[17].

Optimum surface color of fresh meat (i.e., cherry red for beef; dark cherry-red for lamb; grayish-pink for pork; and pale pink for veal) is highly unstable and short-lived. When meat is fresh and protected from contact with air (such as in vacuum packages), it has the purple-red. When exposed to air, gives meat a pleasingly cherry-red color. However, exposure to store lighting as well as the continued contact with oxygen turns meat into brownish-red. This color change alone does not mean the product is spoiled. Cooked ground beef can be pink inside after it is safely cooked. Because doneness and safety cannot be judged by color, it is very important to use a food thermometer when cooking ground beef[17].

Raw poultry can vary from a bluish-white to yellow. Ground poultry varies in color according to the part being ground. Darker pink means more dark-meat was used and a lighter pink means more white-meat was included (or skin was included). Darkening of bones and meat around the bones occurs primarily in young (6-8 weeks) broiler-fryer chickens. Since the bones have not calcified or hardened completely, pigment from the bone marrow seeps through the bones and into the surrounding area. Freezing can also contribute to this darkening. This is

an aesthetic issue and not a safety one. Safely cooked poultry can vary in color from white to pink to tan. For safety when cooking poultry, use a food thermometer to check the internal temperature[17].

World Health Organization also has 10 golden rules for safe food preparation. WHO data indicates that only small number of factors related to food handling is responsible for a large proportion of food borne disease episodes everywhere. Common errors include:

- preparation of food several hours prior to consumption, combined with its storage at temperatures which favor growth of pathogenic bacteria and/or formation of toxins;
- insufficient cooking or reheating of food to reduce or eliminate pathogens;
- cross contamination; and
- people with poor personal hygiene handling the food.

The 10 golden rules respond to these errors, offering advice that can reduce the risk that food borne pathogens will be able to contaminate, to survive or to multiply. Despite the universality of these causes, the plurality of cultural settings means that the rules should be seen as a model for the development of culture-specific educational remedies. Users are therefore encouraged to adapt these rules to bring home messages that are specific to food preparation habits in a given cultural setting. Their power to change habitual practices will be all the greater. The followings are the 10 WHO golden rules for safe food preparation:

1) Choose foods processed for safety

   While many foods, such as fruits and vegetables, are best in their natural state, others simply are not safe unless they have been processed. For example, it is recommended to always buy pasteurized as opposed to raw milk and, if the choice is available, it is recommended to select fresh or frozen poultry treated with ionizing radiation. When shopping, we should keep in mind that food processing was invented to improve safety as well as to prolong shelf-life. Certain foods eaten raw, such as lettuce, need thorough washing.

2) Cook food thoroughly

Many raw foods, most notable poultry, meats, eggs and unpasteurized milk, may be contaminated with disease-causing organisms. Thorough cooking will kill the pathogens, but remember that the temperature of *all parts of the food* must reach at least 70°C. If cooked chicken is still raw near the bone, it is recommended to put it back in the oven until it's done all the way through. Frozen meat, fish, and poultry, must be thoroughly thawed *before* cooking.

3) Eat cooked foods immediately

When cooked foods cool to room temperature, microbes begin to proliferate. The longer the wait, the greater the risk. To be on the safe side, it is recommended to eat cooked foods just as soon as they come off the heat.

4) Store cooked foods carefully

If we must prepare foods in advance or want to keep leftovers, we should be sure to store them under either hot (near or above 60°C) or cool (near or below 10°C) conditions. This rule is of vital importance if we plan to store foods for more than 4 or 5 hours. Foods for infants should preferably not be stored at all. A common error, responsible for countless cases of food borne disease, is putting too large a quantity of warm food in the refrigerator. In an overburdened refrigerator, cooked foods cannot cool to the core as quickly as they must. When the centre of food remains warm (above 10°C) for too long, microbes thrive, quickly proliferating to disease-causing levels.

5) Reheat cooked foods thoroughly

This is your best protection against microbes that may have developed during storage (proper storage slows down microbial growth but does not kill the organisms). Once again, thorough reheating means that all parts of the food must reach at least 70°C.

6) Avoid contact between raw foods and cooked foods

Safely cooked food can become contaminated through even the slightest contact with raw food. This cross-contamination can be

direct, as when raw poultry meat comes into contact with cooked foods. It can also be more subtle. For example, we should not prepare a raw chicken and then use the same unwashed cutting board and knife to carve the cooked bird. Doing so can reintroduce the disease-causing organisms.

7) Wash hands repeatedly

It is recommended to wash hands thoroughly before start preparing food and after every interruption, especially if we have to change the baby or have been to the toilet. After preparing raw foods such as fish, meat, or poultry, we should wash hands again before start handling other foods. And if we have an infection on the hand, we should be sure to bandage or cover it before preparing food. Household pets are often harbor dangerous pathogens that can pass from hands into food.

8) Keep all kitchen surfaces meticulously clean

Since foods are so easily contaminated, any surface used for food preparation must be kept absolutely clean. Every food scrap, crumb or spot can be as potential reservoir of germs. Cloths that come into contact with dishes and utensils should be changed frequently and boiled before re-use. Separate cloths for cleaning the floors also require frequent washing.

9) Protect foods from insects, rodents, and other animals

Animals frequently carry pathogenic microorganisms which cause food borne disease. Storing foods in closed containers is the best protection.

10) Use safe water

Safe water is just as important for food preparation as for drinking. If we have any doubts about the water supply, it is recommended to boil water before adding it to food or making ice for drinks. We should be especially careful with any water used to prepare an infant's meal.

The World Health Organization regards illness due to contaminated food as one of the most widespread health problems in the contemporary world. For infants, the consequences can be fatal. It is recommended to protect the family by

following these basic rules. They will reduce the risk of foodborne disease significantly[18].

2.3. Hazard Analysis Critical Control Point (HACCP)

HACCP was originally developed by the Pillsbury Company, the National Aeronautics and Space Administration (NASA), and the US Army Natick Laboratories to produce foods with high assurance of safety for use in the space program. It has two components: first, to identify or analyze the hazards associated with the production and processing of a food; and second, to identify critical control points (CCPs) (i.e., the places during processing of a food where proper control measures need to be implemented in order to prevent any risk to consumers). It is regarded as a systemic approach to assure safety and as better than end-product testing[19].

Since the introduction of the concept in 1971, HACCP has undergone several changes according to specific needs. In its simplest form, HACCP consists of seven principles[20]:

1) Conduct a hazard analysis
2) Determine critical control points (CCPs)
3) Establish critical limit(s)
4) Establish a system to monitor control of a CCP
5) Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control
6) Establish procedures for verification to confirm that the HACCP system is working effectively
7) Establish documentation concerning all procedures and records appropriate to these principles and their application

In the more than 30 years since its conception, the Hazard Analysis Critical Control Point system (HACCP) has grown to become the universally recognized and accepted method for food safety assurance. The recent and growing concern about food safety from public health authorities, food industry and consumers worldwide has been the major impetus in the application of the

HACCP system. This concern has been substantiated by a significant increase in the incidence of food borne diseases in many countries during recent years[21].

The HACCP system is a scientific, rational and systematic approach to identification, assessment and control of hazards during production, processing, manufacturing, preparation and use of food to ensure that food is safe when consumed (i.e. it does not present an unacceptable risk to health). With the HACCP system, food safety control is integrated into the design of the process rather than the present ineffective system of end-product testing. Therefore, the HACCP system provides a preventive and thus a cost-effective approach to food safety. In 1993, the Codex Alimentarius Commission endorsed the HACCP system as the most cost-effective approach devised to date for ensuring the safety of food[22].

The HACCP system offers a rational approach to the control of microbiological hazards in foods and avoids the many weaknesses inherent in the inspectional approach and circumvents the shortcomings of reliance on microbiological testing. By focusing attention on the factors that directly affect the microbiological safety of a food, it eliminates wasteful use of resources on extraneous considerations, while ensuring that the desired levels of safety and quality are met and maintained[8].

The HACCP principles can be applied in a variety of ways. The HACCP concept can be used to study food preparation practices, and to identify and assess hazardous behavior, which should be the focus of health education interventions. The additional benefits of the HACCP system among others are as follows[22]:

- The HACCP system allows for the identification of conceivable, reasonably-expected hazards, even where failures have not previously been experienced. It is therefore particularly useful for new operations.
- The HACCP system is sufficiently flexible to accommodate changes introduced, such as progress in equipment design, improvements in processing procedures and technological developments related to the product.
- The HACCP system will help target/direct resources to the most critical part of the food operation.

- The HACCP system is applicable to the whole food chain, from the raw material to the end-product, i.e. growing, harvesting, processing or manufacturing, transport and distribution, preparation and consumption.

2.4. Application of HACCP for food preparation and handling

All links in the food chain, except the consumer, have been urged to adopt the HACCP approach. This inevitably raises the question of whether it is possible or even desirable to try to apply HACCP to domestic food preparations. The approach of HACCP has been applied to more than 108 observations of domestic food preparation since 1981 to analyzing potential hazards in recipe for home used. Some studies on the applicability of HACCP to domestic kitchens have revealed the potential benefits and uses of applying HACCP to the home[23]:

- as a technique in analyzing cases of domestic food borne disease;
- as an auditing tool of domestic procedures to identify errors in everyday domestic food preparation. Such information would provide feedback on consumer practices and could be incorporated into health education programs;
- as an approach or basis for teaching hygiene;
- as the basis for an improved method of writing recipes.

There are some factors to be considered when applying HACCP to the home. The domestic food handler is unlikely to have been trained in food hygiene and may have little or no knowledge of food and its associated hazards and the risks. Levels of good domestic kitchen practice are very variable. Unlike the commercial kitchen or food plant, the domestic kitchen is not a dedicated food production environment. It can serve as a laundry, work room and even living quarters for family pets. These activities may contribute to contamination, restrict working space making it difficult to separate clean and dirty food processes and to clean effectively. Hygiene is often given a low priority in the design of domestic kitchens and equipment. The materials used in construction are often less durable and more difficult to clean than their commercial equivalent. Levels of organic soil on surfaces are likely to be higher than commercial premises. This is likely to

be a reflection of the standards of construction, cleaning programs and cleaning equipment available to commercial food producers[23].

In the domestic kitchen, a wide range of food products is handled using a variety of production techniques. There are wide varieties of end products. Often precise statements can be made about the product end use. Food service systems including cook-serve, cook-chill and cook-freeze can be used separately or combined on an *ad hoc* basis. Unlike commercial operations which use standardized recipes, continuous production and production schedules, domestic food operations are often individual to that unique meal. Only general flow diagrams can be constructed, work flow is often extremely variable[23].

The domestic kitchen unless preparing food for commercial reasons, is exempt from legislation. Access for people concerned with carrying out the HACCP (e.g. health officers) can be difficult. A team can be used to construct a strategy and method but implementation and evaluation will often be by individuals[23].

Application of the decision tree is also not so easy. It is more difficult to have confidence in future steps eliminating or reducing a hazard. This is due to the variable nature of the environment, equipment and the critical limits and target values. The individual and variable nature of production plus a different type of environment require the application of HACCP, as a quality assurance technique, to be more flexible than the very specific product, process and plant application found in food manufacturing. This is particularly true in the realistic setting of control measures and limits which can be much more difficult to monitor in the domestic kitchen and monitoring equipment is generally unavailable. It is only possible to use simpler documentation if at all[23].

The application of HACCP system to the domestic kitchen presents unique challenges due to the lack of well-defined food flow diagram, and wide variety of knowledge, practices, equipment, and environment condition. In those situations, the application of HACCP system is far more complicated due to the difficulty of controlling basic sanitary standards resulting in an increased number of CCPs to prevent or reduce risks of cross-contamination and recontamination of foodstuffs[24].

Thus, in these situations, HACCP should be used as a means of managing food safety, highlighting the importance of CCPs and monitoring operations, rather than strictly complying with the seven principles defined for the food industry[24].

Based on study on critical control points of complementary food preparation and handling in Eastern Nigeria, the followings are example of flow diagram and HACCP data sheet of *jolloff* rice preparation and handling (**Table 2.1** and **Figure 2.1**).

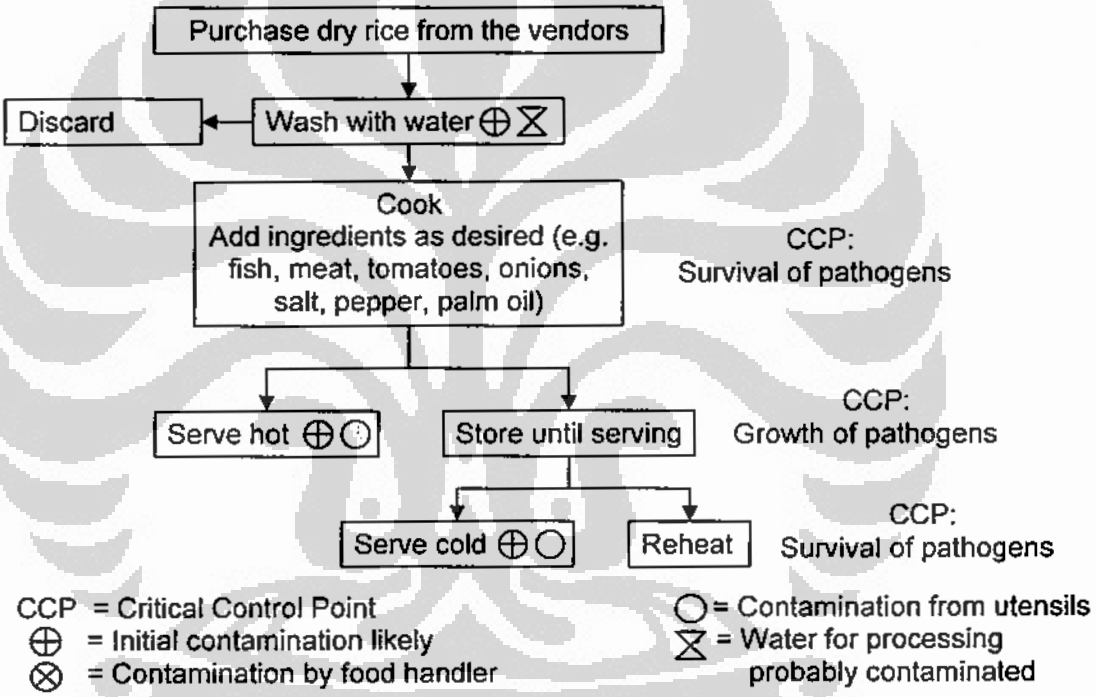


Figure 2.1. Flow diagram of *jolloff* rice

[1]

Table 2.1. HACCP data sheet of *jolloff* rice

Hazards	CCPs	Control measures	Monitoring
Enteric pathogens and spores of potential pathogens	Cooking	Cook thoroughly	Ensure cooking is thorough by checking for color changes, particularly of fish, meat, or other added microbiologically sensitive ingredients
	Storage	Serve as soon as prepared	Check appearance of food for spoilage and hygiene quality, and limit storage time
	Reheating	Reheat thoroughly	Reheat thoroughly for a reasonable length of time, and check for indication of heat, e.g. bubbling

[1]

One might expect considerable variation in food preparation practices in individual homes, but the types of food, fuel and energy sources, cooking facilities, economic resources and cultural influences often result in considerable uniformity within sub-groups of a society. Therefore, the HACCP approach can be used to obtain information about hazards associated with preparation and storage of foods in homes, to assess risks, and to identify critical control points. Furthermore, those data and practices that entail a high risk generated from such analyses can be disseminated in food safety education intervention[8].

2.5. Hazards (microbiological food borne pathogens) in food

The sources of food contamination are varied (**Figure 3**). They include night soil, polluted water, flies, pests, domestic animals, unclean utensils and pots, food handlers (eg, soiled hands), dust, and dirt. Raw foods themselves are frequently a source of contaminants as some may naturally harbor pathogens or come from infected animals. Moreover, during food preparation and storage there is an added risk of cross-contamination as well as an opportunity for pathogenic bacteria to multiply. A careful analysis of food borne diseases has shown that in particular 2 errors in food preparation increase the risk because they permit the survival and growth of pathogens to disease-causing levels. The first is the preparation of food several hours before consumption, which, combined with its

storage at ambient temperatures favors growth of pathogens or formation of toxins, or both. The second error is that of having insufficient cooling of foods or subsequently, inadequate reheating of food to reduce or eliminate pathogens[9].

Bacterial hazards examples are pathogenic *Escherichia coli*; *Salmonella*; *Listeria monocytogenes*; *Campylobacter* and *Arcobacter*; Enterotoxin-producing *Staphylococcus*, *Shigella*, *Yersinia*, *Vibrio*, *Aeromonas* and *Plesiomonas*; spore-forming bacteria e.g. *Clostridium botulinum*, *Clostridium perfringens*, *Bacillus* sp.. Non-bacterial and emerging food borne pathogens examples are: viruses; parasites e.g. *Cryptosporidium*, *Giardia*, *Cyclospora*; toxigenic fungi; *Mycobacterium paratuberculosis*[25].

Various pathogens have been identified causing diarrhea diseases. Some of these include bacteria such as *Escherichia coli*, *Shigella* spp., *Salmonella* spp., *Vibrio cholerae* 01 and *Campylobacter jejuni*; protozoa such as *Giardia lablia*, *Entamoeba histolytica*, *Cryptosporidium* spp.; and also enteric viruses such as rotavirus. In addition, *Bacillus cereus*, *Staphylococcus aureus*, *Clostridium perfringens*, and helmints are common food borne pathogens that cause diseases frequently accompanied by diarrhea[5]. The infectious doses vary from less than 10 to more than 10^6 organisms[26].

Based on study of commonly used local complementary foods in North Western Nigeria, the microbiological analyses showed that unacceptable level of *Salmonella* and *Shigella* were detected in some of the samples. Results also indicated the predominance of *Staphylococcus* sp. and fungi and molds, which showed that the levels of contamination of some of the samples are very high when compared to International Standards. There is also presence of E. *coli* detected in the samples[26]. Based on the study of characterization and quantification of bacterial pathogens and indicator organisms in household kitchens with and without the use of a disinfectant cleaner, shows that normal kitchens can easily be contaminated with a variety of bacterial contaminants including fecal coliforms, E. *coli*, *Salmonella*, and *Campylobacter*[27].

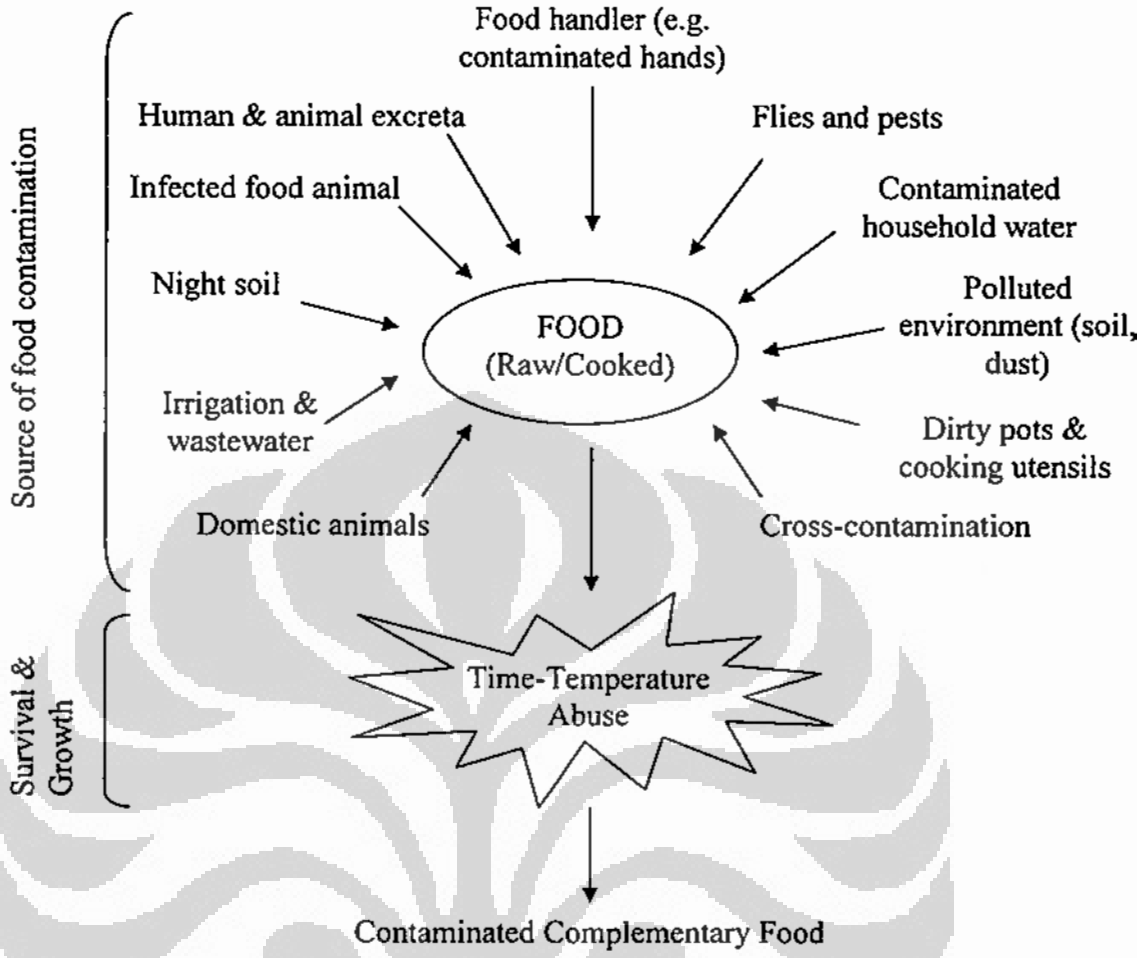


Figure 2.2. Source of food contamination

[9]

The presence of fungi in a food product is undesirable and has been implicated in food poisoning illness and also known as spoilage microorganisms. The presence of *Staphylococcus* sp., could as a result of processors handling while the presence of coliform is an indication of fecal contamination[26]. A study of complementary food preparation and handling in Eastern Nigeria also confirmed the presence of enteric pathogens and that the exotoxin of *Staphylococcus* sp. is associated with food poisoning and spores of pathogens with handlers[1]. High levels of pathogens such as *Staphylococcus, Salmonella, Shigella,* and E. *coli* are sometimes found in traditional foods after processing under unhygienic conditions. The coliforms may include strains of E. *coli* which is heat stable form,

as the virulence factor of enterotoxigenic E. *coli* strains which can withstand 100°C for 15 minutes[26].

2.5.1. *Escherichia coli*

E. *coli* is commonly used as surrogate indicator and its presence generally indicates fecal contamination in water sources and milk. Typically, they are intestinal parasites of humans and animals, though some species may occur in other parts of the body, on plants and in the soil and many species are pathogenic. Substantial number of E. *coli* in food suggests a general lack of cleanliness in handling and improper storage. The presence of E. *coli* in ready-to-eat foods is undesirable because it indicates poor hygienic condition which has led to contamination or inadequate heat treatment. **Table 2.2** indicates some of the key growth-limiting parameters for pathogenic E. *coli*[25].

Table 2.2. Growth-limiting parameters for pathogenic E. *coli*

	Minimum	Optimum	Maximum
Temperature (°C) E. *coli* (all types)	7-8	35-40	44-46
VTEC 0157:H7	6.5	37	44-45
pH pathogenic E. *coli*	4.4	-	9.0
a_w pathogenic E. *coli*	0.95	-	-
Sodium chloride Pathogenic E. *coli*	Grows vigorously in 2.5% NaCl Grows slowly in 6.5% NaCl Does not grow in 8.5% NaCl		

[25]

Ideally E. *coli* should not be detected and as such a level of <3 g^{-1} (the limit of the Most Probable Number test) has been given as the satisfactory criteria for this organism. Levels exceeding 100 g^{-1} are unacceptable and indicate a level

of contamination which may have introduced pathogens or that pathogens, if presence in the food prior to processing, may have survived[26].

There were some incidences of VTEC reported in some raw and processed meat and poultry products. Some foods also associated with outbreaks of illness caused by pathogenic E. *coli* e.g. water, cheese, mayonnaise; canned salmon; sandwiches; beef; yoghurt; hamburgers; sausage; white radish sprouts; lettuce; cream; fruit juices. Historical outbreaks indicate that the factors likely to be associated with increased risk of E. *coli* infection include all of the following:

- Raw material or product exposed to contamination from bovine origin (meat or feces)
- Product manufactured with no processing stage capable of destroying the organism, e.g. cooking
- Product exposed to post-process contamination
- Product sold as ready to eat
- Contact with an infected individual or animals.

Cooking temperature applied to destroy E. *coli* O157 and VTEC vary depending on the product type. Cooked foods such as meat are heat processed to achieve a minimum process of 70°C for 2 minutes. Studies have demonstrated that this process is sufficient to significantly reduce (>6 log cfu/g) the levels of contaminating enteric pathogens including VTEC O157[25].

2.5.2. *Salmonella*

The family Enterobacteriaceae includes many bacteria that are found in the human or animal intestinal tract, including human pathogens such as *Salmonella* and *Shigella enterobacteriaceae* are useful indicators of hygiene and of post-processing contamination of heat processed foods. Their presence in high numbers ($>10^4$ per gram) in ready-to-eat foods indicates that an unacceptable level of contamination has occurred or there has been under processing like inadequate cooking. Ready-to-eat foods should be free of *Salmonella* as consumption of food containing this pathogen may result in food borne illness. The presence of this organism indicates poor food preparation and handling practices such as inadequate cooking or cross contamination[26].

Some *Salmonella* serotypes are specifically host-related, for example, S. *Gallinarum* and poultry, S. *Choleraesuis* and swine, and S. Typhi and S. Paratyphi A and human. Chicken and eggs, two of the most commonly consumed foods in many countries, are, year after year, among the most common food types implicated in food poisoning outbreaks reported in many countries. However, other foods were also associated with outbreaks of illness caused by *Salmonella* e.g. raw meat, apple cider, raw milk, cheese, pasteurized milk, chocolate products, salami sticks, mayonnaise, cooked meats, tiramisu, orange juice, cantaloupe, fresh tomatoes, sprouts, mung bean sprouts, ice cream[25].

Salmonella is readily destroyed by heat in foods with a high water activity (**Table 2.3**), e.g. ≥0.98 but in foods materials with a low water activity, e.g. high fat content, much higher temperatures are needed to kill the organism. In frozen foods or those in which the water activity is low, *Salmonella* has been shown to survive for many months, even years. Although the growth of *Salmonella* is believed to be controlled by low (refrigeration) temperatures and industry relies heavily on refrigerated storage of fresh foods to maintain their safety in relation to pathogen outgrowth, there have been some reports of growth of *Salmonella* in shell eggs at 4°C and in minced meat and chicken parts at 2°C. Some of these reports are, as yet, unconfirmed other than by observation of growth on microbiological media[25].

Common underlying causes of food borne outbreaks of Salmonellosis include[25]:

- Contamination of the primary food raw materials, often from direct or indirect animal fecal contamination or cross contamination from a contaminated source
- Production processes with no stage that reduces or destroys the organism, e.g. cooking
- Product is exposed to post-process contamination through poor personal or equipment hygiene practices
- Product is consumed with no destruction/reduction process applied by the consumer, i.e. it is ready to eat.

Table 2.3. Limits for the growth of *Salmonella* under otherwise optimal condition

	Minimum	Maximum
Temperature (°C)	5.2	46.2
pH	3.8	9.5
Water activity	0.94	>0.99

[25]

The application of high temperature in cooking or pasteurizing foods is one of the best means by which to destroy *Salmonella*. The organisms are readily destroyed by moist heat and temperatures designed to destroy pathogenic E. *coli* will equally destroy (>6 log reduction) *Salmonella*, i.e. 70°C for 2 minutes for meat and 71°C for 15 seconds for milk. Application of heat to destroy organisms in low moisture environments, i.e. chocolate, peanut butter where water activity is very low requires much longer times or higher temperatures (**Table 2.4**) [25].

Table 2.4. D-values for *Salmonella* in some food substrates

	Temperature (°C)	D-value
Milk (sterile, homogenized)	68.3	0.28-10 s
Ground beef	63	0.36 min
Milk chocolate	71	4.5-6.6 h depending on serotype
Liquid whole egg	60	0.55-9.5 min depending on pH and serotype

[25]

2.5.3. *Listeria monocytogenes*

The occurrence of L. *monocytogenes* was reported in raw and processed foods such as cheese, raw chicken, raw beef, seafoods, raw vegetables including bean sprouts, cabbage, cucumber, potatoes, pre-packed salads, radish, salad vegetables, and tomatoes. **Table 2.5** indicates the growth-limiting temperature, pH and water activity for L. *monocytogenes*[25].

L. *monocytogenes* is readily destroyed by pasteurization temperatures applied to meat, which in the UK are specified as 70°C for 2 minutes. The factors

that appear to elevate the risk in relation to the potential for a food product to cause outbreaks of llisteriosis include all of the following[25]:

- Raw material or product exposed to contamination
- Product manufactured with no processing stage capable of destroying the organism, e.g. cooking
- Product with little or no preservation factors e.g. neutral pH, low salt, high moisture
- Product exposed to post-process contamination
- Product sold with long shelf life under chilled conditions
- Product sold as ready to eat.

Table 2.5. Growth-limiting parameters for *Listeria monocytogenes*

	Minimum	Maximum
Temperature (°C)	-0.4	45
pH	4.39	9.4
Water activity (a_w)	0.92	-

[25]

2.5.4. *Campylobacter*

C. *jejuni* is now regarded as one of the leading cause of bacterial food borne infection in many developed countries and is responsible for 80-90% of campylobacteriosis. C. *jejuni* is associated with warm-blooded animals, but unlike *Salmonella* and E. *coli* does not survive well outside the host. C. *jejuni* is susceptible to environmental conditions and does not survive well in food and is, therefore, fortunately relatively easy to control. It is able to grow best between 37 and 42°C and their inability to grow at 25°C. Survival of C. *jejuni* outside the gut is poor, and the organism is sensitive to drying, freezing and low pH (pH≤4.7). C. *jejuni* fails to grow in the presence of 2% NaCl. It survives a few hours at 37°C and several days at 4°C. The decimal reduction time for *Campylobacter* is 1 min at 55°C[25].

2.5.5. *Staphylococcus*

Staphylococci are predominantly of animal origin, although isolation of some species may be made from environmental sources. They may be present as part of the normal micro flora of humans and other animals, S*t. aureus*, being carried on skin and nasal cavities of the healthy human population. Although it may be isolated from a wide range of foods, its presence is usually of little significance. Exposure is associated with specific types of foods, primarily those whose production, or handling, has a significant risk of contamination with S*t. aureus*, which supports rapid growth of the organism and which is stored at suitable temperatures for growth (usually above 15°C). Main types of food involved are as follows[25]:

- Re-contaminated, heat-processed foods. The same risk applies to foods which have been processed by ionizing radiation, high pressures and other "novel" treatments due to the absence of a competitive micro flora. Examples of foods are sliced cooked meats, cream cakes, canned products. Risk is enhanced where a high level of handling is involved.
- Fermented foods, where slow acidification permits growth of S*t. aureus* during fermentation. Examples are salamis and cheese. Risk is enhanced where starter cultures are not used, or are poorly controlled.
- Dried and intermediate moisture products, where growth of S*t. aureus* is favored at some stage in processing, or storage, by a combination of temperature and reduced a_w. Examples are dried milk powder, pasta, griddle bakery products.

S*t. aureus* is not heat resistant and is destroyed at temperatures normally used in food processing, including milk pasteurization and the recommended process severity for meats. The organism is also destroyed at treatment levels proposed for most other means of processing food for safety, such as irradiation. S*t. aureus* is relatively resistant to high-pressure processing. The prime control of growth prevention is efficient refrigeration, the lowest recorded temperature for growth of S*t. aureus* being 7°C, however it is generally resistant to preservatives such as NaCl. It is able to grow in vacuum and modified atmosphere packs[25].

2.5.6. *Clostridium*

Clostridium species can only sporulate under anaerobic condition. It is widely distributed in soils and, fresh water and marine sediments. The minimum growth temperature is 10°C, optimally 35-40°C. the minimum pH and a_w for growth are 4.7 and 0.94 with 10% NaCl. Thermal process of 0.2 minutes in 121°C and 25 minutes in 100°C are able to eliminate spores of *Cl. Botulinum*. Incidence of botulism mentioned in a well-researched case in the UK involved substitution of high levels of sugar by an intense sweetener in the preparation of a hazelnut flavoring for yoghurt without consideration of the resulting high a_w and altering the pasteurization process to a full 12-D canning process (i.e. a 12 log reduction of *Cl. Botulinum* spores). Similarly, inclusion of fresh herbs and spices in oils, such as garlic in oil, is risky as shown by cases in the USA and Canada. Most cases arise from home-prepared foods such as home-canned vegetables (e.g. in USA), improperly salted or lightly cooked fish, or improper time and temperature of holding after cooking[25].

Cl. Perfringens has quite a high optimum temperature for growth, 43-45°C, and will continue to grow to 50°C. Growth slows significantly below 15°C and ceases at 12°C. Vegetative cells of *Cl. Perfringens* are not particularly tolerant of low temperatures, refrigeration or freezing resulting in death. Spores are more resistant to low temperatures and may survive in chilled or frozen cooked foods, only to germinate and begin rapid growth on reheating the food. *Cl. Perfringens* is not particularly tolerant of low a_w or low pH values. For complete inhibition of growth, 6-8% salt is required. Prevention of food poisoning must minimize cross contamination from soil and fecal material[25].

2.5.7. *Bacillus* spp.

Bacillus cereus is sporulating readily only in the presence of oxygen, and is widely distributed in the environment. The resistance of the spores to adverse environmental conditions and the ability to produce a range of food-degrading enzymes enable it to survive and grow well in many different conditions. B. *cereus* has an optimum temperature for growth of 30-35°C, although some strains grow at temperatures down to 5°C. Germination will occur during cooling of

boiled rice (at 55-60°C) with rapid generation of vegetative cells on further cooling. Although B. *cereus* is not generally regarded as tolerant of low pH and a_w values, it will grow in boiled rice with a_w value of 0.91[25].

These organisms are frequently found in dried foods, e.g. spices, farinaceous ingredients, milk powders, as heat resistant spores. On rehydration of such foods, spores will germinate and begin to grow under suitable conditions. Germinated spores can be readily killed by pasteurization, but it is known that not all spores will germinate at the same time. Control consists of limiting germination of spores and more importantly limitation of opportunities for growth, by temperature, low a_w or pH values or combinations of these. If it is necessary to store cooked foods, then rapid cooling and chill storage will minimize growth. For example, rice should be cooked in small quantities, cooled quickly, preferably by cold water either poured through the rice or submersion of the cooking container in cold water, and storage in a refrigerator once cool. Some strains may continue to grow at temperatures down to 5-8°C, the growth rate is very low[25].

2.5.8. Molds

Molds are found in virtually every environment and can be detected, indoors and outdoors, year round. Mold growth is encouraged by warm and humid conditions. Outdoors, they can be found in shady, damp areas or places where leaves or other vegetation are decomposing. Indoors, they can be found where humidity levels are high. Molds form spores which, when dry, float through the air and find suitable conditions where they can start the growth cycle again. Molds most often found on meat and poultry are *Alternaria, Aspergillus, Botrytis, Cladosporium, Fusarium, Geotrichum, Monilia, Manoscus, Mortierella, Mucor, Neurospora, Oidium, Oosproa, Penicillium, Rhizopus* and *Thamnidium*. These molds can also be found on many other foods. Few molds, in the right conditions, produce mycotoxins, poisonous substances that can make people sick. While most molds prefer warmer temperatures, they can grow at refrigerator temperatures, too. Molds also tolerate salt and sugar better than most other food invaders[28].

Cleanliness is vital in controlling mold. Mold spores from affected food can build up in refrigerator, dishcloths, and other cleaning utensils. It is recommended to clean the inside of the refrigerator every few months with 1 tablespoon of baking soda dissolved in a quart of water and rinse with clear water and dry. We should scrub visible mold (usually black) on rubber casings using 3 teaspoons of bleach in a quart of water. It is recommended to keep dishcloths, towels, sponges, and mops clean and fresh. A musty smell means they're spreading mold around. We should discard items that can't clean or launder and keep the humidity level in the house below 40%. When serving food, it is recommended to keep it covered to prevent exposure to mold spores in the air. We should use plastic wrap to cover foods that stay moist e.g. fresh or cut fruits and vegetables, and green and mixed salads. It is recommended to empty opened cans of perishable foods into clean storage containers and refrigerate them promptly. We should not leave any perishables out of the refrigerator more than 2 hours. It is recommended to use leftovers within 3 to 4 days so mold doesn't have a chance to grow[28].

2.6. Potential critical control point of food

A CCP is a point, step, or procedure at which control can be applied and a food safety hazard can be prevented, eliminated, or reduced, to acceptable levels. The potential hazards that are reasonably likely to cause illness or injury in the absence of their control must be addressed in determining CCPs. Critical control points are located at any step where hazards can be either prevented, eliminated, or reduced to acceptable levels. Points in food preparation that may be CCPs may include thermal processing/cooking, chilling, specific sanitation procedures, product formulation control, prevention of cross contamination, and certain aspects of food handler and environmental hygiene. CCPs must be carefully developed and documented. In addition, they must be used only for purposes of product safety. For example; a specified heat process/cooking, at a given time and temperature designed to destroy microbiological pathogens, could be a CCP. Likewise, refrigeration of a precooked food to prevent hazardous microorganisms from multiplying could also be a CCP[29].

Different facilities preparing the same food can differ in the risk of hazards and the points, steps, or procedures which are CCPs. This can be due to differences in each facility such as layout, equipment, selection of ingredients, or the process that is used. Generic HACCP plans can serve as useful guides; however, it is essential that the unique within each facility be considered during the development of a HACCP plan[29].

Certain processes or handling practices by consumers in the home have been identified as being essential or critical in preventing food borne illness. These practices, which prevent or control the microbial contamination associated with food borne illness, are under the direct control of the consumer, from food acquisition through disposal. The potential CCPs of food at home may include purchasing, storing, preparation, cooking, and handling leftovers (e.g. reheating). Failure to take appropriate action at these critical points could result in food borne illness[30].

2.7. Food borne diseases prevention intervention through HACCP approach

Food borne diseases manifest themselves through a wide a range of symptoms, e.g., diarrhea, vomiting, abdominal pain, fever, and jaundice with potentially severe and long-lasting damage to health. Food borne infections can cause anorexia. A poor food intake, aggravated by the loss of nutrients from vomiting, diarrhea, malabsorption, and fever over an extended period of time, will lead to nutritional deficiencies with serious consequences for the growth and immune system of infants and children[5].

Food borne diseases can cause severe and or long lasting damage to health, including acute, watery and bloody diarrhea (leading to severe dehydration or ulceration), meningitis, as well as chronic diseases affecting the renal, articular cardiovascular, respiratory, and immune systems. However, the most serious implications of food borne infections are their effects on nutritional status[5].

Traditionally, poor sanitation and a contaminated water supply have been considered the major cause of diarrhea diseases. There is a need to reexamine this issue from a wider perspective where factors related to food and its preparation are equally and adequately considered[9]. Maternal practices related to hygiene,

sanitary food preparation, and appropriate weaning practices are potentially all important determinants of diarrhea disease incidence[31]. In regard to these maternal practices, there are a number of factors that lead to poor hygienic practices during food preparation and handling[9], such as:

- Food habits and beliefs. In many instances caregivers are not fully aware of the principles of food hygiene, or fail to recognize the relationship between diarrhea and food contamination. Customary practices are also sometimes incompatible with the principles of food safety.
- Inadequate supply of water and lack of sanitation facilities increases the likelihood of food contamination.
- Food shortage or poverty. The availability or low price of food is given priority to the detriment of quality and the safety aspects often neglected.
- The shortage of fuel and the lack of cold storage facilities and time results in the preparation of large quantities of food, which is often insufficiently cooked and stored at ambient temperatures and consumed at subsequent meals throughout the day.

To address these problems, well-designed programs for health education in food safety of food handlers through health workers is fundamental. The Integrated Management of Childhood Illness (IMCI) strategy to reduce childhood mortality and morbidity includes interventions within three areas: 1) improving health worker skills; 2) strengthening the health system; and 3) improving family and community practices. In improving family and community practices, the importance of the key practices for child health is well accepted and there is growing interest in community approaches[32]. These may hold enormous promise for the low-cost, culturally acceptable, effective prevention of diarrhea disease. Indeed, one study from Bangladesh suggests that appropriate behavioral interventions can have a moderate impact on diarrhea disease incidence[30]. The design of such programs should focus on critical control measures during food preparation and should take into consideration the socio cultural and socioeconomic factors leading to food borne diseases[9].

Therefore the food preparation habits of food handlers should be studied using the Hazard Analysis and Critical Control Point system (HACCP) as a

methodology and investigating the socio cultural and socioeconomic factors through anthropological studies[9]. So, control can be directed at specific stages of preparation and handling that are crucial in ensuring the safety of food[8]. Thus, HACCP could be adapted to improve food service processes by looking at hazards, processes or food handling practices and identifying critical control points, or steps in the kitchen, where failure to take appropriate action is most likely to result in food-borne diseases[4].

Worldwide, it is recognized that the application of the Hazard Analysis and Critical Control Point (HACCP) system through out the food-chain has clear benefits and the potential of enhancing food safety and preventing many cases of food borne diseases. Also, experiences gained in some countries indicate that application of HACCP systems leads to more efficient prevention of food borne diseases[22].

PART 3
METHODOLOGY

3.1. Variables indicators matrix (VIM)

Table 3.1. Variable indicators matrix (VIM) of HACCP study

No	Variables	Indicators	Method	References
1	Type of food	10 type of most consumed food	Interview	Ehiri et al., 2001 Bryan, 1992
2	Food preparation and handling	Flow diagram of food preparation and handling	FGD	Ehiri et al., 2001 Bryan, 1992
3	Hazard analysis	Potential risk toward the present of foodborne pathogens and spores of pathogens in the food	Literature review	Ehiri et al., 2001 Bryan, 1992
4	Critical control points (CCPs)	Step in the flow diagram of food preparation and handling which can control the potential hazard until safe level	CCP decision trees	USDA, 1998
5	Control measures	Activity to control hazard at particular CCP	Literature review	Ehiri et al., 2001 Bryan, 1992
6	Monitoring procedures	Activity to ensure CCP is always under control	Literature review	Ehiri et al., 2001 Bryan, 1992

Table 3.2. Variable indicators matrix (VIM) of food handler's practices

No	Variables	Indicators	Method	References
1	Food preparation and handling practices	• storing cooked food practice • feeding practice • safe water source for drinking and uncooked food • washing fruit practice • through cooking practice • reheating practice • practice on buying package food	• Interview	Motarjemi, 2000 Bryan, 1992 Ehiri et al., 2001 Michanie et al., 1987 Dalgic and Belibagh, 2008

No	Variables	Indicators	Method	References
		• prepare child's food during illness • environment condition • practice on adding ingredient after heat treatment		
1.1	Attitude on food preparation and handling	Attitude on: • Thorough cooking • Feeding practice • Cross contamination • Handling frozen food • Storing cooked food • Reheating food • Following food label instructions • Place of purchasing food • Washing fruit and vegetables • Proper washing hands practice • Proper drying hands practice • Preparing or handling food while suffering from illness • Cleaning cooking and eating utensils	Interview	Ahmed et al., 2001 WHO, 2005 Redmond et al., 2004 Cogan et al., 2002 Cogan et al., 1999 Scott and Bloomfield, 1993 Mylius et al., 2007 Montville et al., 2001 Odwin and Badrie, 2008 Michaels et al., 2002 Carrasco et al., 2008 Clayton et al., 2003
1.2	Cooking and storage facility	• Type of kitchen • Type of kitchen work surface • Type of kitchen floor • Type of kitchen wall • Type of kitchen ceiling • Type of cooking fuel • Borrowing cooking facility • Hot water storage • Drinking water storage • Ownership of refrigerator • Separate cooked food storage • Drinking water storage	Interview, observation	Ehiri et al., 2001 Bryan, 1992 Mensah and Tomkins, 2003 Michanie et al., 1987

No	Variables	Indicators	Method	References
		• Cooked food storage • Cooked rice storage • Eating utensils storage • Cooking utensils storage		
1.3	hygiene and safe water facility	• Water source for uncooked food preparation • Drinking water sources • Reboil gallon refill water • Hot water preparation from dispenser • Water source for cleaning eating utensils • Water source for washing fruits • Dish washing soap • Clothes detergent/soap • Hand washing/bath soap • Floor cleaning agent • HH defecation place • Child defecation place • Latrine ownership • Latrine condition • Time of garbage disposal • Garbage disposal services/treatment	Interview, observation	Ahmed et al., 2001 Ehiri et al., 2001 Bryan, 1992 Mock et al., 1993 Michanie et al., 1987
1.4.	Environment condition	• Sunlight enter kitchen • Garbage in the kitchen • Garbage outside the house • Animal in the kitchen • Animal enter kitchen: rat • Dirty cooking utensils in the kitchen • Dirty eating utensils in the kitchen • Garbage bin cover (inside the house) • Garbage bin cover (outside the house)	Observation	Motarjemi, 1993; Bryan, 1992

No	Variables	Indicators	Method	References
		• Garbage bin (inside the house) • Garbage bin (outside the house) • Kitchen door condition • Kitchen window condition • Kitchen ceiling condition		
2	Knowledge on food preparation and handling	Knowledge about: • Cooked food storage and reheating • Washing hands • Drying hands • Washing fruits before eating • Thorough cooking • Addition of ingredients after heat treatment • Cleanliness of place of purchasing • Read expire date • Observe broken package • Package food storage • Washing dishes	Interview	Nielsen et al., 2001 Ahmed et al., 2001 Motarjemi et al., 1993 WHO, 2005 Altekruse et al., 1995 Omemu and Aderoju, 2008 McCarthy et al., 2007
2.1	Educational level	Level of formal education (school attended)	Interview	Mock et al., 1993
2.2	Exposure to information about food preparation and handling	Receive information about: • washing hand with soap • proper dish washing • washing fruit • ownership of TV • ownership of radio	Interview	Gross, 1997 Odwin and Badrie, 2008
3	Economic condition	• Total expenditure of HH	Interview	Gross, 1997 Mock et al., 1993 Michanie et al., 1987

3.2. Area and subjects of the study

Population of children aged less than 5 years old in Bekasi municipality in 2007 was 7.2% or around 155110 children. The incidence of diarrhea in Bekasi municipality based on 31 health centers report in 2007 was 12.54%[7]. Bekasi municipality has 12 sub-districts which consist of 56 villages where 416118 households lived based on Bekasi municipality monographic data of villages in 2006. This study was conducted in 3 sub-districts in Bekasi municipality which represent the housing, rural, and slum areas. The subjects of the study are children aged 6-24 months old who live in those 3 sub-districts in selected villages.

The selections of which sub-district represented the housing area were based on local government data on percentage of area of land used for house compounds. There are some housing complexes located in Jatisampurna sub-districts: Perumahan Kranggan Permai, Perumahan Polri, Perumahan Wahana, Perumahan Bumi Eraska, Perumahan Permata Cibubur, Perumahan Wika. In **Table 3.3**, Jatisampurna sub-district has the highest percentage (83.87%) of house compounds compared to other sub-districts in Bekasi municipality[33]. Therefore, Jatisampurna sub-district represented the housing area of this study.

The selection of which sub-district represented the rural area were based on local government data on wetland and dry land used as agricultural area. As shown in **Table 3.3**, Jatiasih sub-district has the largest wetland and dry land used as agriculture area (32.12%) compared to other sub-districts in Bekasi municipality. The land which was used for paddy field was 10 Ha. The land which was used for crop cultivation was 803 Ha. The area of water pond in Jatiasih was 14 Ha[33]. Therefore, Jatiasih sub-district represented the rural area of this study.

Bantar Gebang sub-district is the place for garbage disposal[33]. From 8 villages in Bantar Gebang, there are 3 villages which become garbage disposal location: Ciketing udik, Cikiwul, and Sumur Batu villages with total area of 108 Ha. Therefore the study in Bantar Gebang was conducted only in those 3 villages of garbage disposal location. Garbage has become economic commodities and source of income for the communities in those 3 villages. The communities contribution in the garbage processing activities were quite significant, however the garbage processing activities by the communities have not yet considered the

hygienic aspect which shown by the flies population which was above the appropriate level. Some researches mentioned that the garbage disposal activities in those 3 villages have resulted in negative effect to the quality of water, soil, and public health. Bad environment quality influenced the health of the community especially young children. It becomes worst by the involvement of the young children help their parents in collecting garbage. Some diseases which infected the communities in these 3 villages were ARI, skin infection, diarrhea, dysentery, pneumonia, ear infection. The air in these 3 villages has been polluted by increased gas concentration and bad smell as a result of garbage processing activities. The river has also been polluted which brought negative effect to the agricultural land and the communities activities in the river. Based on research about the water quality in the well of these villages showed that the water pH was 6 and the water was colored. Besides that there were also found *Escherichia coli* and *Salmonella typhi* which derived from garbage waste water which polluted the well. The content of COD, BOD, Fe, SO_2, and CH_4 have also been below the appropriate level. The distance of well and defecation place was also closed[34]. Therefore, based on the condition stated above, Bantar Gebang sub-district was purposively selected to represent the slum area.

Table 3.3. Total agriculture areas and housing compounds by sub-districts in 2007 (Ha)

No	Sub-district	Total agriculture areas (Ha)	% agriculture areas	House compounds (Ha)	% house compounds	Total Area (Ha)
1.	Pondok Gede	280	18.87	1151	77.56	1484
2.	Jatisampurna	255	13.53	1581	83.87	1885
3.	Pondok Melati	243	20.27	916	76.40	1199
4.	Jatiasih	827	32.12	1653	64.19	2575
5.	Bantar Gebang	602	29.21	1341	65.07	2061
6.	Mustika Jaya	413	16.54	2001	80.14	2497
7.	Bekasi Timur	251	18.94	975	73.58	1325

No	Sub-district	Total agriculture areas (Ha)	% agriculture areas	House compounds (Ha)	% house compounds	Total Area (Ha)
8.	Rawa Lumbu	440	26.57	1122	67.75	1656
9.	Bekasi Selatan	471	29.49	1026	64.25	1597
10.	Bekasi Barat	412	29.06	915	64.53	1418
11.	Medan Satria	329	24.64	871	65.24	1335
12.	Bekasi Utara	463	22.95	1363	67.58	2017
	Total	4986	23.69	14915	70.86	21049

[33]

3.3. Study design, sample size and sampling procedures

The study was designed as cross sectional study. The sampling of respondents was stratified based on the record of selected health posts at 4 health centers in the 3 sub-districts (**Figure 3.1**). Jatiasih sub-district has 2 health centers (Jatiluhur and Jatiasih). Jatisampurna has 1 health center (Jatisampurna) and Bantar Gebang also has 1 health center (Bantar Gebang I)[7]. Not all health posts in those health centers were eligible for this study. The health posts in each sub-district were purposively selected based on the criteria of housing, rural, and slum areas mentioned above in the area of the study, and also based on the accessibility to the areas. For housing area (Jatisampurna sub-district), only health posts located in housing complex and the food handlers also lived in that housing complex selected as respondents. For the rural area (Jatiasih sub-district), only rural health posts were selected and only food handlers who lived in those rural areas selected as respondents. For the slum area (Bantar Gebang sub-district), only health posts located in garbage disposal area and the food handlers also lived around that garbage disposal area were selected as respondents.

As a result, there were 8 health posts located in housing complex were selected for the respondents sampling in Jatisampurna sub-district (housing arcas). There were 7 rural health posts selected for the respondents sampling in Jatiasih sub-district (rural areas). And, there were also 7 health posts located in garbage disposal location were selected for respondents sampling in Bantar Gebang sub-

district (slum areas). Eligible households which have children aged 6-24 months old in those eligible health posts were randomly selected for FGD and interview.

FGD was conducted for 6-15 food handlers from different households in various aged of children between 6-24 months old and with various socio-economic levels, based on convenience sampling from the housing, rural, and slum households, respectively. FGD was conducted until no more other types of complementary food obtained. As a result, 8 times FGD were conducted.

Different from these FGD participants, households who have children aged 6–24 months old lived in the housing, rural, and slum households, respectively, were randomly selected for interview. Sample size formula for interview of food handlers is as follows[35]:

$$n = z^2(pq)/d^2 \times DEFF + 10\%$$

where

n = sample size;

z = statistical certainty chosen = 1.96;

p = estimated prevalence of mothers with good food hygiene practices = 41%[36];

q = 1- p; and

d = degree of precision = 0.10

DEFF = 2; rejection rate = 10%

$n = (1.96^2(0.41)(0.59)/0.1^2 \times 2) / 1\text{-}10\%$

$n = 186 + 10\%$

n = 205 respondents ~ 207 respondents (69 respondents in each area)

Proportion of respondent allocation for interview in each housing, rural, and slum households was equal (69 households in housing, rural, and slum areas, respectively). Therefore, number of sample size become 207 respondents. There were 3 more respondents in the slum areas that has been collected their data which makes the total number of respondents become 210 respondents. The number of foods that were reviewed by HACCP principles was 10 most consumed foods.

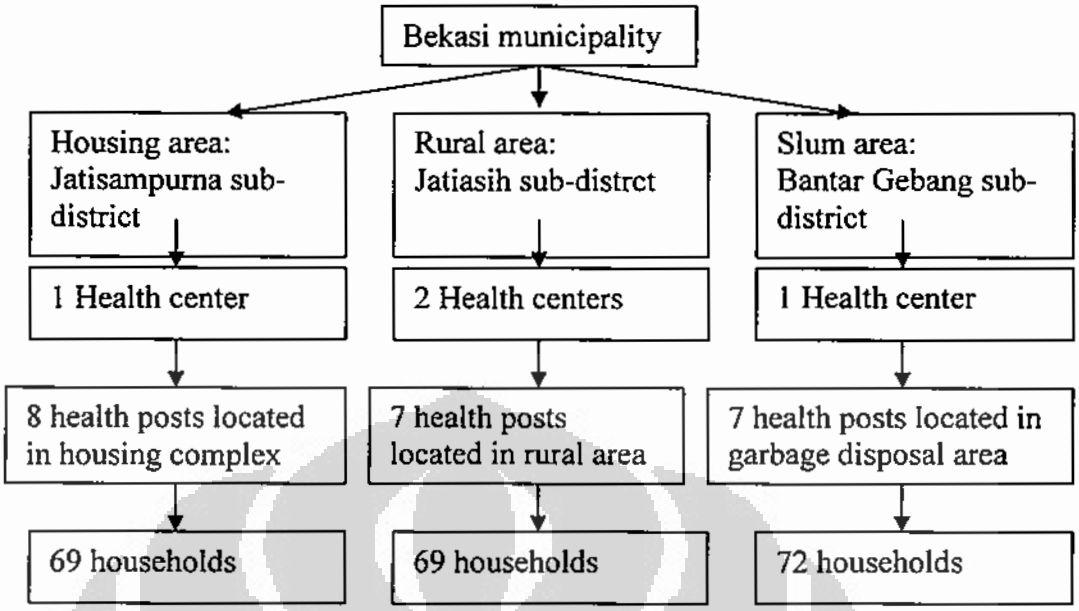


Figure 3.1. Sampling procedure flow

3.4. Data collection procedures

The study was conducted in 2 phases (**Figure 3.2**): the HACCP study and the assessment of food handler's knowledge, attitude, practices and socio-economic condition. The first phase was to assess type of food and its flow diagram which was collected through FGD. The second phase was to assess knowledge, attitude, practices and socio-economic condition of the household which was collected through interview using structured questionnaire.

3.4.1. HACCP study

The first phase was the HACCP study. In HACCP study, FGD was conducted to collect data on the type of food and its flow diagram. Data of types of food obtained from FGD was inserted to the questionnaire of interview to determine the 10 most consumed foods by the 6-24 months old children (Appendix 7). Data of flow diagram obtained from FGD was used to develop the HACCP data sheet.

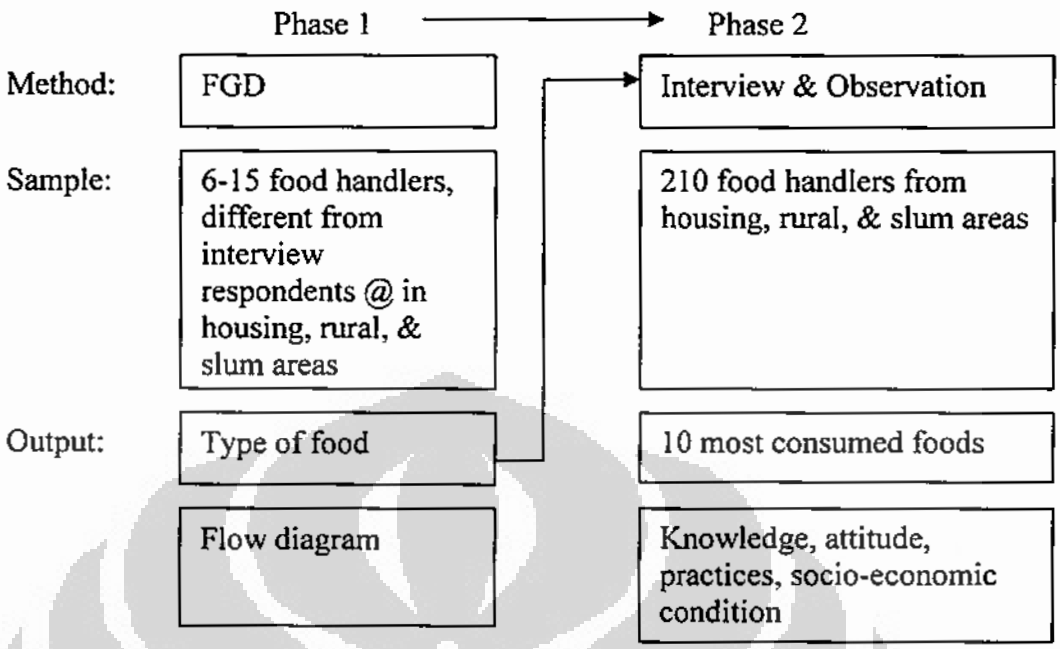


Figure 3.2. Data collection flow

3.4.2. Food handler's knowledge, attitude, practice, socio-demography, and economic condition

The second phase was the assessment of food handler's knowledge, attitude, practices and socio-economic condition which was collected through interview and observation using structured questionnaire. In the interview, the food handler was asked only 3 most-consumed foods by the child in the last 1 month. Interview was conducted through home visit to obtain information about 3 most-consumed foods by the child in the last 1 month, household's socio-demography and economic condition, cooking, storage, and hygiene facility, food handlers' educational level and exposure to information about food safety, and also knowledge, attitude, and practices of food handlers on food preparation and handling for the child. The condition of cooking, storage, and hygiene facility was observed. During the developmental stages of the questionnaires, pre-testing was carried out using a subset of the respondent sample (30 respondents). As a result of pre-testing, changes were made to the questionnaire.

3.5. Data analysis

3.5.1. HACCP study

Based on FGD and interview result, HACCP data sheet development to the 10 foods mostly consumed by 6-24 months old children was conducted through literature review. HACCP data sheet was developed based on the food flow diagram obtained from FGD. In the development of HACCP data sheet, 4 HACCP principles were used (hazard analysis, determine CCP, establish control measures, and establish monitoring procedure). Hazard analyses were conducted through literature study on potential risk toward the present of microbiological food borne pathogens in the food during its preparation and handling. Potential sources of contamination from raw foods, water, equipment, utensils and persons preparing the foods, as was the likelihood of survival or destruction and likelihood of microbial multiplication were noted in the flow diagram[37] [1]. Critical control points that need to be controlled were indicated at appropriate steps of food preparation and handling. Critical control point was determined through CCP decision tree **(Figure 3.3)** approach based on identification of which steps in the food preparation and handling which has significantly unacceptable level of hazards where there will be no further steps in the process that could prevent, minimize, or eliminate the hazards. Control measures and monitoring procedures were determined based on literature study **(Figure 3.4)**. Data of food preparation and handling which is obtained from FGD was presented as flow diagram of its process. Hazards, critical control points (CCPs), control measures, and monitoring procedures of food preparation and handling were presented in the table of HACCP data sheet.

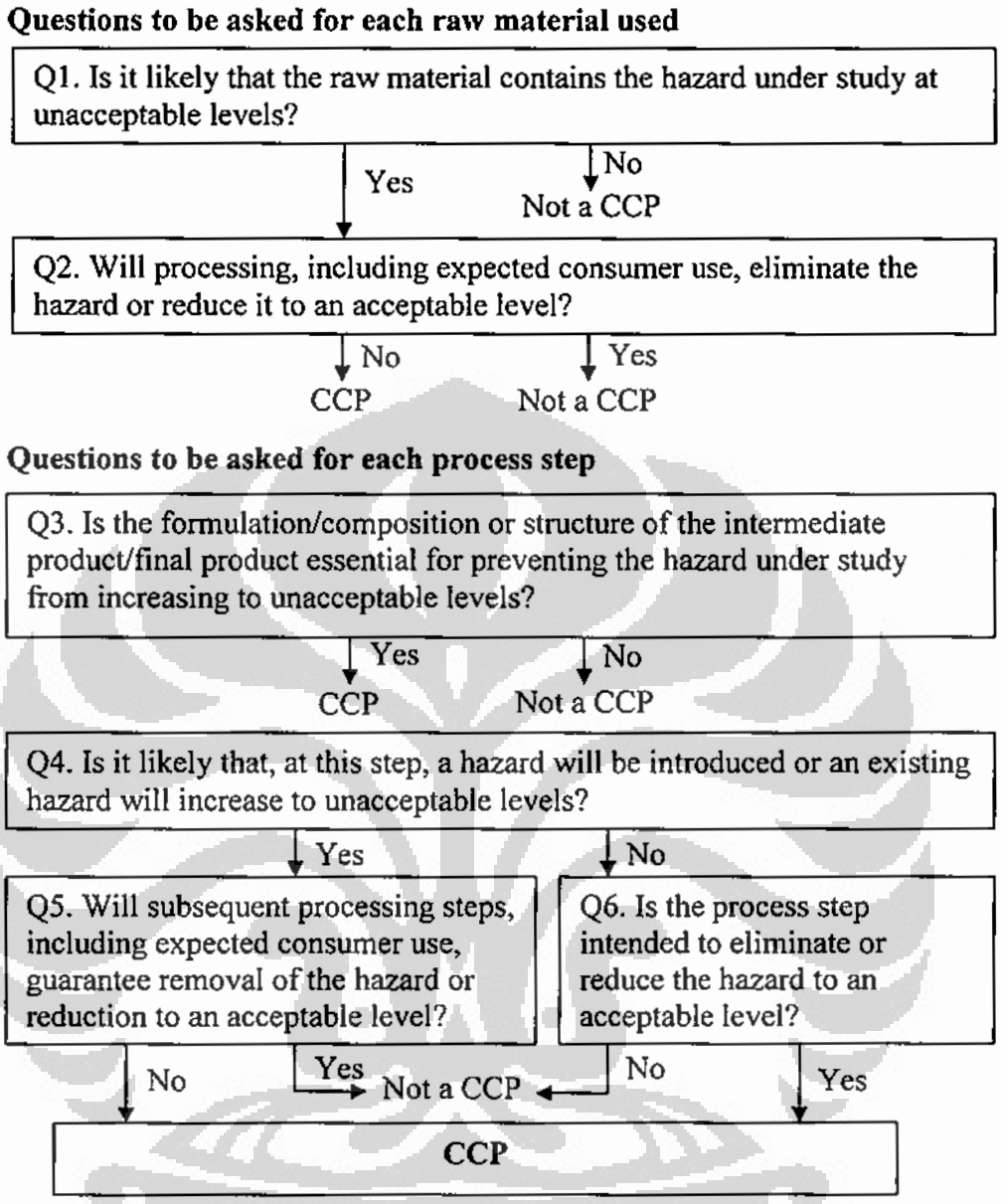


Figure 3.3. Decision tree for determination of critical control point

[20]

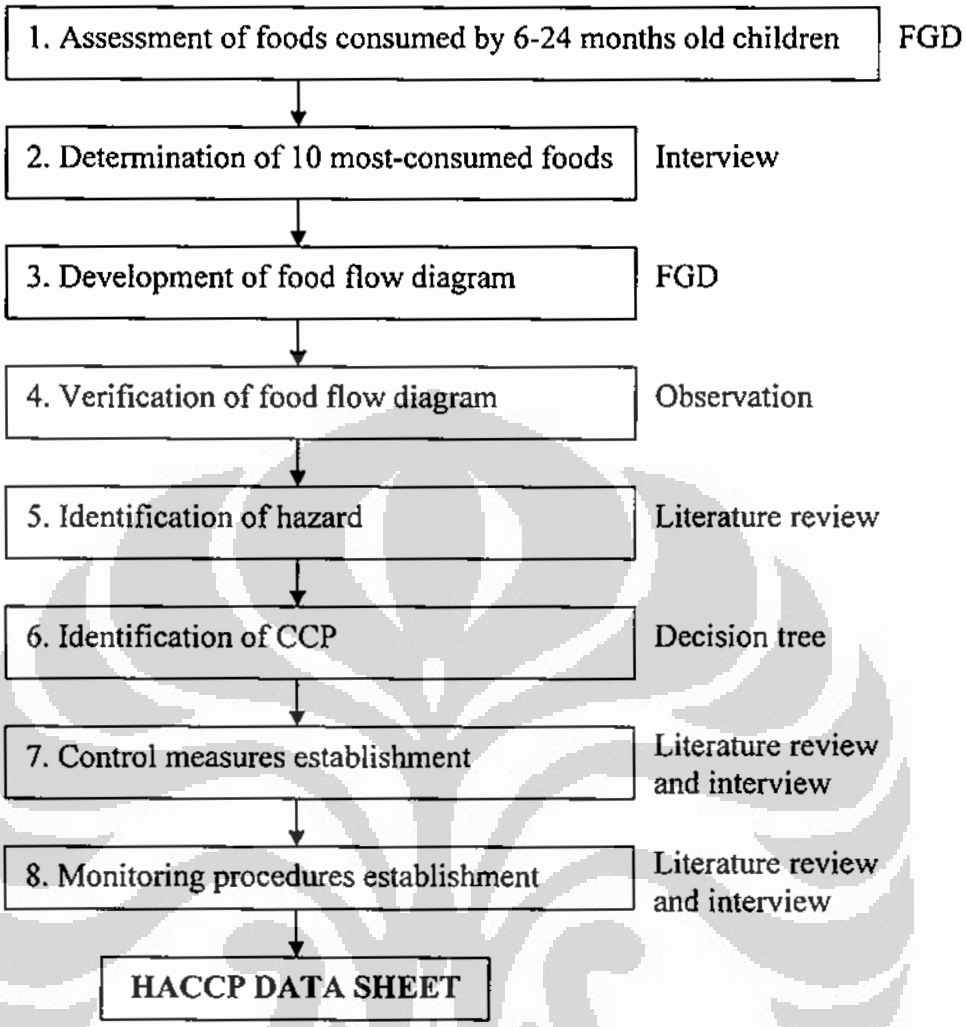


Figure 3.4. Step of data analysis for HACCP data sheet development

3.5.2. Food handler's knowledge, attitude, practice, socio-demography, and economic condition

Data of household's socio-demography and economic condition, cooking, storage, and hygiene facility, food handlers' educational level and exposure to information about food safety, and also knowledge, attitude, and practices of food handlers on food preparation and handling for the child were analyzed by using SPSS 15.0. All continuous data were checked for its normality of the distribution by using one sample Kolmogorov-Smirnov test. Mean and standard deviation were used to describe the normally distributed data, while the data which are not normally distributed were presented as median and the minimum and maximum values presented in parentheses. Descriptive statistical analyses were used to

know the prevalence of the variables. To find out the differences among housing, rural, and slum areas, Chi square test were used.

3.6. Ethical consideration

Before conducting the study, an ethical clearance from the ethical committee of the Medical Faculty of University of Indonesia was obtained. Permission from the local government offices was also solicited before the data collection is started.

Before conducting interview, observation, and FGD, the interviewer has given explanation about the research purpose, procedure, also ensured confidentiality. The respondents have the right to refuse or quit at any time they want to. There is no enforcement for the respondents to participate. Interview and observational data were obtained with the least burden on the respondents' side. There was a written consent that is asked for the respondents. In FGD and observation, the respondents are asked for their permission to be recorded using tape recorder or camera.

PART 4
RESULT

4.1. Foods mostly consumed by 6-24 months old children

Table 4.1 shows foods mostly consumed by 6-24 months old children in the study population. Spinach soup is the most consumed food in the study population. It is mostly made of spinach, carrot, and corn. Most of the rice was cooked by electric rice cooker and held hot. As for the Vegetable soup, it is mostly consisted of carrot, beans, cabbage, potato, and meatball. Instant porridge formula was purchased packaged food which was ready to use. Formula milk, cheese is sometimes added to this instant porridge formula. Biscuit was also purchased packaged food which was ready to consume by the children. Most of the study population directly ate the biscuit without further preparation. Ready to eat rice porridge was also purchased food from mobile vendor. It may consist of rice porridge added with fried chicken, soy sauce, spices, fried soybean, fried onion, celery, and spices as desired or depended on the vendor recipes. *tempe*, fish, and egg were usually fried with additional spices. And for *nasi tim*, mostly used ingredients are rice, carrot, spinach, and chicken.

Table 4.1. 10 foods mostly consumed by 6-24 months old children by areas

Type of food	Frequency in			Total (n(%))	Rank
	Housing	Rural	Slum		
Spinach soup	17	23	23	63 (30)	1
Cooked rice	18	18	19	55 (26)	2
Vegetable soup	22	15	14	51 (24)	3
Instant porridge formula	22	15	5	42 (20)	4
Biscuit	13	12	9	34 (16)	5
Ready to eat rice porridge	3	15	12	30 (14)	6
Fried *tempe*	3	8	13	24 (11)	7
Nasi tim	14	7	1	22 (10)	8
Fried fish	11	8	2	21 (10)	9
Egg omelet	4	3	9	16 (8)	10

4.2. Flow diagram and HACCP data sheet of 10 foods mostly consumed by 6-24 months old children

The flow diagram of selected foods were developed using data collected through FGD. **Figure 4.1** shows flow diagram of instant porridge formula. First, the instant porridge formula was purchased from vendors. Initial contamination at this step was likely to be occurred if the products has been expired or the packaged has been broken which allows contamination into the products. After the purchasing step, the food may be dry-stored or directly used. During dry storage, there is possibility of bacterial growth if not stored properly and also possible contamination from utensils if the food was taken out of the packaged and stored in certain storage place. Sometimes the food handlers added formula milk or cheese to the food before mix it with hot or warm water. At this step, there can be a possible contamination from utensils, initial contamination of formula milk/cheese, and from food handler. After adding ingredients, then it was mixed with hot or warm water, then the last with cool water. The process of mixing with water called preparation step. At this preparation step, there can be possible contamination from water, utensils, food handler, and bacterial growth.

Based on the decision tree analysis result, all of the steps are identified as CCPs: purchasing, dry storage, addition of ingredients, and preparation, because there was no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for instant porridge formula was developed **(Table 4.2)**.

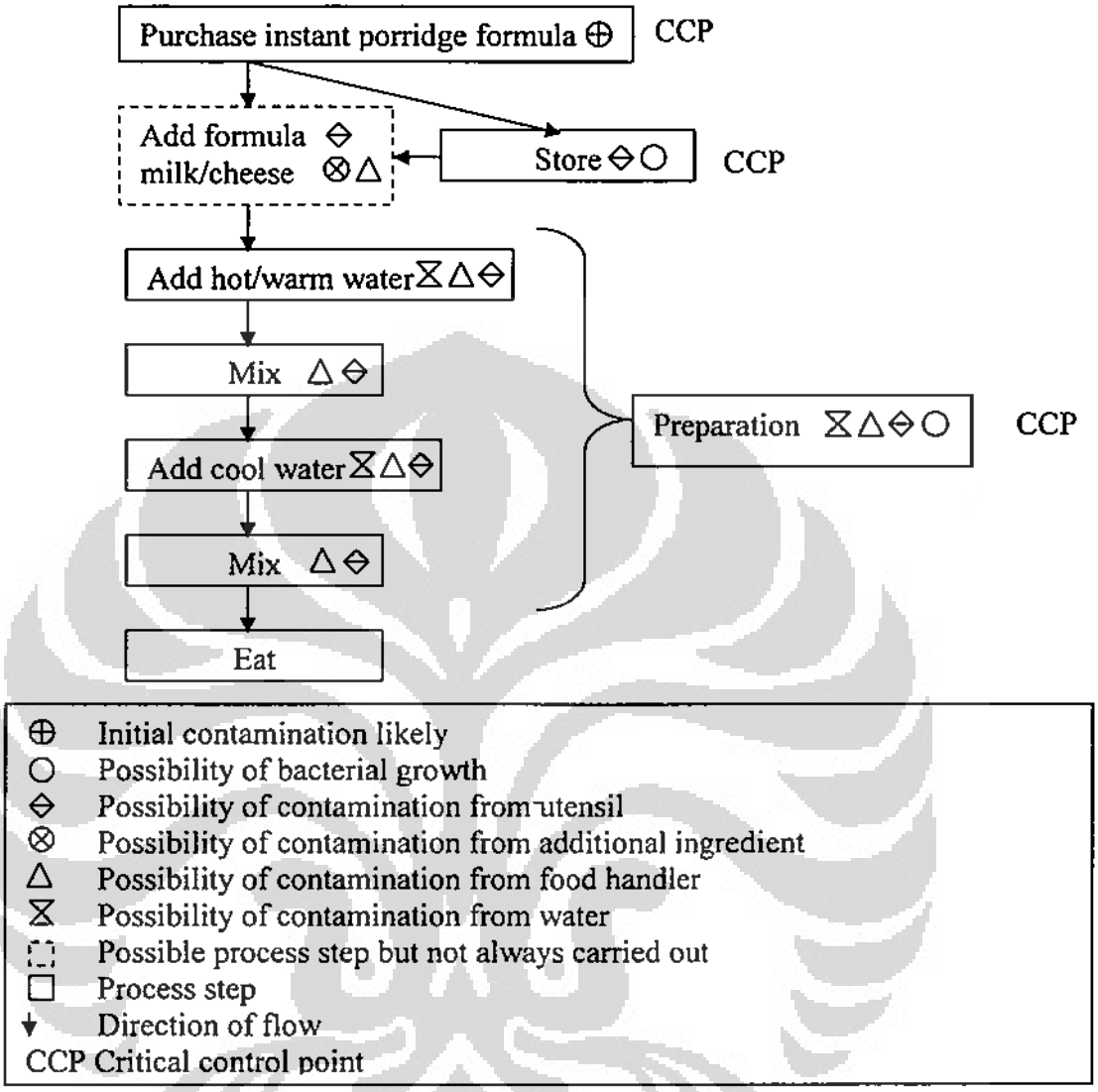


Figure 4.1. Flow diagram of instant porridge formula

Table 4.2. HACCP data sheet for instant porridge formula

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Instant porridge formula	Pathogens present	Purchasing	Purchase food that hasn't been expired and in good package condition	Ensure to read expiry date and observe broken package
	Contamination	Dry-	Store in dry place;	Observe

Food	Hazards	Critical Control Points	Control Measures	Monitoring
	due to break in package; high moisture that resulting bacterial growth during storage	storage	protect foods from contamination, throw away when there's indication of spoilage	storage practices
	Cross contamination from ingredients, food handlers, equipment.	Addition of ingredients	Do not add milk/cheese that have been expired or spoilage, wash hands	Ensure food and personal hygiene
	Cross contamination from food handlers, water, or equipment during preparation, bacterial growth	Preparation	Use hot water, do not use cool water, use clean utensils; eat food promptly; avoid working with food if suffering from illness; wash hand before preparation and before feeding, do not dip finger to child's food, do not use hot water from dispenser machine, use boiled water	Ensure hygiene practices; observe for signs of illness

Figure 4.2 shows flow diagram of *nasi tim*. There are 3 types of process of preparing *nasi tim*: the one which was eaten without blending and filtering process, and the one which was blended and filtered first before consumption. Overall, first the rice, spinach, carrot, and chicken were purchased. In the purchasing step, there can be initial contamination likely to be occurred. For the rice, it was stored where there can be possibility of contamination from storage place and bacterial growth during storage if the rice was not stored appropriately. Before using the rice, it was washed with water. The waste water of washing rice was discarded. The rice was then cooked with addition of water. Washing with water and addition of water can contaminate the rice, and also there can be contamination from food handler's hand, and utensils used when washing the rice and adding water to the rice. In the cooking step, there can be possibility of bacterial survival. For the spinach, carrot, and chicken, after they were purchased,

then they were cut where there can be possibility of contamination from utensils and food handler. Then they were washed with water where there can be possibility of contamination from water, food handler, and utensils used to wash them. Sometimes spinach, carrot, and chicken were stored before cooked into *nasi tim*. There can be possibility of bacterial growth during the storage step. If the spinach, carrot, and chicken were directly cooked together with rice, then they were added into the cooked rice. When they were added into the cooked rice, there were possibility of contamination from the raw spinach, carrot, and chicken. Also there can be possibility of contamination from the food handler and utensils used when adding those raw ingredients into the cooked rice. After that, they were mixed and cooked together with addition of salt. During mixing and cooking step, there can be possibility of bacterial survival and contamination from the salt and utensils used when mixing. After the cooking step, then the *nasi tim* was ready to be consumed, but before consumption, it was hold for a while to cool down the temperature so it was not too hot to be consumed. At the holding step there can be possibility of bacterial growth and contamination from utensils used when serving the *nasi tim*. Those are the steps for *nasi tim* without blending and filtering steps.

For the blended *nasi tim*, after it was hold for a while, then it was put into blender, then hot/warm water was added where there can be possibility of contamination from addition of water, utensils used to add water, and food handler. After that, it was blended where there can be possibility of contamination from utensils and food handler. Sometimes the *nasi tim* was stored after blending if not directly consumed. In the storage step, there can be possibility of bacterial growth and contamination from utensils used for storage. After storage sometimes the *nasi tim* was reheated if not directly consumed. In the reheating step, there can be possibility of bacterial survival.

For the filtered *nasi tim*, after the *nasi tim* was cooked and hold, then it was filtered. At this filtering step there can be possibility of contamination from food handler and utensils used to filter the *nasi tim*. Like the blended *nasi tim*, sometimes the filtered *nasi tim* was also stored and reheated if not directly consumed.

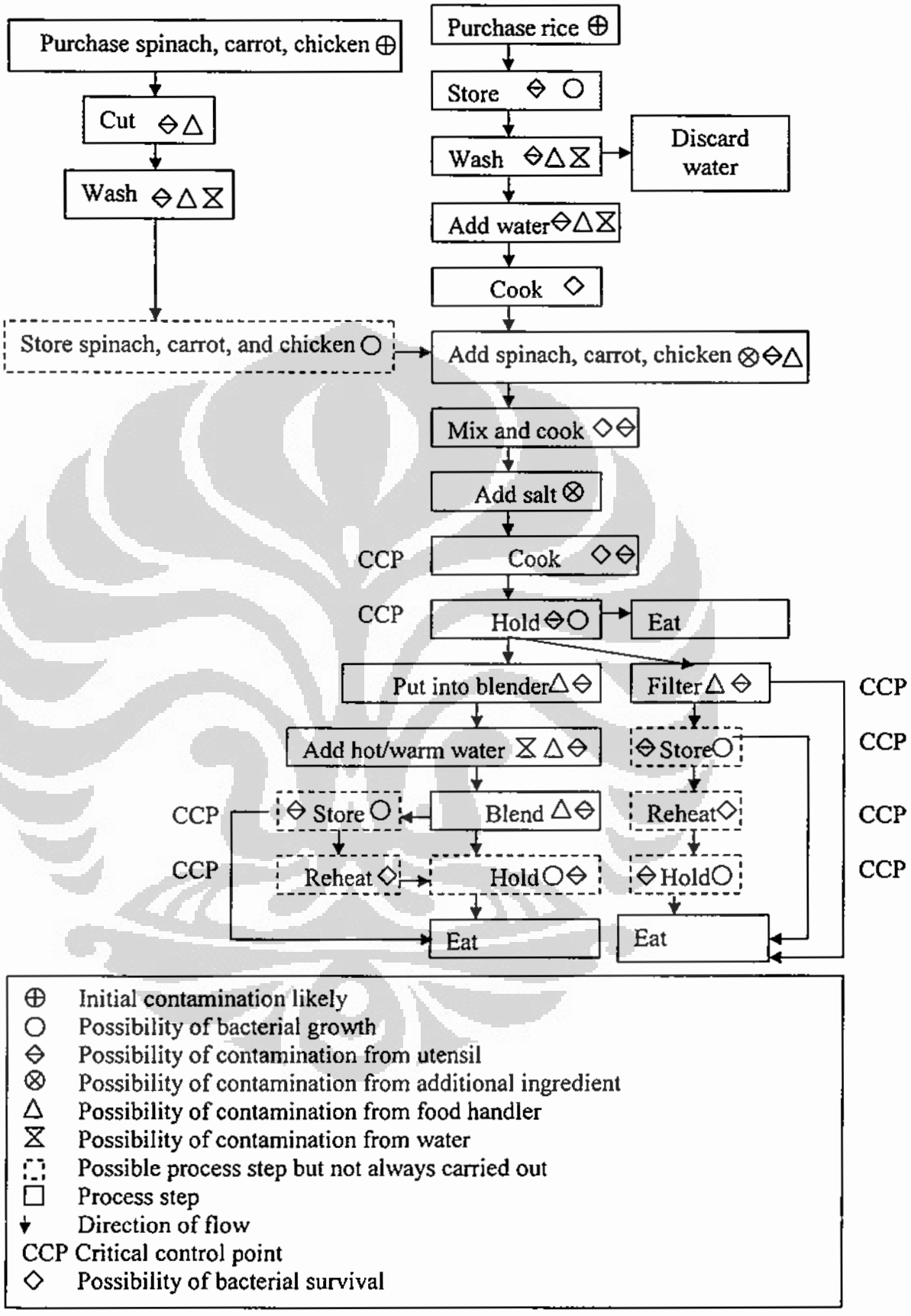


Figure 4.2. Flow diagram of *nasi tim*

University of Indonesia

Table 4.3. HACCP data sheet for *nasi tim*

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Nasi tim	Pathogens survive inadequate cooking; spores survive	Cooking	Cook thoroughly	check for indication of heat e.g. bubbling, or check for texture changes e.g. become softer
	Cross contamination from equipment; bacterial growth	Blending	Blend while it's still hot; use clean equipment; wash hand before blending	Ensure personal and equipment hygiene
	Cross contamination from equipment; bacterial growth	Filtering	Filter while it's still hot; use clean equipment; wash hand before filtering	Ensure personal and equipment hygiene
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not dip finger to child's food	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Check for indication of heat e.g. bubbling

For the *nasi tim* which was directly consumed without blending and filtering step, the CCPs are cooking and holding. For the blended *nasi tim*, the

CCPs are cooking, blending, storing, reheating, and holding. For the filtered *nasi tim* the CCPs are cooking, filtering, storing, reheating, and holding. Cooking and reheating are the CCPs because this step could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. Holding, storing, blending, and filtering prior to consumption are the CCPs because there were no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for *nasi tim* was developed **(Table 4.3)**.

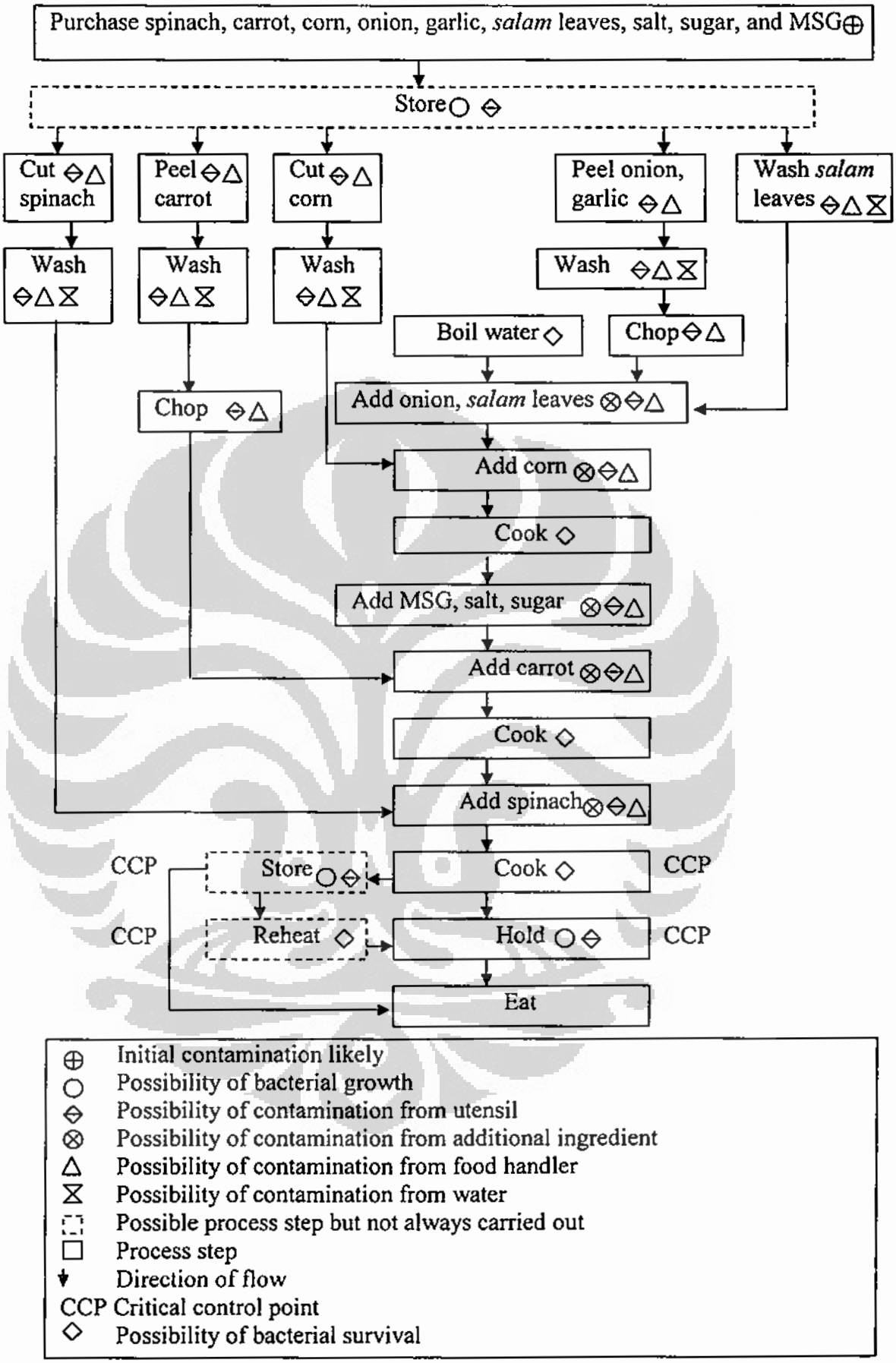


Figure 4.3. Flow diagram of spinach soup

Table 4.4. HACCP data sheet for spinach soup

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Spinach soup	Pathogens survive inadequate cooking; spores survive	Cooking	Cook thoroughly	check for indication of heat e.g. bubbling, or check for texture changes e.g. become softer
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not dip finger to child's food	Check appearance of food for spoilage; ensure personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Do not reheat, but consume directly, throw away when there is indication of spoilage	Check appearance of food for spoilage
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

Figure 4.3 shows flow diagram of spinach soup. First, the spinach, carrot, corn and other ingredients such as onion, *salam* leaves, salt, sugar, and MSG were purchased. In the purchasing step there can be initial contamination likely to be occurred. Sometimes those ingredients were stored if not directly cooked into spinach soup. After they were purchased, the spinach carrot, corn, onion, garlic, and *salam* leaves were cut, chop, peel, and wash where there can be possibility of contamination from utensils used when cutting, peeling, or washing. Also there

can be possibility of contamination from water used to wash them and from food handler. After that, the water was boiled where bacterial might have survived the boiling step. Then onion, *salam* leaves, corn, MSG, salt, sugar, carrot, spinach were added to the boiled water in sequences while cooking. In the addition of ingredients step there can be possibility of contamination from those raw ingredients, food handler, and utensils used when added the ingredients. While in the cooking step, there can be possibility of bacterial survival. Before consumption, the spinach soup was hold for a while to cool down the temperature. In the holding step there can be possibility of contamination from utensils used when serving and possibility of bacterial growth. Sometimes the spinach soup was stored and reheated if not directly consumed.

CCPs for spinach soup were cooking, holding, storing, and reheating. Cooking and reheating are the CCPs because this step could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. Holding and storing prior to consumption are the CCPs because there were no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for spinach soup was developed **(Table 4.4)**.

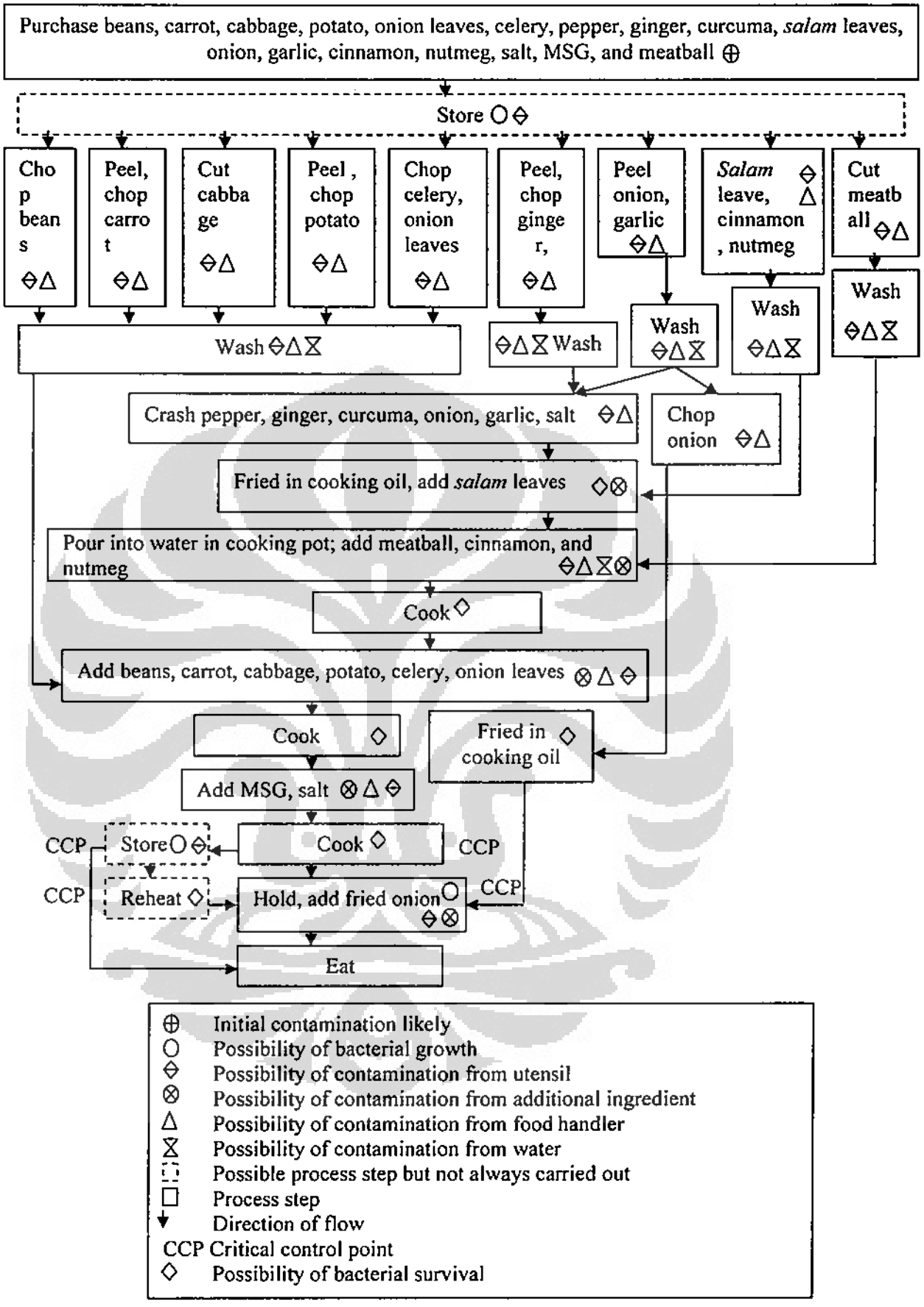


Figure 4.4. Flow diagram of vegetable soup

University of Indonesia

Table 4.5. HACCP data sheet for vegetable soup

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Vegetable soup	Pathogens survive inadequate cooking, spores survive	Cooking	Cook thoroughly	Check for indication of heat e.g. bubbling, or check for texture changes e.g. become softer
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not dip finger to child's food	Check appearance of food for spoilage; ensure personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Check for indication of heat e.g. bubbling
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

Figure 4.4 shows flow diagram of vegetable soup. First, the beans, carrot, cabbage, potato, onion leaves, celery, pepper, ginger, curcuma, *salam* leaves, cinnamon, nutmeg, onion, garlic, salt, MSG, and meatball were purchased. In the purchasing step, there can be initial contamination likely to be occurred. Sometimes these ingredients were stored if not directly cooked into vegetable soup. After that, those ingredients were cut, peel, chop, and wash. During these steps there can be possibility of contamination from utensils used when cutting, peeling, chopping, and washing. And also, there can be possibility of contamination from food handler and water used to wash those ingredients. After that the pepper, ginger, curcuma, onion, garlic, and salt were crashed where there

can be contamination from food handler and utensils used to crash those ingredients. After crashing, they were fried in cooking oil together with *salam* leaves. At this step, there can be possibility of contamination from addition of raw ingredients and possibility of bacterial survival if not fried appropriately. After that, these ingredients were poured into water in cooking pot; meatball, cinnamon, and nutmeg were added. At this step there was possibility of contamination from utensils, food handler, water, and raw ingredients. In the cooking steps, beans, carrot, cabbage, potato, celery, onion leaves, then MSG and salt were added in sequences. At this cooking step there can be possibility of contamination from raw ingredients, food handler, utensils, and bacterial survival if not cooked appropriately. After they were cooked, then the vegetable soup was hold for a while and added fried onion before consumption. Sometimes the Vegetable soup was stored and reheated if not consumed directly. In the holding step there can be possibility of contamination from food handler, addition of ingredient, and bacterial growth. In the storing step there can be possibility of contamination from utensils used for storage and bacterial growth. In the reheating step there can be possibility of bacterial survival if not reheated appropriately.

Cooking, holding, storing, and reheating were CCPs for vegetable soup. Cooking and reheating are the CCPs because this step could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. Holding and storing prior to consumption are the CCPs because there were no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for vegetable soup was developed **(Table 4.5)**.

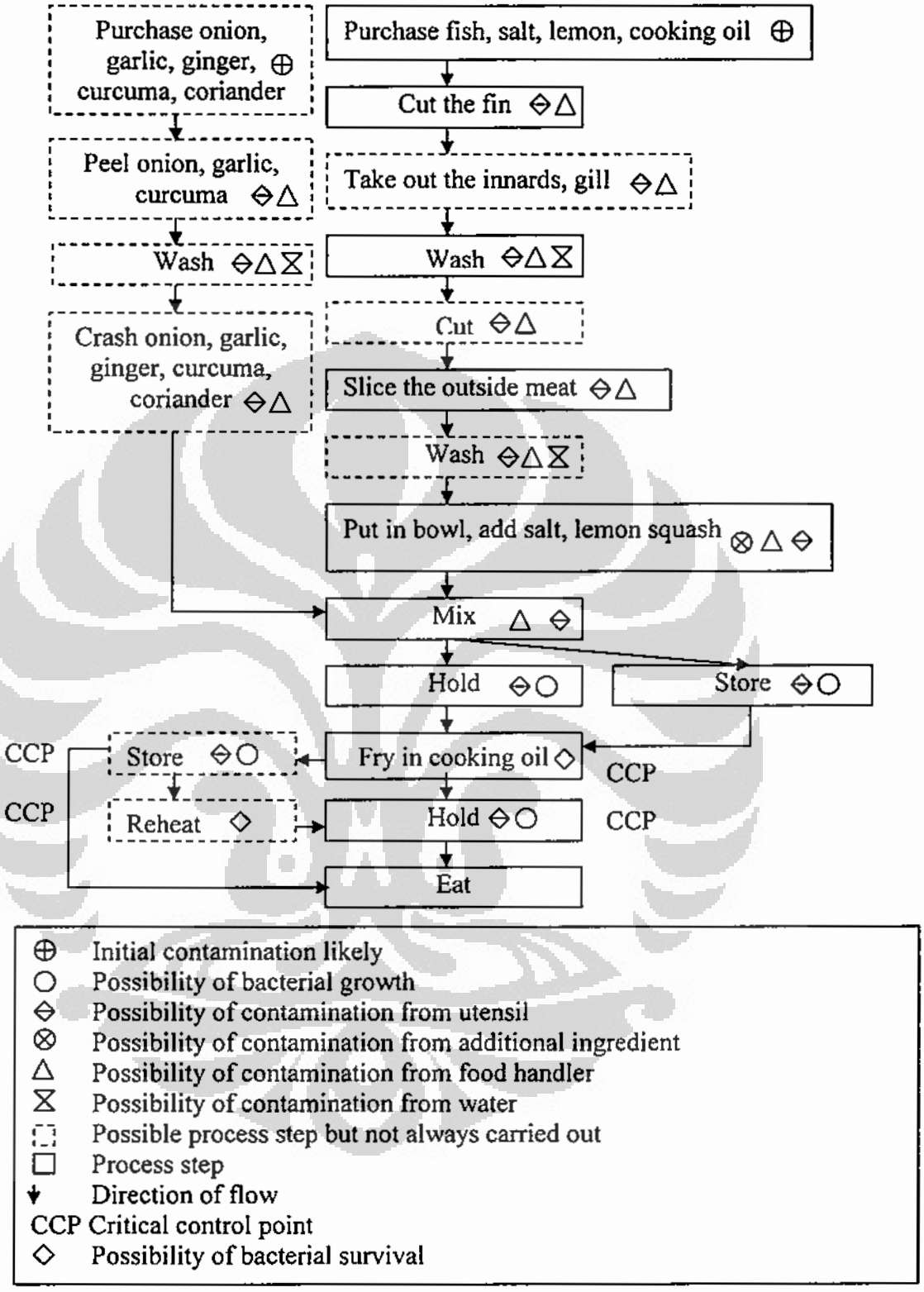


Figure 4.6. Flow diagram of fried fish

Table 4.7. HACCP data sheet for fried fish

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Fried fish	Pathogens survive inadequate frying	Frying	Cook thoroughly	Check for color changes e.g. become darker
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not touch food by finger/hand	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Ensure reheating for reasonable length of time
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

Figure 4.7 shows flow diagram of egg omelet. First step was the purchasing of egg, onion leaves, celery, onion, salt, and MSG. At this step there was possibility of initial contamination likely to be occurred from the raw ingredients. After the purchasing, the egg was broken then put into bowl. At this step there was possibility of contamination from food handler and utensils. Salt and MSG then were added. And, onion leaves, celery, and onion were chopped and added to egg. At this step there can be possibility of contamination from those additional ingredients, utensils, and food handler. After that, all the ingredients were mixed where there can be possibility of contamination from utensils and food handler. Then, it was fried in cooking oil. During frying there can be possibility of bacterial survival. After that, the Egg omelet was cut into several pieces. In the cutting step there can be possibility of contamination from food handler and utensils used. Before the Egg omelet was consumed, it was hold for a

while to cool down the temperature where there can be possibility of contamination from utensils used to serve the Egg omelet and bacterial growth. Sometimes the Egg omelet was stored and reheated if not directly consumed. During Egg omelet storage; there can be possibility of bacterial growth and contamination from utensil used for storage. In the reheating step there can be possibility of bacterial survival if not reheated appropriately.

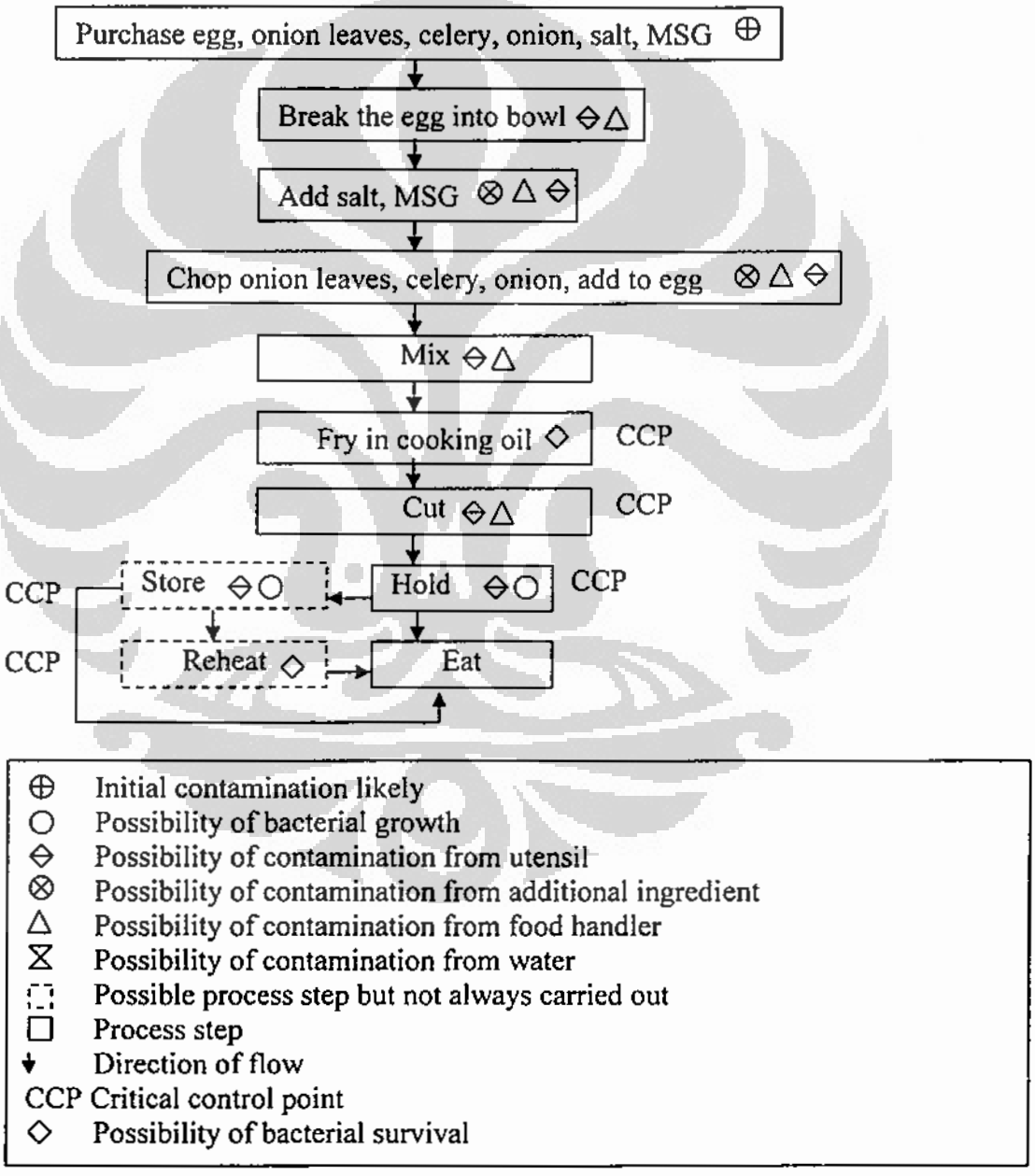
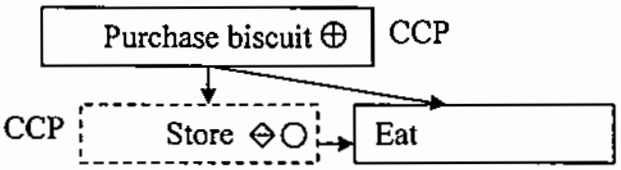


Figure 4.7. Flow diagram of egg omelet

Table 4.8. HACCP data sheet for egg omelet

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Egg omelet	Pathogens survive inadequate frying	Frying	Cook thoroughly	Check for color changes e.g. become darker; observe coagulation
	Cross contamination from equipment; bacterial growth	Cutting	Use clean equipment; wash hand before cutting	Ensure personal and equipment hygiene
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not touch food by finger/hand	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Ensure reheating for reasonable length of time
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

The CCPs for egg omelet were frying, cutting, holding, storing, and reheating. Frying and reheating are the CCPs because this step could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. Holding, cutting, and storing prior to consumption are the CCPs because there were no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for egg omelet was developed **(Table 4.8)**.



⊕ Initial contamination likely
○ Possibility of bacterial growth
◈ Possibility of contamination from utensil
⬚ Possible process step but not always carried out
□ Process step
↓ Direction of flow
CCP Critical control point

Figure 4.8. Flow diagram of biscuit

Table 4.9. HACCP data sheet for biscuit

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Biscuit	Pathogens present	Purchasing	Purchase food that hasn't been expired and in good package condition, check the expired date	Ensure to read expiry date and observe broken package
	Contamination due to break in package; high moisture that resulting bacterial growth during storage	Dry-storage	Store in dry place; protect foods from contamination	Observe storage practices

Figure 4.8 shows flow diagram of ready to eat packaged biscuit. At the purchasing step there can be possibility of initial contamination. The biscuit was stored if not directly consumed. At the storage step there can be possibility of contamination from utensils used for storage and bacterial growth. The CCPs for Biscuit were purchasing and storing because there were no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for biscuit was developed **(Table 4.9)**.

Figure 4.9 shows flow diagram of ready to eat rice porridge. At the purchasing step there can be possibility of initial contamination. After that soybean sauce where added into rice porridge where there can be possibility of contamination from the sauce, food handler, and utensils used when serving. The Rice porridge was stored if not directly consumed. At the storage step there can be possibility of contamination from utensils used for storage and bacterial growth. Before consumption, the rice porridge was hold for a while to cool down the temperature. At this step there can be possibility of bacterial growth and contamination from utensils used when holding. The CCPs for rice porridge were purchasing, addition of ingredients, storing, and holding because there were no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for rice porridge was developed **(Table 4.10)**.

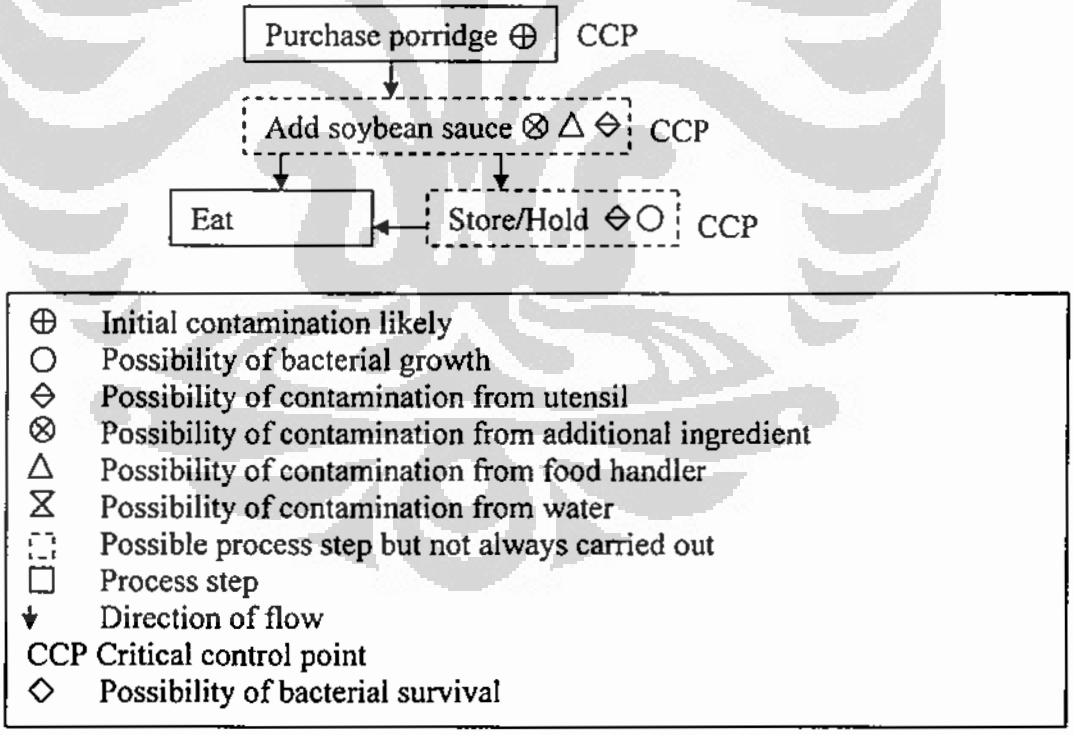


Figure 4.9. Flow diagram of ready to eat rice porridge

Table 4.10. HACCP data sheet for ready to eat rice porridge

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Ready to eat rice porridge	Pathogens present, cross contamination from food handlers or equipment during preparation;	Purchasing	Purchase from reliable vendors with adequate protection from dust and flies; use clean serving utensils	Check appearance of food for spoilage, check hygiene behavior of vendor with regard to utensils used and personal hygiene
	Bacterial growth	Holding	Eat directly as soon as purchased; wash hand before feeding, use clean eating utensils, do not dip finger to child's food	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Cross contamination from ingredients, food handler, equipment, bacterial growth	Addition of ingredients	Do not add raw ingredients without heat treatment	Ensure food and personal hygiene
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

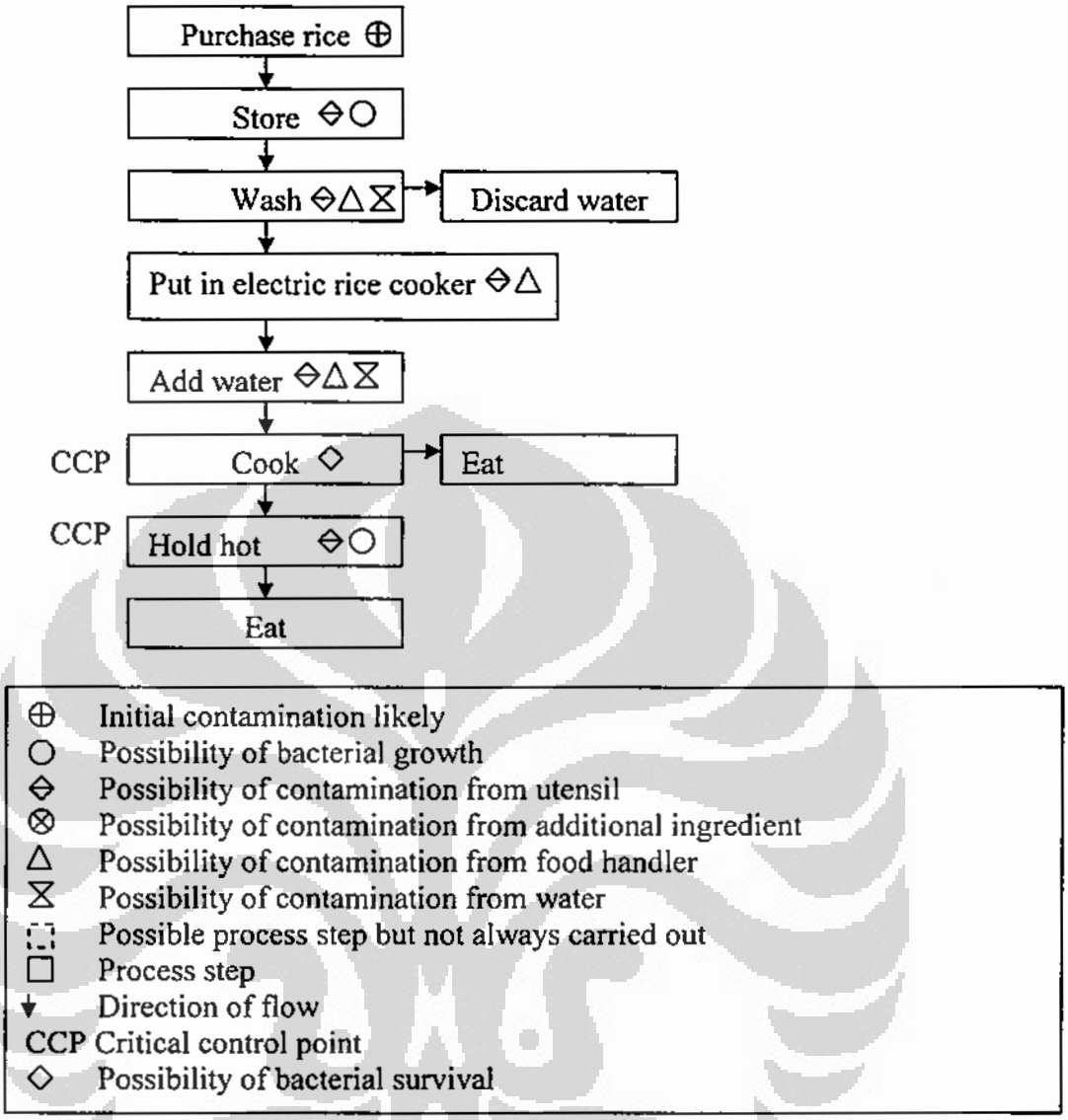


Figure 4.10. Flow diagram of cooked rice

Figure 4.10 shows flow diagram of cooked rice. First, the rice was purchased where there can be possibility of initial contamination. After that the rice was stored if not directly used. During storage there can be possibility of contamination from utensils used for storage and bacterial growth. Before cooking, the rice was first washed with water where there can be possibility of contamination from water, food handler, and utensils. During cooking there can be possibility of bacterial survival. After the rice was cooked, it was hold hot where there can be possibility of bacterial growth and contamination from utensils. The CCPs for rice were cooking and hot-holding. Cooking is the CCP

because this step could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. Hot-holding prior to consumption is the CCP because there were no further steps that could eliminate the hazard(s) or reduce its likely occurrence to an acceptable level. After determination of CCPs, HACCP data sheet for cooked rice was developed **(Table 4.11)**.

Table 4.11. HACCP data sheet for cooked rice

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Rice cook by electric rice cooker	Pathogens survive inadequate cooking; spores survive	Cooking	Cook thoroughly; follow the cooking operation manual if any	Ensure the rice cooker operates properly
	Bacterial growth	Hot holding	Eat promptly after cooking; do not store too long	Check appearance of food for spoilage

4.3. Knowledge, attitude, practice, socio-demography, and economic condition

4.3.1. Socio-demography data of the households

The socio-demography data of the 210 study households are shown in Table 4.12. Half of children (56.2%) in the households studied were male. Almost all of the food handlers in the households were mothers (95.7%). The mean age of children was 14.56 months. The mean age of food handlers and fathers were 29.07 and 33.96 years, respectively. There was significant difference on food handler's age, father's age, number of under-five children, and number of household members among housing, rural, and slum areas. There were more young food handlers and fathers in the slum area compared to housing and rural areas. There were more households that had 1 under-five children in the slum area compared to housing and rural areas. There were more households that had ≤4 household's members in the slum area compared to housing and rural areas.

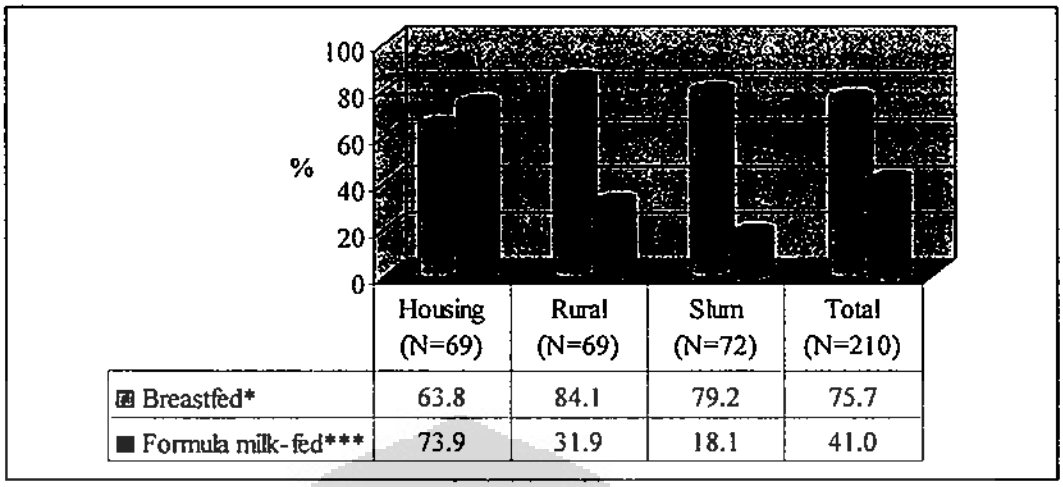
Table 4.12. Socio-demography data of the households by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Children's sex: male	38 (55.1)	38 (55.1)	42 (58.3)	118 (56.2)
Food handlers: mother	67 (97.1)	65 (94.2)	69 (95.8)	201 (95.7)
grandmother	1 (1.4)	4 (5.8)	2 (2.8)	7 (3.3)
housemaid	1 (1.4)	0 (0)	1 (1.4)	2 (1.0)
Children's age: 6-12 months	25 (36.2)	26 (37.7)	22 (30.6)	73 (34.8)
Food handler's age ≤ 30 years***	20 (29)	37 (53.6)	51 (70.8)	108 (51.4)
Father's age ≤ 30 years***	9 (13.2) (N=68)	22 (32.8) (N=67)	32 (45.7) (N=70)	63 (30.7) (N=205)
Number of children: U5 = 1 child**	45 (65.2)	55 (79.7)	66 (91.7)	166 (79)
5-15 years old = 1 child	54 (78.3)	57 (82.6)	62 (86.1)	173 (82.4)
Household members ≤ 4 people*	29 (42)	35 (50.7)	48 (66.7)	112 (53.3)

*Chi-square test ($p<0.05$)
**Chi-square test ($p<0.01$)
***Chi-square test ($p<0.001$)

4.3.2. Breastfeeding and formula milk feeding status

A majority of children (75.7%) were breastfed (**Figure 4.11**). There were 41% of the children fed with formula milk. There was significant difference on breastfeeding, formula milk feeding among housing, rural, and slum areas. There were more children in rural area that were breastfed compared to slum and housing areas. Formula milk feeding was more in the housing area compared to rural and slum areas.



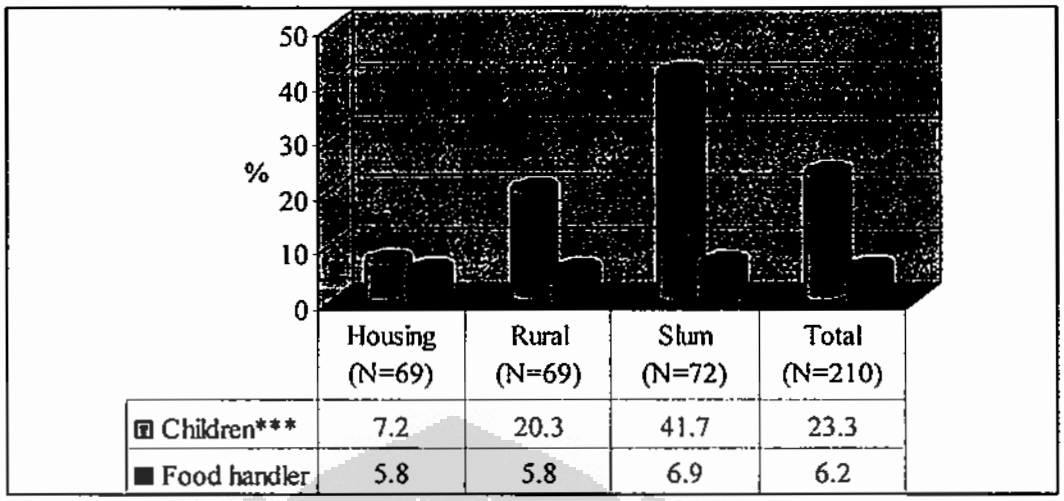
	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
Breastfed*	63.8	84.1	79.2	75.7
Formula milk-fed***	73.9	31.9	18.1	41.0

*Chi-square test ($p<0.05$)
***Chi-square test ($p<0.001$)

Figure 4.11. Breastfeeding and formula milk feeding status of the children by areas

4.3.3. Diarrhea disease

The prevalence of children and food handlers' diarrhea within 2 weeks was 23.3% and 6.2%, respectively (**Figure 4.12**). There were 34.8% food handlers who perceived children diarrhea due to violation in food preparation and hygiene practices (**Figure 4.13**). There was significant difference on children's diarrhea in the last 2 weeks and food handler's perception on diarrhea. There were more children who had diarrhea in the slum area compared to rural and housing areas. There were more food handlers in housing area who perceived children diarrhea due to violation in food preparation and hygiene practices.



***Chi-square test (p<0.001)

Figure 4.12. Diarrhea status in the last 2 weeks by areas

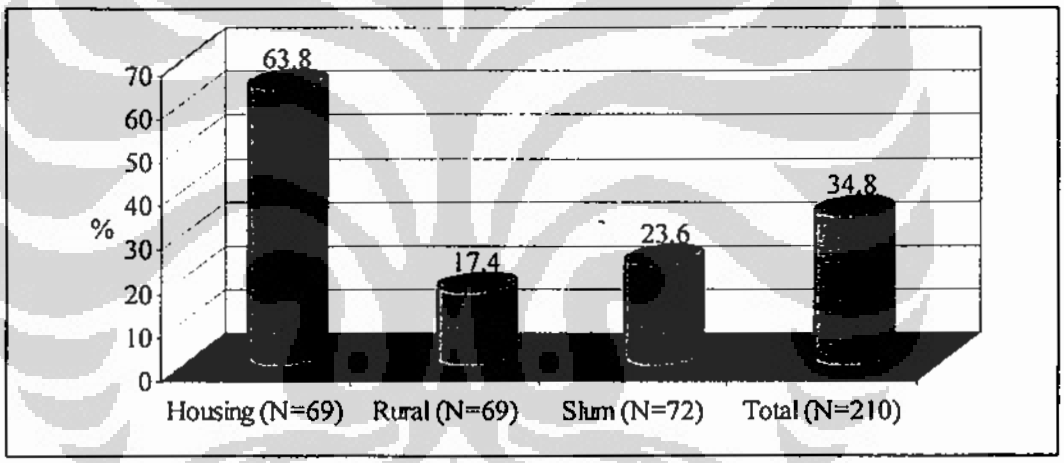
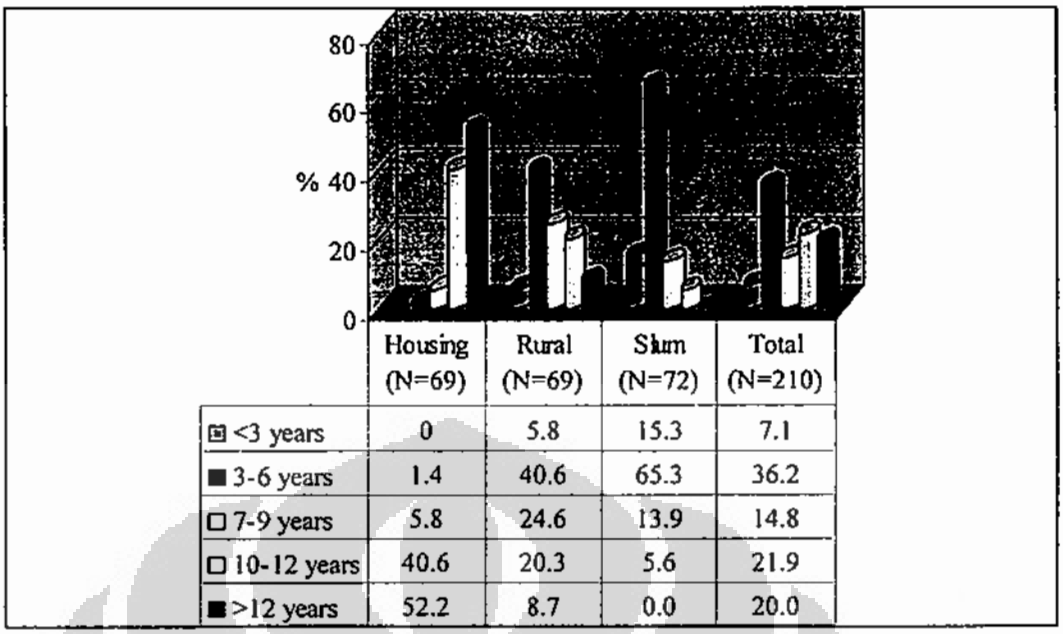


Figure 4.13. Food handler's perception on diarrhea due to food and hygiene by areas (Chi-square test (p<0.001))

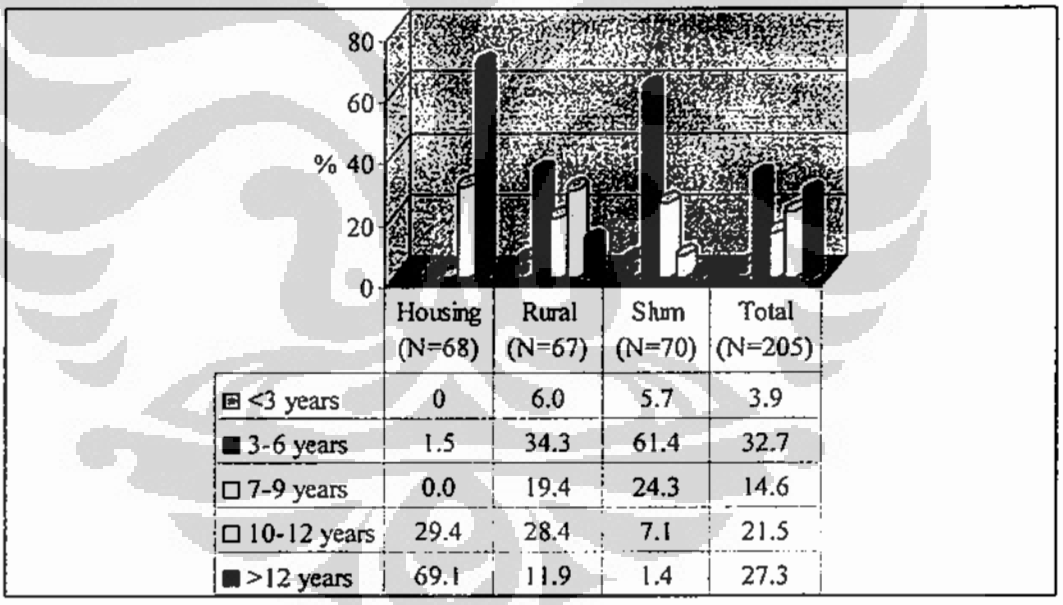
4.3.4. Educational level

The educational level of food handlers and fathers are shown in **Figure 4.14** and **Figure 4.15**. Most of the food handlers (36.2%) and fathers (32.7%) were having 3-6 years school education. There was significant difference on food handlers and father's education among housing, rural, and slum areas. Food handlers and fathers in housing area tend to have more than 12 years education. Food handlers and fathers in rural and slum areas tend to have 3-6 years education.



	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
<3 years	0	5.8	15.3	7.1
3-6 years	1.4	40.6	65.3	36.2
7-9 years	5.8	24.6	13.9	14.8
10-12 years	40.6	20.3	5.6	21.9
>12 years	52.2	8.7	0.0	20.0

Figure 4.14. Food handler's educational level by areas (Chi-square test ($p<0.001$))



	Housing (N=68)	Rural (N=67)	Slum (N=70)	Total (N=205)
<3 years	0	6.0	5.7	3.9
3-6 years	1.5	34.3	61.4	32.7
7-9 years	0.0	19.4	24.3	14.6
10-12 years	29.4	28.4	7.1	21.5
>12 years	69.1	11.9	1.4	27.3

Figure 4.15. Father educational level by areas (Chi-square test ($p<0.001$))

4.3.5. Mother and father's occupation

Figure 4.16 and **Figure 4.17** shows mother and father's occupation. Most of the mothers were housewives (78%). Most fathers were working as labor (40%) and employer in private company (31%). There were more housewives mothers in slum area compared to housing and rural areas. Most fathers in

housing area worked as employee in private company. Most fathers in rural and slum areas worked as labor. However, there was no significant difference on mother and father's occupation among housing, rural, and slum areas.

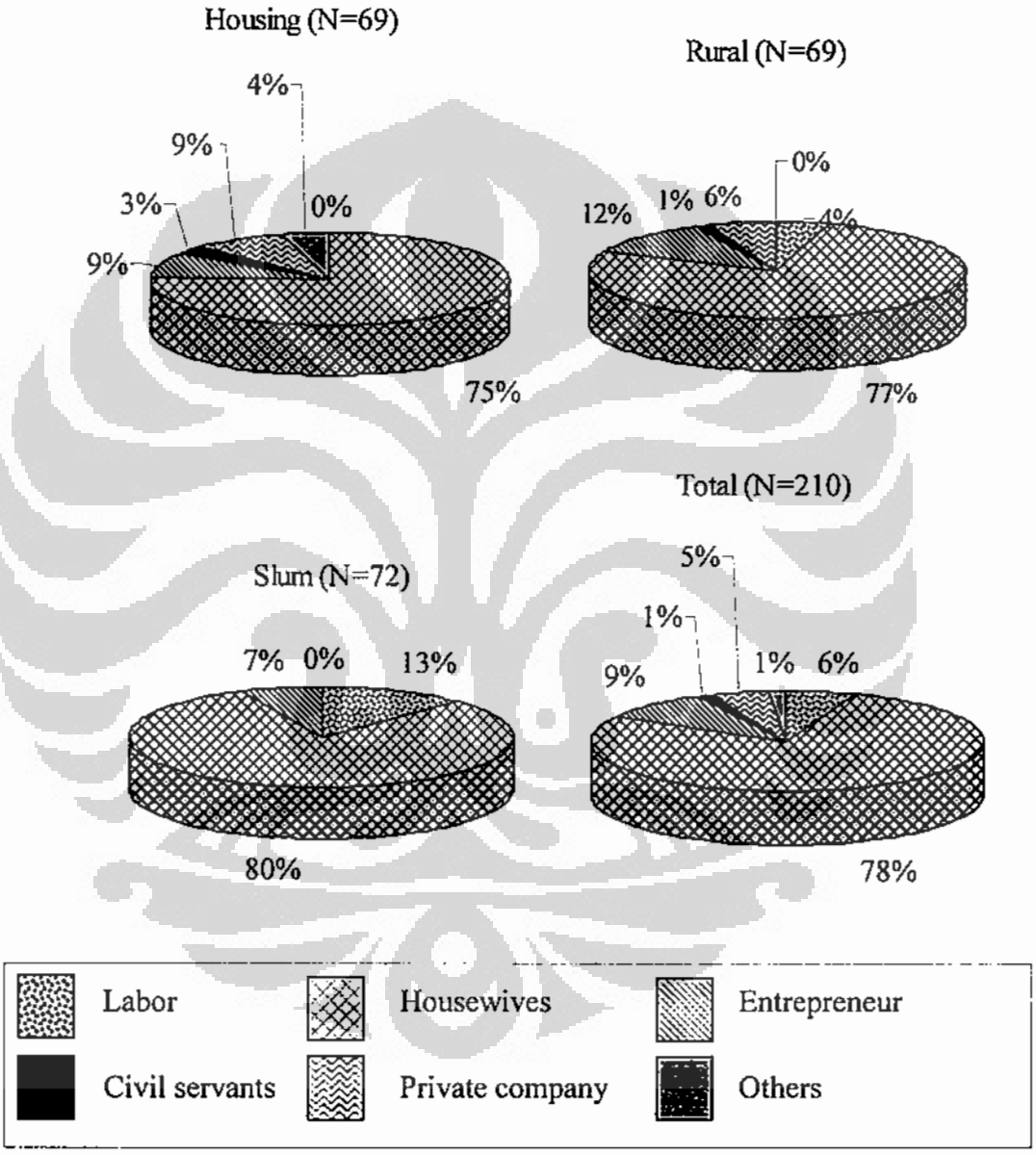


Figure 4.16. Mother's occupation by areas

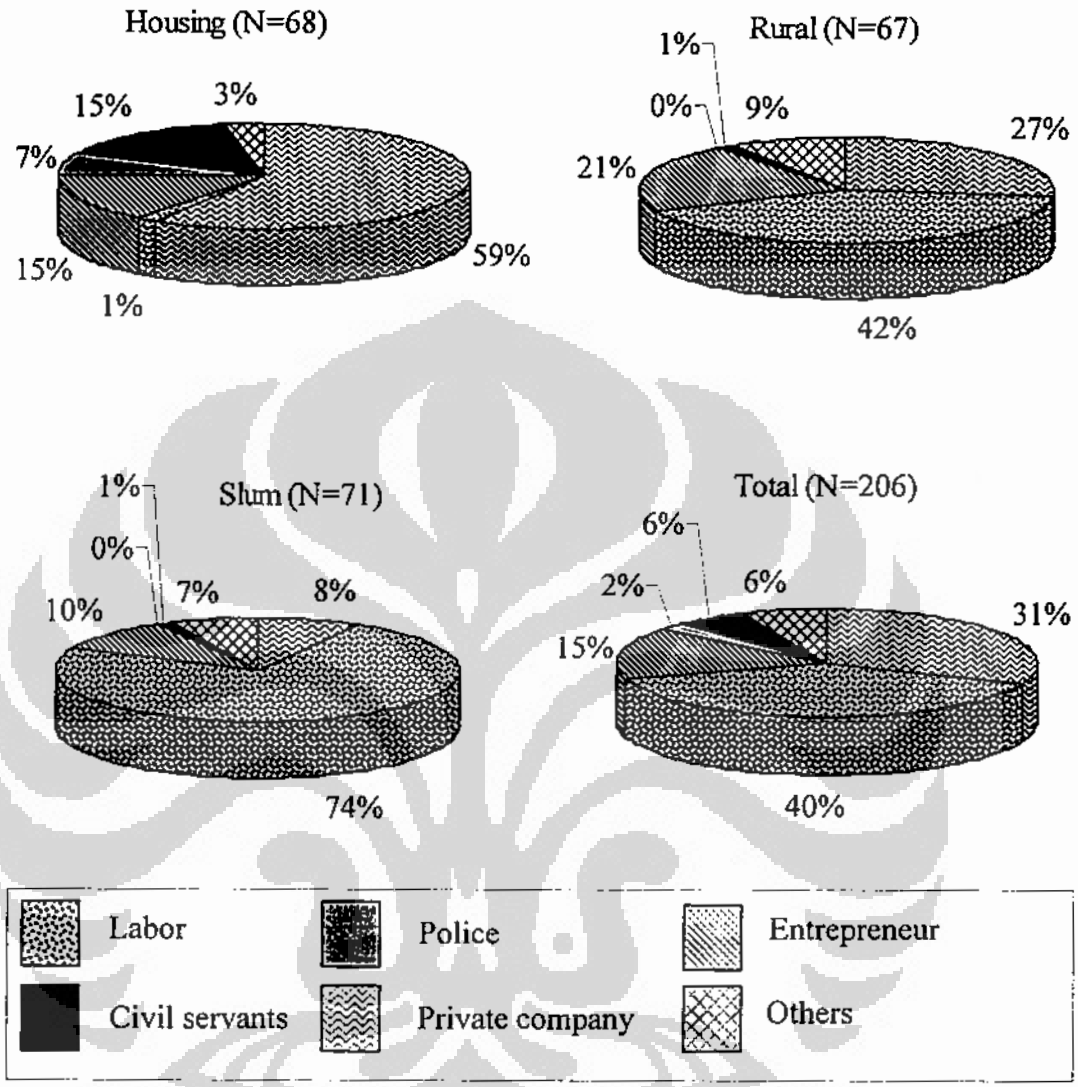


Figure 4.17. Father's occupation by areas

4.3.6. Economic condition

The economic condition of the household was shown in **Table 4.13**. There was significant difference on monthly food expenditure, cooking fuel expenditure, expenditure for cleaning material and equipment, and total expenditure of household among housing, rural, and slum areas. Households in housing area tend to have higher food expenditure, cooking fuel expenditure, and cleaning material and equipment expenditure compared to rural and slum areas. Households in housing area also tend to have higher total expenditure compared to rural and slum areas.

Table 4.13. Number of household monthly income contributor and expenditure by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Number of income contributor to HH = 1 person	47 (68.1)	42 (60.9)	53 (73.6)	142 (67.6)
Food expenditure ≤ Rp. 750.000,-***	5 (7.2)	45 (65.2)	57 (79.2)	107 (51)
Cooking fuel expenditure ≤ Rp. 40.000,-***	16 (23.2)	41 (59.4)	51 (70.8)	108 (51.4)
Cleaning material and equipment expenditure ≤ Rp. 55.000,-***	10 (13)	49 (71)	46 (63.9)	105 (50)
Total expenditure ≤ Rp. 2.000.000,-***	5 (7.2)	40 (58)	57 (79.2)	102 (48.6)

***Chi-square test ($p<0.001$)

4.3.7. Food handler's knowledge

Table 4.14 shows food handler's food preparation and handling knowledge. Regarding the knowledge about cooked food storage and reheating, half of them (59.5%) responded correctly. Only 11.9% and 22.9% of them answered correct answers to the questions of knowledge about washing and drying hands. Most of them (79%) responded correctly for knowledge about washing fruits and thorough cooking. Only 33.5% respondent correctly answered the questions about addition of ingredients after heat treatment knowledge. Most of them (80.5%) answered correctly to the questions regarding knowledge about cleanliness of the place of purchasing food. Less than half of the respondent (45.7% and 48.1%) correctly responded on the knowledge about reading expiry date and observing broken package prior to purchasing of package food. Almost all of them (96.2%) knew the correct package food storage. Most of them (75.7%) knew the correct practice of washing dishes.

There was significant difference on knowledge about washing fruit, thorough cooking, addition of ingredients after heat treatment, reading expiry date, observing broken package, and washing dishes among housing, rural, and slum areas. Food handlers in housing area tend to have better knowledge about

washing fruit, thorough cooking, addition of ingredient after heat treatment, read expiry date, observe broken package, and washing dishes compared to rural and slum areas.

Table 4.14. Food handlers' food preparation and handling knowledge by areas

Correct responses	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n(%)			
Storing and reheating:				
- Cooked food storage and reheating	43 (62.3)	45 (65.2)	37 (51.4)	125 (59.5)
- Package food storage	69 (100)	69 (100)	64 (88.9)	202 (96.2)
Hand washing and drying:				
- Hand washing	6 (8.7)	8 (11.6)	11 (15.3)	25 (11.9)
- Hand drying	21 (30.4)	13 (18.8)	14 (19.4)	48 (22.9)
Washing fruits***	65 (94.2)	54 (78.3)	47 (65.3)	166 (79)
Thorough cooking*	61 (88.4)	49 (71)	56 (77.8)	166 (79)
Addition of ingredients***	37 (64.9)	11 (27.5)	5 (8.2)	53 (33.5)
Purchasing:				
- Cleanliness of place of purchasing	60 (87)	56 (81.2)	53 (73.6)	169 (80.5)
- Read expire date***	43 (62.3)	32 (46.4)	21 (29.2)	96 (45.7)
- Observe broken package**	44 (63.8)	32 (46.4)	25 (34.7)	101 (48.1)
Dish washing***	66 (95.7)	48 (69.6)	45 (62.5)	159 (75.7)

*Chi square test ($p<0.05$)
**Chi square test ($p<0.01$)
***Chi square test ($p<0.001$)

4.3.8. Food handler's exposure to food safety information

Table 4.15 shows the food handlers exposure to food safety information. Although most of them (88.6%) owned television and half of the respondents (50%) owned radio, but only 32.4% of the food handlers have received information about washing hand with soap. And only few of them (7.1% and 5.7%, respectively) have received information about proper dish washing and washing fruits and vegetables. There was significant difference on ownership of

TV and radio among housing, rural, and slum areas. There were more households in housing area that had television and radio compared to rural and slum areas.

Table 4.15. Food safety information received by food handlers and ownership of TV and radio by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n(%)			
Receive information about:				
- hand washing with soap	23 (33.3)	21 (30.4)	24 (33.3)	68 (32.4)
- proper dish washing	9 (13)	4 (5.8)	2 (2.8)	15 (7.1)
- washing fruits	5 (7.2)	5 (7.2)	2 (2.8)	12 (5.7)
Ownership of (%):				
- TV***	69 (100)	64 (92.8)	53 (73.6)	186 (88.6)
- Radio***	54 (78.3)	32 (46.4)	19 (26.4)	105 (50.0)

***Chi square test ($p<0.001$)

4.3.9. Food handler's attitude

Table 4.16 shows food handler's attitude on food preparation and handling. Most of the food handlers have good attitude toward cross contamination statements. Except, for the statement of "it is alright to taste food with finger"; "it is alright to clean kitchen surface without soap"; and "preparing food whilst suffering from flu/typhus/wound in hand is acceptable", there were 30%; 27.1%; and 60% food handlers, respectively were agreed to the statement. Most of the food handlers also have good attitude toward thorough cooking statements. However, there were 14.3% food handlers agreed to the statement of "it is acceptable for child to eat fish/chicken/meat that has been cooked rare or medium rare" and 18.6% food handlers disagreed to the statement of "diarrhea in children can be caused by eating uncooked foods".

Regarding storing, most of the food handlers have good attitude, except that there were 27.1% and 38.1% food handlers, respectively, disagreed to the statement of "cooked foods, once cooled should be refrigerated or frozen immediately if stored" and "frozen food that has been defrosted should not be refrozen". Most of the food handlers also have good attitude toward reheating,

except that there were 64.3% and 53.8% food handlers, respectively, agreed to the statement of "it is acceptable to reheat child food until warm" and "if foods are not having bad smell, it is acceptable to be eaten by child".

Almost half of the food handlers have poor attitude toward addition of ingredients after heat treatment. Regarding purchasing, most of the food handlers have good attitude. However, there were 37.6% food handlers agreed to the statement of "ready to eat food purchased from mobile food vendor must be safe to be eaten by child". Regarding attitude toward washing fruits, almost all food handlers have good attitude. Almost all of the food handlers also have good attitude toward hand washing but not hand drying. Regarding bottle cleaning and dish washing, almost all of the food handlers have good attitude.

Table 4.16. Food handler's food preparation and handling attitude

Attitude statement (N=210)	Strongly agree	Agree	Disagree	Strongly disagree
Cross contaminations:				
- Knife that has been used for cutting fish/chicken/meat no need to wash before using it for cutting fruit for child	1 (0.5)	10 (4.8)	115 (54.8)	84 (40)
- Cutting board that has been used for cutting fish/chicken/meat no need to wash before using it for cutting fruit for child	0 (0)	8 (3.8)	115 (54.8)	87 (41.4)
- It is alright to taste food with fingers	1 (0.5)	63 (30)	120 (57.1)	26 (12.4)
- It is alright to clean kitchen surface without soap	1 (0.5)	57 (27.1)	129 (61.4)	23 (11)
- Preparing food whilst suffering from flu/typhus/wound in hand is acceptable	2 (1)	126 (60)	61 (29)	21 (10)
Thorough cooking:				
- It is acceptable for child to eat food containing raw egg	0 (0)	17 (8.1)	130 (61.9)	63 (30)
- It is acceptable for child to eat fish/chicken/meat that has been cooked rare or medium rare	1 (0.5)	30 (14.3)	140 (66.7)	39 (18.6)
- It is alright if child drink unboiled water	2 (1)	1 (0.5)	88 (41.9)	119 (56.7)

Attitude statement (N=210)	Strongly agree	Agree	Disagree	Strongly disagree
- Diarrhea in children can be caused by eating uncooked foods	39 (18.6)	123 (58.6)	39 (18.6)	9 (4.3)
Storing:				
- It is important to cover cooked food for child during storage	72 (34.3)	136 (64.8)	0 (0)	2 (1)
- Cooked foods, once cooled should be refrigerated or frozen immediately if stored	21 (10)	131 (62.4)	57 (27.1)	1 (0.5)
- It is alright to leave cooked food for child on a kitchen work surface overnight	1 (0.5)	15 (7.1)	154 (73.3)	40 (19)
- Frozen food that has been defrosted should not be refrozen	16 (7.6)	113 (53.8)	80 (38.1)	1 (0.5)
Reheating:				
- It is acceptable to reheat child food until warm	7 (3.3)	135 (64.3)	61 (29)	7 (3.3)
- If foods are not having bad smell, it is acceptable to be eaten by child	4 (1.9)	113 (53.8)	80 (38.1)	13 (6.2)
- It is essential to reheat stored food before consumed by child	43 (20.5)	152 (72.4)	15 (7.1)	0 (0)
Addition of ingredient:				
- It is alright to add celery into chicken porridge without reheating again	3 (1.4)	85 (40.5)	106 (50.5)	16 (7.6)
Purchasing:				
- Ready to eat food purchased from mobile food vendor must be safe to be eaten by child	2 (1)	79 (37.6)	112 (53.3)	17 (8.1)
- It is important to follow food handling instructions on product packaging	78 (37.1)	119 (56.7)	13 (6.2)	0 (0)
- It is important to read expire date on food packaging	115 (54.8)	87 (41.4)	8 (3.8)	0 (0)
- It is essential to purchase child food from a clean place	102 (48.6)	107 (51)	0 (0)	1 (0.5)
Washing fruits:				
- It is important to wash fruit before it is consumed by child	98 (46.7)	108 (51.4)	2 (1)	2 (1)
Hand washing and drying:				
- It is not necessary to wash hand prior to child feeding	3 (1.4)	12 (5.7)	136 (64.8)	59 (28.1)
- It is not necessary to wash hand before taste child food with finger	4 (1.9)	13 (6.2)	135 (64.3)	58 (27.6)
- It is important to wash hand before preparing child food	71 (33.8)	134 (63.8)	4 (1.9)	1 (0.5)

Attitude statement (N=210)	Strongly agree	Agree	Disagree	Strongly disagree
- It is important to wash hand after preparing child food	54 (25.7)	148 (70.5)	8 (3.8)	0 (0)
- It is alright to wipe hand with clothes/hand towel	6 (2.9)	186 (88.6)	17 (8.1)	1 (0.5)
- It is better to use tissue to dry child hand rather than clothes/hand towel	19 (9)	119 (56.7)	70 (33.3)	2 (1)
Bottle cleaning:				
- It is not necessary to clean child bottle before using it	0 (0)	5 (2.4)	131 (62.4)	74 (35.2)
Dish washing:				
- It is important to wash child eating utensils with soap	60 (28.6)	144 (68.6)	5 (2.4)	1 (0.5)

4.3.10. Food handler's practice

Table 4.17 shows food handlers' food preparation and handling practices. There were 37.1% food handlers who add ingredients to the children food after heat treatment. However most of the ingredients were soybean sauce and fried onion, there was only few of them who add raw ingredients such as celery. Most of the food handlers (80.1%) store the food in room temperature for more than 2 hours, and among them there were 70.7% food handlers who did not reheat the food after storage before consumption.

There were 18.6% of food handlers who gave raw food to the children. There were 19% of food handlers who gave half cooked egg to the children. Most of the children consumed package food (98.1%). However, there were 40.8% of them who did not read the expiry date of the product and most of them (81.1%) did not observe the package condition. There were 34.3% of the food handlers who chewed child food prior to feeding. There were 44.3% of the food handlers who checked the temperature of child's food by taking the food with spoon and there were 29.5% of the food handlers who dip finger into the child's food to check the temperature. There were only 9.5% of the food handlers who put the child's food in the palm to check the temperature. There was significant difference on practice of giving half cooked egg to children, practice of reading expiry date when purchased packaged food and practice of chew child food prior to feeding among housing, rural, and slum areas. There were more children who

consumed half cooked egg in the slum area compared to housing and rural area. There were more food handlers who did not read expiry date and chew child food prior to feeding in the slum area compared to housing and rural areas.

Table 4.17. Food handler's food preparation and handling practice by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Addition of ingredient: Yes	21 (33.9) (N=62)	27 (42.9) (N=63)	24 (34.8) (N=69)	72 (37.1) (N=194)
Storing: Store cooked food in room temperature for more than 2 hours	42 (79.2) (N=53)	45 (84.9) (N=53)	46 (76.7) (N=60)	133 (80.1) (N=166)
Reheating: No (after storage in room temperature for more than 2 hours)	33 (62.3)	37 (82.2)	31 (67.4)	94 (70.7)
Thorough cooking:	8 (11.6)	15 (21.7)	16 (22.2)	39 (18.6)
- Consume uncooked food (tomato, carrot, cucumber, beans, long bean, *tempe*, tofu, local chicken egg, uncooked instant noodles)				
- Consume half cooked egg*	6 (8.7)	16 (23.2)	18 (25)	40 (19.0)
Purchasing: Consume package food	67 (97.1)	68 (98.6)	71 (98.6)	206 (98.1)
- not reading expire date***	9 (13.4)	29 (42.6)	46 (64.8)	84 (40.8)
- not observe broken package	50 (74.6)	57 (83.8)	60 (84.5)	167 (81.1)
Cross contamination:	13 (18.8)	25 (36.2)	34 (47.2)	72 (34.3)
- Chew child food prior to feeding**				
- Procedure for checking temperature of children's food prior to feeding:				
- take a little portion with spoon and put it in the mouth (use the same spoon to feed the child)	22 (31.9)	29 (42)	42 (58.3)	93 (44.3)
- take a little portion with spoon and put it in the palm (spoon touch the palm)	10 (14.5)	7 (10.1)	3 (4.2)	20 (9.5)
- dip a finger into the food	14 (20.3)	24 (34.8)	24 (33.3)	62 (29.5)
- Use same cutting board for fruit/veg & meat: Yes	13 (18.8)	10 (14.5)	19 (26.4)	42 (20.0)

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
- not cleaning (in between the work)	3 (23.1)	1 (10)	2 (10.5)	6 (14.3)
- not using soap for cleaning	2 (20)	0 (0)	1 (5.9)	6 (16.6)
- Use same knife for fruit/veg & meat: Yes*	34 (49.3)	48 (69.6)	47 (65.3)	129 (61.4)
- not cleaning (in between the work)	16 (47.1)	25 (52.1)	27 (57.4)	68 (52.7)
- not using soap for cleaning	1 (5.6)	7 (30.4)	3 (15)	11 (18.0)
- Food handler still prepare food during illness	50 (75.8)	43 (63.2)	57 (79.2)	150 (72.8)
- Clean kitchen before cooking: Yes**	1 (1.5)	9 (13)	14 (19.4)	24 (11.5)
- not using cleaning agent/soap	0 (0)	9 (100)	12 (85.7)	21 (87.5)

*Chi square test ($p<0.05$)
**Chi square test ($p<0.01$)
***Chi square test ($p<0.001$)

Table 4.18 shows food handlers' hygiene practices. Almost all the children consume fruit (97.6%). However, there were 26.3% of the food handlers did not wash the fruit prior to consumption. Among food handlers who washed the fruit prior to consumption, there were 16.1% of them who did not wash the fruit in running water. There was 46.7% food handlers practiced bottle feeding. Among them there were 10.2% who did not use soap nor boil/steam for cleaning the bottle. There were 20% food handlers who used same cutting board for meat and fruit/vegetable, 14.3% of them did not clean the cutting board after using it for meat before using it for fruit/vegetable. And among those who clean the cutting board after using it for meat before using it for fruit/vegetable, 16.6% of them did not used soap when washed the cutting board. There were 61.4% of food handlers who used the same knife to cut meat and fruit/vegetable, 52.7% of them did not clean the knife after using it to cut meat before using it to cut fruit/vegetable. And among those who clean the knife after using it to cut meat before using it to cut fruit/vegetable, 18% of them did not used soap when washed the knife. There were only 11.5% of food handlers who clean kitchen prior to food

preparation, and 12.5% of them did not used soap when cleaned the kitchen prior to food preparation.

Table 4.18. Food handler's hygiene practices by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Washing fruits: Consume fruit	66 (95.7)	69 (100)	70 (97.2)	205 (97.6)
- not wash	16 (24.2)	20 (28.9)	18 (25.7)	54 (26.3)
- wash with water in bowl	8 (12.1)	13 (18.8)	12 (17.1)	33 (16.1)
Bottle feeding**	44 (63.8)	30 (43.5)	24 (33.3)	98 (46.7)
Bottle cleaning practices:				
- wash with soap then boil/steam	30 (68.2)	12 (40)	1 (4.2)	43 (43.9)
- wash with soap not boil/steam	10 (22.8)	14 (46.6)	15 (62.5)	39 (39.7)
- wash without soap then boil/steam	3 (6.8)	2 (6.7)	1 (4.2)	6 (6.1)
- wash without soap not boil/steam	1 (2.3)	2 (6.7)	7 (29.1)	10 (10.2)
Dish washing practices:				
- not in running water***	9 (13)	34 (49.3)	32 (44.4)	75 (35.7)
- clean dishes put on the floor***	0 (0)	10 (14.5)	17 (23.6)	27 (12.9)

**Chi square test ($p<0.01$)
***Chi square test ($p<0.001$)

There were 35.7% of food handlers who washed the cooking/eating utensils not in running water. There were 12.9% of food handlers who put the clean cooking/eating utensils on the floor right after washing them before store on the shelves, kitchen cabinet, or bucket. Most of the food handlers (72.8%) still prepare food even though they were suffering from flu/typhus/hand wound.

There was significant difference on practice of bottle feeding, practice on the use of same knife for meat and fruit, practice of cleaning kitchen before cooking, and washing dishes practice among housing, rural, and slum areas. There were more children who were bottle-fed in the housing area compared to rural and slum areas. There were more food handlers who used same knife for meat and fruit in the rural area compared to housing and slum areas. There were more

households in the slum area that clean kitchen before cooking compared to housing and rural areas. There were more food handlers who did not wash dishes in running water in rural area compared to housing and slum areas. There were more food handlers who put clean dishes on the floor after washing in the slum area compared to housing and rural areas.

Table 4.19 shows food handlers and children's washing and drying hand practices. There were 39.5% of food handlers who washed hands before food preparation, among them there were 14.5% who did not use soap when washed their hands and not washed their hands in running water, and almost all of them (97.6%) used towel/clothes to dry their hands. There was only 25.7% of food handlers who washed hands before feeding the children, among them there were 13% who did not use soap when washed their hands and 5.6% who did not wash hands in running water. And, almost all of them (94.4%) used towel/clothes to dry their hands. Among 39% of food handlers who touched food by finger/hands to check the temperature of the food, there was only 2.4% who washed their hands in running water and using soap before touching the food, but all of them used towel/clothes to dry their hands. Almost all of the children (95.7%) hold the food by their own hands during eating activities. However, there were only 43.3% of them who washed their hands before eating. Among them who washed their hands before eating, there were 27.6% children who did not use soap when washed their hands and 24.1% children who did not wash hands in running water. And, almost all of them (96.6%) dried their hands by wiping them to towel/clothes.

There was significant difference on food handler's hand washing practice before feeding the child among housing, rural, and slum areas. There were more food handlers in the housing area who wash hand before feeding the child compared to rural and slum areas.

Table 4.19. Food handler's and children's hand washing and drying practice by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Food handler hand washing and drying practices:				
- Before food preparation: Yes	33 (47.8)	29 (42)	21 (29.2)	83 (39.5)
- wash hand without soap	5 (15.2)	6 (20.7)	1 (4.8)	12 (14.5)
- wash hand not in running water	3 (9.1)	5 (17.2)	4 (19)	12 (14.5)
- dry hand by wiping to towel/clothes	31 (93.9)	29 (100)	21 (100)	81 (97.6)
- Before feed the child: Yes**	28 (40.6)	14 (20.3)	12 (16.7)	54 (25.7)
- wash hand without soap	2 (7.1)	3 (21.4)	2 (16.7)	7 (13)
- wash hand not in running water	0 (0)	2 (14.3)	1 (8.3)	3 (5.6)
- dry hand by wiping to towel/clothes	25 (89.3)	14 (100)	12 (100)	51 (94.4)
- Before taste child food by finger/hand: Yes	1 (4.2)	1 (3.2)	0 (0)	2 (2.4)
- wash hand without soap	0 (0)	0 (0)	0 (0)	0 (0)
- wash hand not in running water	0 (0)	0 (0)	0 (0)	0 (0)
- dry hand by wiping to towel/clothes	0 (0)	1 (100)	0 (0)	2 (100)
Number of child eat by themselves	65 (94.2)	68 (98.6)	68 (94.4)	201 (95.7)
Children hand washing and drying practices:				
- Before eating: Yes	31 (47.7)	27 (39.1)	31 (43.1)	87 (43.3)
- wash hand without soap	6 (19.4)	6 (22.2)	13 (41.9)	24 (27.6)
- wash hand not in running water	6 (19.4)	4 (14.8)	11 (35.5)	21 (24.1)
- dry hand by wiping to towel/clothes	29 (93.5)	26 (96.3)	31 (100)	84 (96.6)

**Chi square test ($p<0.01$)

4.3.11. Cooking, storage, and hygiene facility condition

Table 4.20 shows household cooking facility. There were only 5% of respondents who had outdoor type of kitchen. Most of the kitchen work surface

was made of tile and wood (45% and 52%, respectively). Most of kitchen floor were made of tile (53.5%), soft cement (19.5%), and soil (26.5%). Most of kitchen wall were wooden wall (19.5%), tile (36%), soft cement (20%), hard cement (20%). Most of kitchen ceiling were tile (31%), concrete cement, triplex/gypsum (29.5%), and asbestos (24%). Most of the respondents used LPG (77.1%) as cooking fuel; there was only 12.9% and 10% who used firewood and kerosene, respectively. Almost all of the respondents have their own cooking equipment for preparing children's food as only few of them (6.7%) who ever borrowed the cooking equipment. There was significant difference on type of cooking fuel among housing, rural, and slum areas. There were more households who used LPG as cooking fuel in housing area compared to rural and slum areas.

Table 4.20. Household's cooking facility by areas

	Housing (N=69)	Rural (N=69)	Slum (N=62)	Total (N=200)
	n (%)			
Type of kitchen: outdoor	0 (0)	3 (4.3)	7 (11.3)	10 (5)
Type of kitchen work surface:				
- Wooden surface	1 (1.4)	46 (66.7)	57 (91.9)	104 (52)
- Tile	65 (94.2)	21 (30.4)	4 (6.5)	90 (45)
- Soft cement	3 (4.3)	1 (1.4)	1 (1.6)	5 (2.5)
- Rough cement	0 (0)	1 (1.4)	0 (0)	1 (0.5)
Type of kitchen floor:				
- Tile	65 (94.2)	33 (47.8)	9 (14.5)	107 (53.5)
- Soft cement	4 (5.8)	21 (30.4)	14 (22.6)	39 (19.5)
- Rough cement	0 (0)	1 (1.4)	0 (0)	1 (0.5)
- Soil	0 (0)	14 (20.3)	39 (62.9)	53 (26.5)
Type of kitchen wall:				
- Wooden wall	0 (0)	7 (10.1)	32 (51.6)	39 (19.5)
- Half tile	62 (89.9)	8 (11.6)	2 (3.2)	72 (36)
- Soft cement	7 (10.1)	23 (33.3)	10 (16.1)	40 (20)
- Hard cement	0 (0)	30 (43.5)	10 (16.1)	40 (20)
- Zinc	0 (0)	1 (1.4)	3 (4.8)	4 (2)
- None	0 (0)	0 (0)	5 (8.1)	5 (2.5)
Type of kitchen ceiling:				
- Tile	1 (1.4)	37 (53.6)	24 (38.7)	62 (31)
- Concrete cement	28 (40.6)	0 (0)	0 (0)	28 (14)
- Zinc	0 (0)	0 (0)	2 (3.2)	2 (1)
- Triplex/gypsum	28 (40.6)	12 (17.3)	19 (30.7)	59 (29.5)
- Asbestos	12 (17.4)	20 (29)	16 (25.8)	48 (24)

	Housing (N=69)	Rural (N=69)	Slum (N=62)	Total (N=200)
	n (%)			
- None	0 (0)	0 (0)	1 (1.6)	1 (0.5)
Type of cooking fuel:***				
- Kerosene	4 (5.8)	12 (17.4)	5 (6.9)	21 (10)
- LPG	65 (94.2)	50 (72.5)	47 (65.3)	162 (77.1)
- Firewood	0 (0)	7 (10.1)	20 (27.8)	27 (12.9)
Borrowing cooking facility	1 (1.4)	6 (8.7)	7 (9.7)	14 (6.7)

***Chi-square test ($p<0.001$)

Table 4.21 shows household storage facility. Most of the household's hot water storage were in thermos (82.3%) and 11.4% remain stored in the kettle. Out of gallon water (dispenser) users, there was 87% household who stored drinking water in water pot, but 13.5% were not closed. There was 65.4% household who did not separate the storage place for cooked food; most of the cooked food were stored openly (not cover) and 27% of rice were also stored without cover. Half of the household (52.9%) had refrigerator. Almost all of the storage for cooking and eating utensils (97.5% and 99%, respectively) was not closed. There was significant difference on ownership of refrigerator, and condition of drinking water and rice storage among housing, rural, and slum areas. There were more households who had refrigerator in housing area compared to rural and slum areas. There were more food handlers who stored openly the drinking water and cooked rice in the slum area compared to housing and rural areas.

Table 4.21. Household's storage facility by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Hot water storage:	N=43	N=56	N=59	N=158
- Thermos	33 (76.7)	48 (85.7)	49 (83.1)	130 (82.3)
- Remain in the kettle	5 (11.6)	4 (7.1)	9 (15.3)	18 (11.4)
- No storage, immediately boil	5 (11.6)	3 (5.4)	1 (1.7)	9 (5.7)
- Gallon	0 (0)	1 (1.8)	0 (0)	1 (0.6)
Drinking water storage:	N=15	N=49	N=44	N=108
- Water pot	13 (86.7)	46 (93.9)	35 (79.5)	94 (87)
- Remain in the boiler pot	0 (0)	3 (6.1)	5 (11.4)	8 (7.4)

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
- Bottle	1 (6.7)	0 (0)	4 (9.1)	5 (4.6)
Ownership of refrigerator: Yes***	66 (95.7)	28 (40.6)	17 (23.6)	111 (52.9)
Separate cooked food storage: No	37 (55.2)	49 (73.1)	39 (68.4)	125 (65.4)
Drinking water storage: open**	1 (1.4)	10 (14.5)	16 (25.8)	27 (13.5)
Cooked food storage: open	34 (64.2)	40 (75.5)	39 (78)	113 (72.4)
Cooked rice storage: open***	3 (5.3)	12 (20.3)	32 (55.2)	47 (27)
Eating utensils storage: open	65 (94.2)	69 (100)	61 (98.4)	195 (97.5)
Cooking utensils storage: open	67 (97.1)	69 (100)	62 (100)	198 (99)

**Chi square test ($p<0.01$)
***Chi square test ($p<0.001$)

Table 4.22 shows household safe water source facility. Most of the food handlers (64.2%) used boiled water from well and tap for preparing uncooked food for the children (food that doesn't have heat treatment e.g. fruit juices, instant food, etc); 22.5% food handlers used water from gallon non refill; and 12.1% used refill water gallon. There were 51% food handlers used boiled drinking water; 25.7% used gallon non refill; and 22.4% used refill gallon water, among them there were 19.1% who boiled the refill gallon water before drinking. There were 24.8% of food handlers who used hot water from dispenser. The water source for cleaning eating utensils was mostly from tap water (90.5%) and unboiled. The water source for washing fruit was mostly (85.7%) from unboiled water (tap and well). There was significant difference hot water source among housing, rural, and slum areas. There were more food handlers who prepared hot water by dispenser in the housing area compared to rural and slum areas.

Table 4.22. Household's safe water facility by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Water source for uncooked food preparation:	N=65	N=54	N=54	N=173
- Unboiled	0 (0)	0 (0)	2 (3.7)	2 (1.2)
- Boiled	25 (38.5)	44 (81.5)	42 (77.8)	111 (64.2)

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
- Gallon non refill	33 (50.8)	3 (5.6)	3 (5.6)	39 (22.5)
- Gallon refill	7 (10.8)	7 (13)	7 (13)	21 (12.1)
Drinking water sources				
- Unboiled	0 (0)	1 (1.4)	1 (1.4)	2 (1)
- Boiled	15 (21.7)	48 (69.6)	44 (61.1)	107 (51)
- Gallon non refill	43 (62.3)	4 (5.8)	7 (9.7)	54 (25.7)
- Gallon refill	11 (15.9)	16 (23.2)	20 (27.8)	47 (22.4)
- Boil gallon refill water	3 (27.3)	2 (12.5)	4 (20)	9 (19.1)
Hot water preparation from dispenser*	26 (37.7)	13 (18.8)	13 (18.1)	52 (24.8)
Water source for cleaning eating utensils:				
- Well	0 (0)	8 (11.6)	7 (9.7)	15 (7.1)
- Tap	66 (95.7)	59 (85.5)	65 (90.3)	190 (90.5)
- Mobile water vendor	1 (1.4)	0 (0)	0 (0)	1 (0.5)
- Boiled water	1 (1.4)	0 (0)	0 (0)	1 (0.5)
- Gallon non refill	1 (1.4)	1 (1.4)	0 (0)	2 (1)
- Gallon refill	0 (0)	1 (1.4)	0 (0)	1 (0.5)
Water source for washing fruits:	N=57	N=62	N=66	N=185
- Unboiled	42 (73.7)	56 (90.3)	61 (92.4)	159 (85.9)
- Boiled	8 (14)	5 (8.1)	5 (7.6)	18 (9.7)
- Gallon non refill	7 (12.3)	1 (1.6)	0 (0)	8 (4.3)

*Chi square test ($p<0.05$)

Table 4.23 shows household hygiene facility. From the result of observation, 42.5% of household did not have dish washing soap; only few households (1.5% and 1% respectively) that did not clothes detergent/soap and hand washing/bath soap. There were 43.5% households who did not have cleaning agent for the floor. Most of the households (84.2%) defecate in latrine, only 15.6% were public latrine and most latrines (89.4%) were equipped with closet and septic tank. However, there were only 69.5% children throw their feces to the latrine as 10.5% was to the house surroundings. There were 44.8% food handlers who throw the kitchen garbage as soon as they finished the cooking; 31% was when the garbage bin has already been full; and 20.5% was in the day after. There was only 33.3% household who provided by routine garbage pick-up services; half of the households (54.3%) were burning their garbage on their house surroundings; 10% were digging hole to dispose their garbage.

Table 4.23. Household's hygiene facility by areas

	Housing (N=69)	Rural (N=69)	Slum (N=62)	Total (N=200)
	n (%)			
Dish washing soap: No***	0 (0)	30 (43.5)	55 (88.7)	85 (42.5)
Clothes detergent/soap: No	0 (0)	1 (1.4)	2 (3.2)	3 (1.5)
Hand washing/bath soap: No	1 (1.4)	0 (0)	1 (1.6)	2 (1)
Floor cleaning agent: No***	5 (7.2)	36 (65.5)	23 (100)	64 (43.5)
HH defecation place:				N=210
- Latrine	69 (100)	58 (84.1)	52 (72.2)	179 (85.2)
- House surroundings	0 (0)	0 (0)	5 (6.9)	5 (2.4)
- River	0 (0)	0 (0)	1 (1.4)	1 (0.5)
- Pond	0 (0)	11 (15.9)	9 (12.5)	20 (9.5)
- Dig hole	0 (0)	0 (0)	4 (5.6)	4 (1.9)
- Gutter	0 (0)	0 (0)	1 (1.4)	1 (0.5)
Child defecation place:				N=210
- Latrine	58 (84.1)	51 (73.9)	37 (51.4)	146 (69.5)
- House surroundings	3 (4.3)	3 (4.3)	16 (22.2)	22 (10.5)
- River	1 (1.4)	0 (0)	0 (0)	1 (0.5)
- Pond	0 (0)	14 (20.3)	7 (9.7)	21 (10)
- Gutter	0 (0)	1 (1.4)	9 (12.5)	10 (4.8)
- Garbage bin	7 (10.1)	0 (0)	1 (1.4)	8 (3.8)
- Dig hole	0 (0)	0 (0)	2 (2.8)	2 (1)
Latrine ownership: public***	0 (0)	9 (15.5)	19 (36.5)	28 (15.6)
Latrine condition:				
- No closet	0 (0)	2 (3.4)	3 (5.8)	5 (2.8)
- With closet no septic tank	0 (0)	9 (15.5)	5 (9.6)	14 (7.8)
- With closet and septic tank	69 (100)	47 (81)	44 (84.6)	160 (89.4)
Time of garbage disposal:				N=210
- Immediately after cooking	24 (34.8)	34 (49.3)	36 (50)	94 (44.8)
- When the garbage bin is full	22 (31.9)	25 (36.2)	18 (25)	65 (31)
- The day after	18 (26.1)	9 (13)	16 (22.2)	43 (20.5)
- In the afternoon/night	5 (7.2)	1 (1.4)	2 (2.8)	8 (3.8)
Garbage disposal services/treatment:				
- Taken routinely by garbage officer	69 (100)	0 (0)	1 (1.4)	70 (33.3)
- Throw to river	0 (0)	0 (0)	5 (6.9)	5 (2.4)
- Dig hole	0 (0)	9 (13)	12 (16.7)	21 (10)
- Burn in house surroundings	0 (0)	60 (87)	54 (75)	114 (54.3)

***Chi square test ($p<0.001$)

There was significant difference on availability of dish washing soap, floor cleaning agent, and latrine ownership among housing, rural, and slum areas.

There were more households who had dish washing soap and floor cleaning agent in the housing area compared to rural and slum areas. Households in housing area also tend to have their own latrine.

4.3.12. Environment condition

Table 4.24 shows the environment condition of the household. Based on observation, there was 33.5% household kitchen that did not enter by sunlight. There was 82.5% and 83% household respectively who was seen to have garbage in the kitchen and outside of house. Based on the interview, 48.1% respondents said that there was rat entering their kitchen. Based on the observation, there were 32% household who was seen to have animal e.g. rat, flies, chicken, cat entering their kitchen. There was 61% and 68.5% household who was seen to have dirty cooking and eating utensils in their kitchen. Most of the garbage bin either in the kitchen (90.7%) or outside the house (85.1%) did not have a cover. Almost all of the garbage was left open even though the garbage bin was equipped by a cover, either in the kitchen (96%) or outside the house (98.3%). For the kitchen that has door and window, almost all of the door (97.3%) and window (97.9%) were opened during cooking activity. And, 78.4% of the kitchen ceilings were having open access.

There was significant difference on availability of garbage outside the house, animal in the kitchen, dirty cooking and eating utensils in the kitchen, garbage bin cover in the kitchen and outside the house, and kitchen ceiling condition among housing, rural, and slum areas. There were more households in the slum area that had garbage outside the house, animal in the kitchen, dirty cooking and eating utensils in the kitchen compared to housing and rural areas. There were more households in the rural area that had no cover for the garbage bin compared to housing and slum areas. There were also more households in the rural area that had open ceiling of the kitchen compared to housing and slum areas.

Table 4.24. Household's environment condition by areas

	Housing (N=69)	Rural (N=69)	Slum (N=62)	Total (N=200)
	n (%)			
Sunlight enter kitchen: No	22 (31.9)	26 (37.7)	19 (30.6)	67 (33.5)
Garbage in the kitchen: Yes	58 (84.1)	53 (76.8)	54 (87.1)	165 (82.5)
Garbage outside the house: Yes***	54 (78.3)	50 (72.5)	62 (100)	166 (83)
Animal in the kitchen: Yes***	3 (4.3)	3 (4.3)	58 (93.5)	64 (32)
Animal enter kitchen: rat***	20 (29)	34 (49.3)	47 (65.3)	101 (48.1)
Dirty cooking utensils in the kitchen: Yes*	34 (49.3)	42 (60.9)	46 (74.2)	122 (61)
Dirty eating utensils in the kitchen: Yes***	34 (49.3)	48 (69.6)	55 (88.7)	137 (68.5)
Garbage bin cover (inside the house): No**	51 (81)	55 (98.2)	50 (94.3)	156 (90.7)
Garbage bin cover (outside the house): No***	38 (64.4)	52 (98.1)	58 (93.5)	148 (85.1)
Garbage bin (inside the house): open	58 (92.1)	54 (96.4)	54 (100)	166 (96)
Garbage bin (outside the house): open	56 (94.9)	53 (100)	62 (100)	171 (98.3)
Kitchen door: open	21 (91.3)	47 (97.9)	40 (100)	108 (97.3)
Kitchen window: open	26 (96.3)	48 (100)	18 (94.7)	92 (97.9)
Kitchen ceiling: open***	45 (66.2)	66 (97.1)	41 (70.7)	152 (78.4)

*Chi square test ($p<0.05$)
**Chi square test ($p<0.01$)
***Chi square test ($p<0.001$)

PART 5
DISCUSSIONS

5.1. CCPs of 10 foods mostly consumed by 6-24 months old children

The CCPs commonly found in this study on 10 foods mostly consumed by 6-24 months old children in 3 sub-districts in Bekasi municipality were cooking, holding, storing, reheating, purchasing, preparation, and addition of ingredient after heat treatment. This study was focused only for 10 foods mostly consumed by 6-24 months old children because as we know that in order for the foods can cause diarrhea to the children, the foods need to be consumed first by the children. Other foods out of these 10 foods that were also identified in this study based on FGD result elaborated in Appendix 7 section D of the questionnaire were also can cause diarrhea to the children if the foods were not prepared and handled properly.

Hazards in the homes were associated with: (1) presence of bacterial spores for example on rice, beans, spices, vegetables and enteric pathogens such as on raw poultry and fresh fish; (b) time-temperature abuse of cooked foods during holding or storing after cooking; (c) cross contamination from water, food handlers, utensils to cooked foods; (d) improper cleaning of utensils and storage containers, and (e) handling of foods[37]. Therefore, violation to safe food preparation and handling practices may result in diarrhea disease incidence, especially for perishable foods for example foods with a_w, pH, or temperature favorable for bacterial growth[25].

According to the literature, leaving food out too long at room temperature can cause bacteria (e.g. *Staphylococcus aureus*, *Salmonella enteriditis*, *Escherichia coli* O157:H7, and *Campylobacter*) and moulds to grow to dangerous levels that can cause illness. They exist everywhere in nature. They are in the soil, air, water and the foods we eat. When they have nutrients (food), moisture, time and favorable temperatures, they grow rapidly increasing in numbers to the point where some can cause illness. They grow most rapidly in the range of temperatures between 40 °F and 140 °F, doubling in number in as little as 20 minutes. This range of temperatures is often called the "Danger Zone". That's why we should never leave food out of refrigeration over 2 hours. If the

temperature is above 90 °F (32.22°C), food should not be left out more than 1 hour. Any food left out at room temperature for more than 2 hours (1 hour if the temperature was above 90 °F (32.22°C)) should be discarded[38].

Based on the literature review, when cooking, all poultry: whole, pieces or ground, should reach a safe minimum internal temperature of 165 °F (73.89°C). For storing food, the refrigerator should be kept at 40°F (4.44°C) or below. Cooked chicken soup can be refrigerated for 3-4 days. Eggs should be always cooked before eating them. When cooked, eggs should be firm, not runny. Fresh-in shell egg can be refrigerated for 3-5 weeks. For its raw yolks and whites can be refrigerated for 2-4 days. For the hard cooked egg can be refrigerated for 1 week. Hot food should be held at 140 °F (60°C) or warmer. The cold leftovers can be used only within 4 days of storage. Leftovers should be reheated to 165°F (73.89°C) or until hot and steamy[15] [16].

However, in terms of CCP, actually CCP for particular system are usually the same wherever use[8]. A CCP is defined as a step at which control can be applied and is essential to prevent or eliminate a food safety hazard or to reduce it to an acceptable level. Therefore, CCP refers to the step in the process not to the type of food because different type of food may have same CCP depended on the system.

Spinach soup, vegetable soup, fried *tempe*, fried fish, and egg omelet has the system of cook/store. The CCPs were cooking, holding (storing), and reheating. Similar study[1] also found the same CCPs for typical Nigeria complementary food (*Jollof rice*, *Moi moi*, and *Agidi*). And also found by other studies[39] [40] for the preparation of stew. Cooked rice has the system of cook/hold hot. The CCPs were cooking and hot holding[8]. For ready to eat food such as biscuit and ready to eat rice porridge, the CCPs were purchasing and storage. Similar study[1] [41] [42] also found the same CCPs for ready to use soybean powder, and ready to eat vegetables. Instant porridge formula has the system of prepare/serve. For this system, the CCPs were purchasing, preparation, addition of ingredients, and storage. Similar study[1] also found the same CCPs for *Akamu*, typical Nigeria complementary food. *Nasi tim* has the system of cook/serve. For this system, the CCPs were cooking and holding[8]. In this case, even though there

were only 10 foods that were analyzed in this study, the identification of CCPs can be applied to other foods which has the same system, thus makes the findings of this study be useful for and may also covered for more than 10 foods under this study. In addition, the control measures described are applicable at critical control points wherever the specific foods evaluated are prepared in a similar manner.

Some processes and products are more difficult to keep under control than others. The products that involve thermal processes are relatively easy to monitor and keep under control. This is due to the lethality of the thermal process for particular hazards. However, products that are processed without a final lethal step may be more complicated to control and monitor. This is because these types of products are processed relying on the additive impact of a series of operations or practices that prevent or decrease contamination and limit microbial growth. For example, in the instant porridge formula, all the steps from purchasing, addition of ingredients, to its preparation may be considered as CCPs. Consequently there will be more monitoring tasks to do in order to maintain the safety of the product than a food that uses a single lethal step to eliminate or reduce the hazards present in the food. Thus, the introduction of HACCP system in this type of food can only prevent the increase of contamination or minimally reduce it[24].

The control measure of cooking will be to cook thoroughly although how best to describe this in terms of critical limits and target levels is more difficult in the domestic environment. The widely used term "piping hot" meaning so hot as to sizzle or hiss is not clearly understood and there are widely different interpretations. It is unrealistic to expect the domestic kitchen to have sophisticated temperature-monitoring equipment and the strategy to describe and achieve correct cooking in the home is twofold[23].

Firstly, emphasis must be given to adhering to cooking instructions. These must be carefully constructed to ensure that a sufficiently high end-point temperature can be achieved. They should consider not just cooking times and temperature but also factors such as method of cooking, initial temperature of food, size of food and cooking utensils as well as surface area and depth. The cooking process, recommended by the food manufacturer or the recipe author,

should not be arbitrary but should be verified and incorporate a safety margin to allow for equipment performance[23].

Secondly, the means of checking that an adequate temperature has been reached must be given. This might include the use of thermometers. Additionally other means of monitoring including color changes in meat, setting or coagulation of proteins in egg, bubbling of liquids for a minimum time, can be stated[23].

Correct storage of the dish is critical. With the advent of cheap refrigerator thermometers, monitoring of post cooling storage temperatures is not difficult. The need and the mechanism for preventing cross-contamination of the cooked food should be explicit. The procedures for ensuring adequate reheating will be similar to those for primary cooking but should emphasize that reheating should be carried out once only[23].

Ready prepared foods, requiring no further cooking, have different critical control points. Greater emphasis is required on the correct purchase, storage, and handling of these foods. The need to prevent the growth of pathogens and cross-contaminations determine the control measures that should be employed[23].

5.2. Food handler's knowledge, attitude, practices, socio-demography, and economic condition

Cooking was one of the CCPs commonly found. By looking at the practice of food handlers in this study, there were more food handlers in the slum (25%) and rural (23.2%) areas compared to housing (8.7%) area that did not practice thorough cooking and it was significantly different. The results showed that not all food handlers conducted thorough cooking. It is a common practice of food handlers to judge the doneness of food by appearance or color. However, research has shown that color is not a reliable indicator of thoroughly cooked food as there may be premature browning and persistent color[43].

The practice of cooking was in contrast to their attitude in which almost all (91.9%) of the food handlers had good attitude for the statement of "it is acceptable for children to eat food containing raw egg". The practice was also in contrast to their attitude for the statement of "it is acceptable for child to eat fish/chicken/meat that has been cooked rare or medium rare" in which most of the

food handlers (85.3%) had good attitude. Similar result[44] found that 82% respondents were disagree and strongly disagree to the attitude statement of "it is acceptable to eat beef-burgers that are cooked to medium rare (slightly pink in the middle)".

The thorough cooking practices was also in contrast to their knowledge in which not consistent number of food handlers had good knowledge on thorough cooking and it was significantly different among housing (88.4%), rural (71%), and slum (77.8%) areas. In housing area, there were more food handlers with good knowledge than them who had good practices. Similar finding[45] mentioned that knowledge of specific food-handling principles was more prevalent than the corresponding safe hygiene practices. The study found that a noticeable difference existed between the level of knowledge of principles and safe food preparation and handling practices. Even though the level of knowledge of food safety principles was high but the respondents had lower rates of self-reported safe practices. The disparity between knowledge and self-reported practice may relate to food preparation and handling experience which may be lacking or it may be due to risk-taking behavior. In either case, interventions probably need to be based on strategies beyond simply stating basic food preparation and handling principles.

Failure to cook food adequately may be seen as a food preference rather than a food safety issue by the respondents[45]. It was also stated that majority of food handlers operating in a food premises in UK admitted that they did not always carried out all the food safety practices they know they should be implementing[46]. There is also possible role of psychological determinants such as habit, optimism, trait worry, and internal locus of control in consumer behavior regarding food preparation. The act of preparing food can be assumed to be repeated frequently by many consumers. As consequences, it can be predicted that heuristic and experiential factors are determinants of people's behavior that influence consumer food safety practices[47].

The practice of food handler on thorough cooking was also in contrast to the cooking facility because all food handlers have accessibility to cooking facility. Availability of facility does not guarantee that the facility was used by the

food handlers[46]. Food handlers have different method in looking whether the food safe or not to eat by the appearance and feel of the food[46], or may be due to preferences[45].

Illusion of control can be as barrier prior to HACCP implementation. Even managers of company, without appropriate training, may well think that as long as the product looks normal and there is no evidence of spoilage, the product is alright to distribute. The managers have had good results in using "common sense" manufacturing practices during the past and they do not see the need for HACCP systems. This is because they may be unaware of the risks involved with the food preparation and handling. There was a survey found that the majority of businesses surveyed identified themselves as low-risk and were significantly less likely to use HACCP than businesses perceived as high-risk by their managers. It is also suggested that companies either did not correctly identify food hazards or they were prioritized after others which posed minimum risks to the nature of their operations. Acceptance of risk is influenced by factors such as degree of voluntaries, familiarity, and personal control associated with the activity. Thus, people tend to underestimate the risks involved with familiar activities[24].

Also, risks judgments are often "optimistically biased" and individuals believe that they have greater control over a potentially hazardous situation (and hence are at reduced risk from the hazard) than a comparable other one. The more people feel they know about hazards, the more they feel they have control over it. Thus managers and food handlers may think that they can make food completely safe by using particular cleaning and cooking methods. In that case, people will be less motivated to adopt risk-reduction tools such as HACCP. People often make their risk evaluations based on what they believe to be true which may not be necessarily based on complete or correct information. Even when they have access to an accurate source of information (such as government warnings) whether the message is believable or not will depend on the perceived credibility of the source[24].

Holding and storing were also the CCPs commonly found in this study. In the practice, most of the food handlers (80.1%) stored cooked food in room temperature for more than 2 hours and it was not significantly different among

housing, rural, and slum areas. The storing practice was not in line with food handler's attitude. For the statement of "cooked foods, once cooled should be refrigerated or frozen immediately if stored" most (72.4%) of the food handlers had good attitude. Other study[44] found the prevalence of 85% for this attitude statement. For the statement of "it is alright to leave cooked food for child on a kitchen work surface overnight" almost all (92.3%) food handlers had good attitude. Other study[44] found the prevalence of 75% for this attitude statement. The knowledge on proper storing was also not in line with the practice. There were less number (59.5%) of food handlers that had good knowledge on proper cooked food storage but it was not significantly different among housing, rural, and slum areas.

The preparation of food long before its consumption, storage at ambient temperature, and contaminated cooked food were identified as the key factors in the handling of cooked food that contributed to food poisoning outbreaks[48]. This situation is particularly critical when foods are consumed without reheating and when reheating temperatures are typically well below levels capable of destroying pathogens. If knowledge of food hygiene is low, the reasons for reheating food may simply be to make it warm and improve palatability, rather than to destroy pathogens[1].

Food spoilage is usually the result of chemical reactions medicated by microbial and endogenous enzymes. The storage life of many foods can be increased by storage at low temperature. The refrigerator should be kept at 5°C (40°F) or below and the freezer at -18°C (0°F) or below[43]. In terms of facility, there were only 52.9% households that had refrigerator and it was significantly different among housing (95.7%), rural (40.6%), and slum (23.6%) areas. Households in urban settings were more likely to have facilities for the refrigerated storage than those in the rural settings[1]. In this study, refrigerator ownership did not guarantee that the food handlers will practice better storage.

Other storage practices identified in this study was storing cooked food openly and not in separate place. This practice was improper because the environment condition could contaminate the foods during storage such as there were kitchen floor were made from soil, kitchen wall were made of wood/bamboo

and hard cement, kitchen ceiling were made of tile, kitchen's door; window; and ceiling were not really closed, garbage in the kitchen, garbage outside the house, open garbage bins in the kitchen and outside the house, animal in the kitchen, dirty cooking and eating utensils the kitchen, child's feces in the house surroundings; gutter; and pond next to the house. The sources of food contamination are numerous: night soil, domestic animals, flies, unclean utensils and pots, and also polluted environment caused by lack of sanitation, dust, dirt, etc[5]. Households may regard children's feces as innocuous, but evidence suggests that they are as hazardous as those of adults and may contain high concentrations of pathogens. Outdoor defecation by children and adults can attract flies and also contaminate water sources[1].

Reheating was also the CCP commonly found in this study. There were 70.7% food handlers who did not practice reheating before consumption after storing cooked food in room temperature for more than 2 hours. Other study[43] found less number (63.5%) of respondents that served cooked foods which were left at room temperature longer than 2 hours. This was perhaps because the respondents had more awareness to food borne microbial types.

The attitude on reheating was not in line with the practices because less number (27.1%) of food handlers who had good attitude for the statement of "it is acceptable to reheat child food until warm". Other study[44] found prevalence of 76% for this statement. For the statement of "it is essential to reheat stored food before consumed by child" almost all (92.9%) food handlers had good attitude. In terms of knowledge, more than half (59.5%) of food handlers had good knowledge on reheating cooked food after storage which was also not in line with the practice.

Addition of ingredients after heat treatment was also the CCP commonly found in this study. In the practice, there were 37.1% food handlers who added ingredients to the child food after heat treatment without reheating the food afterwards. The practice was in contrast to the attitude, for the statement of "it is alright to add celery into purchased ready to eat rice porridge without reheating again" more than half (50.5%) of the food handlers had good attitude. In terms of knowledge, it was also not in line with the practice because less number (33.5%)

of food handlers had good knowledge. Food handlers in housing (64.9%) area had better knowledge compared to rural (27.5%) and slum (8.2%) areas while in the practice it was not significantly different. So, even though the food handlers had better knowledge; it does not guarantee that they will have better practice. In this case, the educational messages should be focused on the reheating of the food after the food handlers add the ingredients to the food because even though they know that they should not add ingredients after heat treatment to the food without reheating but in the practice they did it. The potential for contamination and growth of pathogens increases when microbiologically sensitive raw ingredients are added to food, and consumed without adequate reheating[1].

Purchasing was the CCP commonly found for the ready to eat foods such as biscuit and instant porridge formula. In the practice, when purchasing, there were 40.8% and 81.1% food handlers did not reading expiry date and did not observe broken package of the food and it was significantly different among housing, rural, and slum areas. However, the practice was not in line with the attitude, for the statement of "it is important to read expiry date on food packaging" almost all food handlers (96.2%) had good attitude.

The practice when purchasing was in contrast to the knowledge. Almost half (45.7% and 48.1%) of the food handlers had good knowledge on reading expiry date and observing broken package condition prior to purchasing and it was significantly different among housing, rural, and slum areas.

Purchasing was also the CCP for ready to eat rice porridge. There were 30 respondents (14.3%) purchased ready to eat rice porridge in this study from mobile food vendor. For the statement of "it is essential to purchase child food from a clean place" almost all food handlers (99.6%) had good attitude. There were 80.5% food handlers had good knowledge on the cleanliness of place of purchasing food. In this case, most of the food handlers knew that they should purchased food in the clean place.

Street foods have been positively implicated as vectors of food borne diseases like cholera and typhoid fever. The time and temperature of cooking should be sufficient to ensure the destruction of non-spore forming pathogenic micro-organisms. Food vendors often partially of fully cook the chicken a head of

time, store it, and use it for the rice porridge without reheating when the customers purchased. Ready to eat foods intended for continuous serving should be protected from environmental contamination and kept at 60°C or above for food served hot. Food that is not maintained within the safety temperature zone acts as an incubator for pathogenic bacteria whether the food is raw, partially cooked, or fully done[48].

Purchasing ready to eat food from mobile vendor poses a considerable health risk. The reasons for this are apparent from observational data on hygiene practices of the vendors. Foods and ingredients are often displayed openly in very poor sanitary environments. The prevalence of flies and the apparent lack of facilities for food protection suggest a high potential for contamination. Foods and ingredients are also subjected to repeated contamination from the unwashed hands of vendors, and the materials used for serving may also be a source of contamination.

A study conducted by FAO in Thailand in 1991-1993 showed that vended foods contributed 88% of the total energy intake for children less than 6 years of age and such foods were often heavily contaminated with pathogens that cause diarrhea. Studies across Africa have also highlighted the extent of the problem posed to child health by foods sold on streets and open markets and there is now acceptance that such foods sold on street and open markets contribute significantly to morbidity and even mortality among children[1]. However, in this study the number of diarrhea incidence were not in line with the number of consumption of ready to eat rice porridge among housing, rural and slum areas. For example, in the slum area where there were 16.7% children consumed ready to eat rice porridge but the incidence of diarrhea was higher (41.7%) compared to rural and housing areas. So, in this case, the improper preparation of home-prepared foods or improper hygiene practices maybe has more contribution to the incidence of diarrhea compared to street foods. Other study also concluded that the majority of children under five years of age are unlikely to be significantly affected by these food outlets, since their foods are usually prepared and stored at home[1].

However, this may not be true in some settings, for example in many urban trading communities in Nigeria, the benefits of hygiene measures applied during food preparation and handling in the home maybe negated if foods and ingredients purchased from vendors are already contaminated. For example, even though cooking may destroy vegetative pathogens in foodstuffs, it may not eliminate toxins or spores. Furthermore, even though vended foods may not be blamed for a major burden of childhood diarrhea, a positive association between consumption of vended food and diarrhea morbidity has been demonstrated in West Africa, and this underscores the need for the development and promotion of healthy market place initiatives supported by WHO[1].

Preparation was the CCP found for instant porridge formula. For the CCP of preparation of instant porridge formula the practice of hand washing and drying before food preparation is important. By looking at the practice of food handlers in this study, there were 29.5% food handlers dip a finger into the food for checking temperature of child's food prior to feeding. There were only 39.5% food handlers who washed their hands before preparing child's food and 14.5% of them did not wash their hands by soap and not in running water, and after washing hands most of them (97.6%) wipe their hands to towel/clothes. The hands are the most important vehicle for the transfer of organisms from feces, nose, skin or other sites to food. Epidemiological studies of *Salmonella* typhi, non-typhi salmonellae, *Campylobacter* and *Escherichia coli* have demonstrated that these organisms can survive on finger tips and other surfaces for varying periods of time and in some cases after hand washing. There were only few food handlers with good knowledge that met the WHO requirement for effective hand wash which include washing of hands in hot soapy water before preparing food[48].

The practice of hand washing without soap in one bowl of water and hand drying in one hand towel before eating may contribute to food contamination in a number of ways. For example, pathogens present on hands of infected household members can be transferred to those who subsequently dip their hands in the water or used the hand towel, including those feeding children. There is also potential health risks associated with methods used by food handlers to test whether foods are cool enough for children, including dipping a finger (often

unwashed) into cooked foods. Furthermore, fingers are also normally used to feel foodstuffs and ingredients for texture. This also has the potential to contribute to the microbial load of the food[1].

Study in Barbados and Trinidad found 81.8% consumers reported washing hands with soap and water prior to preparation of meals. Study in Germany asked participant about the hygienic measures taken after handling raw meat or raw ground meat; 46.6% of them reported not washing their hands with water. Study in Jamaica showed 76% of respondents correctly indicated the acceptable practice of washing hands with soap after handling raw meat or chicken[4].

In terms of attitude, for the statement of "it is alright to taste child's food with finger" more than half (69.5%) of food handlers had good attitude. Other study[44] found the prevalence of 66% for this statement. For the statement of "it is important to wash hand before preparing child food" almost all food handlers (97.6%) had good attitude. For the statement of "preparing food whilst suffering from flu/typhus/wound in hand is acceptable" less number (39%) of food handlers had good attitude. Other study[44] found the prevalence of 82% for this statement. For the statement of "it is better to use tissue to dry child hand rather than clothes/towel" more than half (56.7%) of the food handlers had good attitude. Other study[44] found the prevalence of 58% for this statement. The finding on attitude was in contrast to the practice.

In terms of knowledge, the result was in contrast to the practice because less number (11.9% and 22.9%) of food handlers had good knowledge on proper hand washing and hand drying. There were 32.4% food handlers had ever received information about washing hand with soap. By looking at the hygiene and safe water facility, almost all households already had access to safe water and cleaning agent for hand washing.

This study also described other practices of food handlers that may contribute risk to the food. Those practices are: improper fruits washing prior to consumption, improper dish washing, chew children's food prior to feeding, unhygienic procedure of checking temperature of children's food, usage of the same cutting board and knife for meat and fruit without washing in between the activity, not cleaning kitchen before food preparation, improper children's hand

washing and drying, improper storage of drinking water, preparation of hot water from water dispenser machine, improper garbage disposal treatment, and bottle feeding practices. Those practices could cross contaminate the children's food[5]. As for bottle feeding practice was not recommended by WHO[12]. Improper wash of plates and spoons used for serving food may also contribute to post-cooking contamination of the food[1].

In this study, the higher educational level in the housing area compared to rural and slum areas did not consistently show that the food handlers have better knowledge and exposure to food safety information. Education is more related to employment and income, which influence access to household facilities, including those related to food hygiene and environmental health[1].

Those are the critical points that should be controlled in order to assure the safety of the food consumed. At these critical control points, the potential hazards and faulty practices can be identified at an early stage in food preparation and handling. Their identification will lead to measures that prevent or reduce risks to children. The control measures which were identified in this study can be used as a base for education message on safe food preparation and handling practice to food handlers, especially for them in the slum area with the higher incidence of diarrhea (41.7%) compared to housing (7.2%) and rural (20.3%) areas. And it is also important to note that the number of food handlers who perceived diarrhea due to violation in food preparation and hygiene practices were lower in the slum (23.6%) and rural (17.4%) areas compared to housing (63.8%) area.

In situations of poverty and adverse environmental conditions, sustainable strategies for preventing diarrhea associated with contaminated complementary foods may involve developing a protocol that permits the production of safe food in unsafe environments. Though a polluted environment poses many hazards for children's food, the hygienic quality of prepared food can be assured if basic food safety principles are observed. When many factors contribute to food contamination, identification of CCPs becomes particularly important and can facilitate appropriate targeting of resources and prevention efforts[1].

It is proven that HACCP study is relatively cheap and quick to determine the hazards, critical control points, control measures, and monitoring procedures

in the food preparation and handling practices that are crucial for the prevention of food borne disease. The HACCP strategy has the potential to make a significant contribution and can facilitate a more pragmatic approach to developing messages that assure effective behavior change[1]. Preventive actions are based on the food handler's knowledge of hazards and practical control measures. Therefore, the education must give caution about the identified hazards and provide economically-feasible and practical preventive measures and monitoring procedures, and stimulate the food handlers to become motivated to take appropriate action to safety of their children foods[49]. The development of sustainable strategies for controlling diarrhea among children would thus constitute a significant advance in public health[1]. Furthermore, the impact and efficacy of health education interventions need to be evaluated and, if needed, improved[9].

HACCP approach does useful for domestic food preparation. It is important to note that there are potential benefits in studying the HACCP approach to obtain information on domestic hazards and risks and this can be used to formulate realistic control measures and provide information on which specific education programs can be based. Educational efforts among food handlers should include the link between specific critical control point and appropriate practices, the most-current research-based scientific facts associated with food safety, and preferred delivery methods. Such educational efforts will support safe food handling at home that will result in continued independence of consumer in their homes. Thus, HACCP approach can be used as a potential tool for the purpose of preventing diarrhea disease occurrence.

If later on to be applied, a HACCP system that really works in practice will depend on the competency of the people who both developed it and who operate it, and the prerequisite programs, which support it. If it is to be truly successful then there must be an overriding internal belief in the HACCP approach and what it can do once properly implemented. The critical success factors will thus be: proper preparation and planning; trained and educated people; belief in the approach by all implementers; and a shared commitment to food safety. It will be successful only if it has been put together by people with

sufficient technical ability, implemented with enthusiasm and driven by forces. The dilemma is that HACCP can be used to help stimulate that supportive quality culture yet, perhaps without the culture change it is more difficult to make it really work in practice. The key to a successful food safety management program lies in resolving this problem[50].

However, it is possible that the problem of breaking old habits and learning new behaviors represents an impediment if HACCP approach is to be applied for domestic food handlers. The food handlers may not see the need to change to a system that involves them in what they consider too complicated and beyond their capabilities. They may take the view that there is no justification in changing their current procedures when those procedures have worked well during years and enabled them to produce "safe" foods. Furthermore, in a fast-moving environment as today condition of working mothers, time is always limited while workloads keep take pressure. Therefore, it is not surprising that people always prioritize tasks according to their own perception of importance rather than be based on the scientifically safe and correct practices[24].

The food handlers were also not fully aware of the principles of food hygiene, or fail to recognize the relationship between diarrhea and food contamination. Customary practices are also sometimes incompatible with the principles of food safety. Inadequate safe water supply and lack of sanitation facilities increases the likelihood of food contamination. The availability or low price of food is given priority to the detriment of quality and the safety aspects often neglected. The shortage of fuel and the lack of cold storage facilities and time results in the preparation of large quantities of food, which is often insufficiently cooked and stored at ambient temperatures and consumed at subsequent meals throughout the day.

PART 6
CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

This study found the 10 foods most commonly consumed by 6-24 months old children in the study population were spinach soup, cooked rice, vegetable soup, instant porridge formula, biscuit, ready to teat rice porridge, fried *tempe*, *nasi tim*, fried fish, and egg omelet. The flow diagrams of those foods have also been described with identification of hazard at each step of their preparation and handling. Pathogens and spores of pathogens survival, bacterial growth, and cross contamination were hazards identified during those foods preparation and handling. Cooking, holding/storing, reheating, addition of ingredients, purchasing, and preparation were the CCPs commonly found for those foods.

The control measures identified were cook thoroughly, eat food as soon as serve, use clean serving and storage utensils, wash hand before food preparation and feeding, reheat thoroughly, do not dip finger to food, purchase food from reliable and clean vendors, do not add raw ingredients to food without reheating, check expiry date and package of package food when purchasing. The monitoring procedures established for each of the control measures were check for indication of food spoilage, check for indication of bubbling, color changes, texture changes when cooking, and observe food handler's hygiene practices.

This study has also identified the food handler's practices which were still poor. The poor practices of food handlers in relations to food preparation and handling were not cooked thoroughly, store cooked food for more than 2 hours in room temperature without reheating prior to consumption, addition of ingredients to the food after heat treatment without reheating, not reading expiry date and not observe broken package when purchasing, and not properly wash hands by soap in running water.

HACCP approach does have potential benefits for domestic food preparation. It can be used to obtain information on domestic hazards and risks in order to formulate realistic control measures and then provide information on which specific education programs can be based.

6.2. Recommendations

Knowing the critical control points in homes directs attention to education. Information about critical control points, their control and monitoring in homes needs to be communicated to persons (e.g., health officials, educators, and food handlers) who can put it into effect. On the basis of CCPs, the main educational messages for ensuring food safety are: (1) cook thoroughly; (2) eat cooked food as soon as serve; (3) reheat cooked food after 2 hours of storage in room temperature and after addition of ingredient; (4) read expiry date of package food before consumption; (5) observe the package condition before purchasing; and (6) wash hand by soap in running water

Markets, health centers/health posts, mosques, and homes would be an effective place to reach the food handlers with food safety education. Face to face programs by educators from producers, health centers/health posts, and local authorities provide more exposure time to explain scientific facts, provide demonstrations and hands-on experiences, and allow food handlers to ask questions. Media campaigns and videotapes provide an excellent opportunity to focus on safe food preparation and handling practices. Media campaigns can reach large number food handlers in their homes. Written educational pieces provide a good opportunity to focus on all food safety practices because they provide educators with more space to explain the growth of microorganisms and their link to inappropriate practices.

The results of this study have important implications for food safety education programs and government policies. The literature clearly states that food safety should be a collaborative approach between the government, food industry, and the consumers. Although television and other mass media have wider reach, government publications are more trusted, hence, can be used more effectively in educating consumers. Educational materials need to emphasize safe food handling practices to begin in childhood and continue to be refined throughout the life time to avoid food borne illnesses. For food safety education to be effective, it must be a collaborative effort between children, parents, educators, and food safety professionals. Food safety education in itself will enable food handlers to change their knowledge and practices, once they are motivated to do

so. The problem of changing people's behavior is more complicated and this is a health education challenge which is becoming increasingly important.

Further research should be conducted about validation of the HACCP plan. Validation studies may be conducted by laboratories, by universities, by equipment or ingredient manufacturers, or partnership among them. Validation may involve the use of scientific publications, historical knowledge, regulatory documents, experimental trials, scientific models, operational data, and surveys. Generally a combination of these approaches will be used. Validation is defined as the element of verification focused on collecting and evaluating scientific and technical information to determine whether the HACCP plan, when properly implemented, will effectively control the hazards[51]. The primary focus of validation is to determine that critical limits at critical control points are capable of controlling the identified hazards; however, the justification for why a hazard is or is not reasonably likely to occur (to evaluate whether it needs to be addressed in a HACCP plan) can also be viewed as a form of validation.

The processing equipment e.g. equipment for hot-holding of cooked rice and water dispenser machine, monitoring frequency, and where the monitoring occurs can also be validated. In heat treatment such as cooking/frying, hot holding, and reheating, it is important to know in what time and temperature of heat treatment that being practiced by the food handlers. Also it is important to identify the temperature of the hot water and the cleanliness of the filter in the water dispenser machine. Pathogens testing in validating those CCPs are also need to be conducted. Microbial quality of food after cooking, holding, storage, and reheating should be measured.

This study was a cross sectional design which precluded determination of the causal relationships among factors associated with food preparation and handling practices. Therefore, study in further research design should be conducted. Study on proportion of control measures violation that contributes to incidence of children's diarrhea at home should be also conducted. There should be also further research on studies to evaluate the effectiveness of proposed food safety interventions, with the goal of identifying strategies that not only can improve knowledge and motivate food handlers but also strategies that can affect

the food handlers to practice safe food preparation and handling. Program for ensuring good knowledge among food safety educators is also needed.

REFERENCES

1. Ehiri, J. E., Azubuike, M. C., Ubbaonu, C. N., Anyanwu, E. C., Ibe, K. M., & Ogbonna, M. O. (2001). Critical control points of complementary food preparation and handling in Eastern Nigeria. *Bulletin of the World Health Organization*, 79, 423–433.
2. World Health Organization. (1998). *Complementary feeding of young children in developing countries: A review of current scientific knowledge.* Geneva: Author.
3. Unusan, N. (2007). Consumer food safety knowledge and practices in the home in Turkey. *Food Control*, 18, 45-51.
4. Odwin, R. & Badrie, N. (2008). Consumers' perceptions and awareness of food safety practices in Barbados and Trinidad, West Indies – a pilot study. *International Journal of Consumer Studies*, 32, 394–398.
5. Motarjemi, Y., Käferstein, F., Moy, G., & Quevedo, F. (1993). Contaminated weaning food: A major risk factor for diarrhea and associated malnutrition. *Bulletin of the World Health Organization*, 71 (1), 79-92.
6. World Health Organization. (2008). *Food borne diseases*. August 12, 2008. http://www.who.int/ foodsafety/food borne_disease/en/.
7. *Dinas kesehatan Kota Bekasi*. (2008). *Profil Kesehatan Kota Bekasi 2008 (data 2007)*. Bekasi: Author.
8. Bryan, F. L. (1992). *Hazard analysis critical control point evaluations: A guide to identifying hazards and assessing risks associated with food preparation and storage*. Geneva: World Health Organization.
9. Motarjemi, Y. (2000). Research priorities on safety of complementary feeding. *Pediatrics*, 106 (5), 1304-1305.
10. Kikafunda J. K., Walker A. F., & Tumwine, J. K. (2003). Weaning foods and practices in Central Uganda: A cross-sectional study. *African Journal of Food, Agriculture, Nutrition and Development*, 3 (2).

11. United States Department of Agriculture. (2008). *Chapter 5: Complementary foods*. July 21, 2008. www.nal.usda.gov/wicworks/Topics/FG/Chapter5_ComplementaryFoods.pdf.
12. World Health Organization. (2000). *Complementary feeding, family foods for breastfed children*. Department of Nutrition for Health and Development. France: Author.
13. Sheth, M., and Dwivedi, R. (2006). Complementary foods associated diarrhea. *Indian Journal of Pediatrics*, 73, 61-64.
14. United States Department of Agriculture. (2006). *Cleanliness helps prevent food borne illness*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.
15. United States Department of Agriculture. (2006). *Cutting boards and food safety*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.
16. United States Department of Agriculture. (2006). *Basics for handling food safely*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.
17. United States Department of Agriculture. (2006). *The color of meat and poultry*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.
18. World Health Organization. (2000). *The WHO golden rules for safe food preparation*. Prepared by the technical divisions of the Pan American Health Organization. June 29, 2009. http://www.ops-oms.org/english/ped/te_gold.htm.
19. Ray, B. (1995). *Fundamental Food Microbiology* (2nd ed.). USA: CRC Press.
20. Schothorst, M. van. (2004). *A simple guide to understanding and applying the Hazard Analysis Critical Control Point concept* (3rd ed.). Belgium: ILSI Europe.
21. World Health Organization. (2007). *Hazard Analysis Critical Control Point system (HACCP)*. August 12, 2008. http://www.who.int/foodsafety/fs_management/haccp/en/.

22. World Health Organization. (1997). *HACCP - Introducing the Hazard Analysis and Critical Control Point system.* July 17, 2008. http://www.who.int/foodsafety/fs_management/haccp_intro/en/.

23. Griffith, C. J., & Worsfold, D. (1994). Application of HACCP to food preparation practices in domestic kitchens. *Food Control*, 5 (3), 200-204.

24. Panisello, P. J., & Quantick, P. C. (2001). Technical barriers to Hazard Analysis Critical Control Point (HACCP). *Food Control*, 12, 165-173.

25. Blackburn, C. W., & McClure, P. J. (Ed.). (2002). *Food borne pathogens: Hazards, risk analysis and control.* Cambridge, England: Woodhead Publishing Limited.

26. Anigo, K. M., Ameh, D. A., Ibrahim, S., & Danbauchi, S. S. (2007). Microbiological analyses of commonly used local complementary foods in North Western Nigeria. *Journal Medical Science*, 7 (5), 875-879.

27. Josephson, K.L., Rubino, J.R., & Pepper, I. L. (1997). Characterization and quantification of bacterial pathogens and indicator organisms in household kitchens with and without the use of a disinfectant cleaner. *Journal of Applied Microbiology*, 83, 737–750.

28. United States Department of Agriculture. (2005). *Molds on Food: Are they dangerous?*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.

29. United States Department of Agriculture. (1998). Hazard Analysis and Critical Control Point principles and application guidelines. *Journal of Food Protection*, 61 (9), 1246-1259.

30. United States Department of Agriculture. (2006). *Food Safety in the kitchen: A HACCP approach.* Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.

31. Mock, N. B., Sellers, T. A., Abdoh, A. A., & Franklin, R. R. (1993). Socioeconomic, environmental, demographic and behavioral factors associated with occurrence of diarrhea in young children in The Republic of Congo. *Social Science Medicine*, 36 (6), 807-816.

32. World Health Organization. (2004). *The analytic review of the integrated management of childhood illness strategy*. Final report. Department of Child and Adolescent Health and Development (CAH). Geneva: Author.

33. *Pemerintah daerah Kota* Bekasi. 2008. *Profil Kota Bekasi*. October 28, 2008. http://www.kotabekasi.go.id/content/peta2.php.

34. Noriko, N. (2003). *Tinjauan ekologis tempat pemusnahan akhir Bantar Gebang, Bekasi. Makalah Pengantar Falsafah Sains*. Post graduate program. Bogor Agricultural University.

35. Lwanga, S. K., & Lemeshow, L. (1991). *Sample Size Determination in Health Studies*. Geneva: World Health Organization.

36. Sari, T. P. (2005). *Food hygiene practices, nutritional status, and diarrhea among children aged 12-59 months of selected urban poor areas in Jatinegara sub-district, East Jakarta, Indonesia*. Thesis. Study program in Nutrition. Faculty of Medicine. University of Indonesia.

37. Michanie, S., Bryan, F. L., Alvarez, P., & Olivo, A. B. (1987). Critical control points for foods prepared in households in which babies had salmonellosis. *International Journal of Food Microbiology*, 5, 337-354.

38. United States Department of Agriculture. (2006). *How temperatures affect food*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.

39. Michanie, S., Bryan, F. L., Fernandez, N. M., Vizcarra, M. M., Taboada, D., Navarros, O., Alonso, A. B., & Santillan, L. (1988). Hazard analyses of foods prepared by inhabitants along the Peruvian Amazon River. *Journal of Food Protection*, 51 (4), 293-302.

40. Bryan, F. L., Michanie, S., Vizcarra, M. M., Navarros, O., Taboada, D., Fernandez, N. M., Requejo, E. G., & Munoz, B. P. (1988). Hazard analyses of foods prepared by inhabitants near Lake Titicaca in the Peruvian Sierra. *Journal of Food Protection*, 51 (5), 412-418.

41. Theodoros, H. V., & Arvanitoyannis I. S. (2008). Application of ISO22000 and comparison to HACCP for processing of ready to eat vegetables: Part I. *International Journal of Food Science and Technology*, 43, 1729–1741.

42. Richards, J., Parr, E., & Riseborough, P. (1993). Hospital food hygiene: The application of Hazard Analysis Critical Control Points to conventional hospital catering. *Journal of Hospital Infection*, 24, 273-282.
43. Badrie, N., Gobin, A., Dookeran, S., & Duncan, R. (2006). Consumer awareness and perception to food safety hazards in Trinidad, West Indies. *Food Control*, 17, 370-377.
44. Redmond, E. C., & Griffith, C. J. (2004). Consumer attitudes and perceptions towards microbial food safety in the domestic kitchen. *Journal of Food Safety*, 24, 169-194.
45. Altekruse, S. F., Street, D. A., Fein, S. B., & Levy, A. S. (1995). Consumer knowledge of food borne microbial hazards and food handling practices. *Journal of Food Protection*, 59 (3), 287-294.
46. Jevšnik, M., Hlebec, V., & Raspor, P. (2008). Food safety knowledge and practices among food handlers in Slovenia. *Food Control*, 19, 1107-1118.
47. Fischer, A. R. H., & Frewer, L. J. (2008). Food-safety practices in the domestic kitchen: Demographic, personality, and experiential determinants. *Journal of Applied Social Psychology*, 38 (11), 2859-2884.
48. Omemu, A. M., & Aderoju, S. T. (2008). Food safety knowledge and practices of street vendors in the city of Abeokuta, Nigeria. *Food Control*, 19, 396-402.
49. Michanie, S., Bryan, F. L., Alvarez, P., Olivo, A. B., & Paniagua, A. (1988). Critical control points for foods prepared in households whose members had either alleged typhoid fever or diarrhea. *International Journal of Food Microbiology*, 7, 123-134.
50. Mortimore, S. (2001). How to make HACCP really work in practice. *Food Control*, 12, 209-215.
51. Scott, V. N. (2005). How does industry validate elements of HACCP plans?. *Food Control*, 16, 497-503.

MANUSCRIPT FOR PUBLICATION

To be submitted to: Bulletin of the World Health Organization

HAZARD ANALYSIS CRITICAL CONTROL POINT STUDY OF FOODS FOR 6-24 MONTHS OLD CHILDREN AND FOOD HANDLER'S PRACTICES IN BEKASI, WEST JAVA

Lina Rospita[1], *D. N. Iswarawanti**[1], *Otte Santika*[1], *Siti Muslimatun*[1]

[1]South East Asian Ministries of Education Organization, Tropical Medicine (SEAMEO TROPMED), Regional Centre for Community Nutrition, University of Indonesia

* To whom the correspondent should be addressed:
D. N. Iswarawanti
SEAMEO-TROPMED, Regional Centre for Community Nutrition
Jl. Salemba Raya No. 6, 10430, Central Jakarta, Indonesia
Phone/Fax: (62-21) 3193933
Email:diswarawanti@seameo-rccn.org

Abstract

Objective: to develop HACCP data sheet and to investigate the food handler's practices on food preparation and handling.

Methods: We conducted a cross sectional study of hazard analysis critical control point for 10 foods mostly consumed by 6-24 months old children. We also assessed the knowledge, attitude, practices, and socio economic condition of 210 food handlers in Bekasi, West Java in 2009.

Findings: The 10 foods mostly consumed by 6-24 months old children in this study were spinach soup, cooked rice, packaged instant porridge formula, packaged biscuit, vegetable soup, ready to eat rice porridge, *nasi tim*, fried fish, fried *tempe*, and egg omelet. The CCPs commonly found are cooking, holding, storing, reheating, purchasing, preparation, and addition of ingredient after heat treatment. Many food handlers had poor practices and knowledge in thoroughly cooking, proper cooked food storage, reheating cooked food after 2 hours of storage and after addition of ingredients, reading expiry date and observe broken package prior to purchasing, and proper hand washing and drying, even though the cooking, eating, storing, hygiene, and safe water facility were available. The food handler's practices were in contrast to their knowledge, attitude, and facility availability.

Conclusion

HACCP approach does have potential benefit for domestic food preparation. It can be used to obtain information on domestic hazards and risks to formulate realistic control measures and provide information on which specific education programs can be based.

Keyword: HACCP, food safety, knowledge, attitude, food preparation and handling practice, young children

INTRODUCTION

Children aged 6-24 months are at the greatest risk of developing diarrhea from contaminated food and water[1].Studies have estimated that between 50% and 87% of reported food borne disease outbreaks have been associated with the home. It is known that a part of food borne illnesses in the home result from eating foods from unsafe food preparation practices in the home[2] and also lack of knowledge, awareness and understanding of home hazards and safe home practices. There were 12.54% of diarrhea among under-five children reported in health centers in 2007 in Bekasi municipality[3].

To address errors in hygienic practices there is a need to apply the Hazard Analysis Critical Control Point (HACCP) strategy. This strategy identifies hazards associated with different stages of food preparation and handling, assesses the relative risks, and identifies points where control measures would be effective[4].

The application of HACCP system to the domestic kitchen presents unique challenges due to the lack of well-defined food flow diagram, and wide variety of knowledge, practices, equipment, and environment condition. In those situations, the implementation of HACCP is far more complicated due to the difficulty of controlling basic sanitary standards resulting in an increased number of CCPs to prevent or reduce risks of cross-contamination and recontamination of foodstuffs[5]. Application of the decision tree is also not so easy. It is more difficult to have confidence in future steps eliminating or reducing a hazard. This is due to the variable nature of the environment, equipment and the critical limits and target values[6].

The individual and variable nature of production plus a different type of environment require the application of HACCP to be more flexible than in food manufacturing. This is particularly true in the realistic setting of control measures and limits which can be much more difficult to monitor in the domestic kitchen and monitoring equipment is generally unavailable. It is only possible to use simpler documentation if at all. The domestic kitchen unless preparing food for commercial reasons, is exempt from legislation. Access for people concerned with carrying out the HACCP (e.g. health officers) can be difficult. A team can be used to construct a strategy and method but implementation and evaluation will often

be by individuals[6]. Thus, in these situations, HACCP should be used as a means of managing food safety, highlighting the importance of CCPs and monitoring operations, rather than strictly complying with the seven principles defined for the food industry[5].

HACCP study should be combined with socio cultural and socioeconomic data to understand knowledge, attitude, and practices of caregivers in food safety and also socioeconomic barriers to the preparation of safe foods to shed light on the needs of the caregivers and help formulate appropriate health and food safety education interventions. This study should be conducted in different settings (rural and urban)[4]. Children in rural and urban areas consumed significantly different type of food[7]. So far, there has been no research regarding HACCP study on food preparation and handling practices at home in Indonesia.

METHODS

This cross sectional study was conducted for food handlers for 6-24 months old children's food in Bekasi, West Java from December 2008-March 2009.

Subjects. We randomly selected 210 food handlers lived in housing, rural, and slum at 3 sub-districts respectively in Bekasi using the health post record for interview and @ 6-15 food handlers for each FGD session.

Data collection. Data of type food and flow diagram of food preparation and handling was collected through focus group discussion. Interview using structure questionnaire was conducted to collect data on 10 foods mostly consumed, knowledge, attitude, practices, and socio economic condition. The questionnaire was divided into 9 sections, 1) socio-demography characteristic, 2) diarrhea status, 3) economic condition, 4) food handler's practice, 5) food handler's knowledge, 6) food handler's exposure to safe food preparation and handling information, 7) food handler's attitude, 8) cooking, storage, hygiene, and safe water facility, 9) environment condition.

Data analysis. HACCP data sheet development was conducted through literature review. Data of food handlers' knowledge, attitude, practices, and socio economic condition were analyzed by using SPSS 15.0 for Windows.

Ethical consideration. Ethical clearance was received from ethical committee Faculty of Medicine University of Indonesia. The data collection was implemented after the respondents are informed about the purpose of the study. Then, informed consent was obtained from all respondents, who gave approval for the interview. The identities of the respondents are held confidential.

RESULTS

Table 1 shows 10 foods mostly consumed by 6-24 months old children in the study population. **Figure 1** and **Table 2** show flow diagram of the most consumed foods (spinach soup) and its HACCP data sheet. Other foods flow diagram and HACCP data sheet were shown in **Annex Figure 4-12** and **Annex Table 7-15.**

The mean age of children was 15 months old. The mean age of mother and father were 29 and 34 years old ($p<0.001$), respectively. The median number of under-five children lived in the household was 1 person, range from 1 to 5 children ($p<0.01$). The median number of 5-15 years old children lived in the household was 1 person, range from 0 to 4 children. The median number of household members was 4 persons, range from 3 to 11 persons ($p<0.01$). There were more households in the housing area who owned television and radio compared to rural and slum areas ($p<0.001$). There were only 52.9% households that had refrigerator and it was significantly different among housing, rural, and slum areas ($p<0.001$) (**Table 3**). There were more children who had diarrhea in the slum area compared to rural and housing areas. There were more food handlers in housing area who perceived children diarrhea due to violation in food preparation and hygiene practices ($p<0.001$) (**Figure 2** and **Figure 3**).

Food handlers and fathers in housing area tend to have more than 12 years education. Mothers and fathers in rural and slum areas tend to have 3-6 years education ($p<0.001$). Households in housing area tend to have higher food expenditure, cooking fuel expenditure, drinking water expenditure, cleaning material and equipment expenditure, and total expenditure per month compared to rural and slum areas ($p<0.001$). There were more housewives mothers in slum area compared to housing and rural areas. Most fathers in housing area worked as

employee in private company. Most fathers in rural and slum areas worked as labor.

Food handlers in housing area tend to have better knowledge about thorough cooking ($p<0.05$), addition of ingredient after heat treatment ($p<0.001$), read expiry date ($p<0.001$), and observe broken package ($p<0.01$) compared to rural and slum areas **(Table 4)**. However, there were only 32.4% food handlers have received information about washing hand with soap and 7.1% and 5.7%, respectively have received information about proper dish washing and washing fruits and vegetables. **Table 5** shows food handler's attitude.

There were more food handlers in the slum and rural areas compared to housing area that did not practice thorough cooking ($p<0.05$). When purchasing, there were 40.8% and 81.1% food handlers did not reading expiry date and did not observe broken package of the food and it was significantly different among housing, rural, and slum areas ($p<0.001$). There were 14.3% purchased ready to eat rice porridge from mobile food vendor. There were only 39.5% food handlers who washed their hands before preparing child's food and 14.5% of them did not wash their hands by soap and not in running water, and after washing hands most of them (97.6%) wipe their hands to towel/clothes **(Table 6)**.

DISCUSSIONS

CCP for particular system are usually the same wherever use[8]. CCPs of foods in this study were also found by other studies of same system foods[1] [9] [10] [11] [12]. In this case, the control measures described are applicable at critical control points wherever the specific foods evaluated are prepared in a similar manner.

Hazards in the homes were associated with: (1) presence of bacterial spores for example on rice, beans, spices, vegetables and enteric pathogens such as on raw poultry and fresh fish; (b) time-temperature abuse of cooked foods during holding or storing after cooking; (c) cross contamination from water, food handlers, utensils to cooked foods; (d) improper cleaning of utensils and storage containers, and (e) handling of foods[13]. Therefore, violation to safe food preparation and handling practices may result in diarrhea disease incidence,

especially for perishable foods for example foods with a_w, pH, or temperature favorable for bacterial growth[14]. The storage life of many foods can be increased by storage at low temperature.

Leaving food out too long at room temperature can cause bacteria and moulds to grow to dangerous levels that can cause illness. They grow most rapidly in the range of temperatures between 40°F and 140°F (5°C and 60°C), doubling in number in as little as 20 minutes. This range of temperatures is often called the "Danger Zone". That's why we should never leave food out of refrigeration over 2 hours. If the temperature is above 90°F (32.22°C), food should not be left out more than 1 hour. Any food left out at room temperature for more than 2 hours (1 hour if the temperature was above 90°F (32.22°C)) should be discarded[15]. The potential for contamination and growth of pathogens increases when microbiologically sensitive raw ingredients are added to food, and consumed without adequate reheating[1]. Leftovers should be reheated until hot and steamy[16][17].

The products that involve thermal processes are relatively easy to monitor and keep under control. This is due to the lethality of the thermal process for particular hazards. However, products that are processed without a final lethal step may be more complicated to control and monitor. This is because these types of products are processed relying on the additive impact of a series of operations or practices that prevent or decrease contamination and limit microbial growth. For example, in the instant porridge formula, all the steps may be considered as CCPs. Consequently there will be more monitoring tasks to do than a food that uses a single lethal step to eliminate or reduce the hazards. Thus, the introduction of HACCP system in this type of food can only prevent the increase of contamination or minimally reduce it[5].

Food handlers commonly judge the doneness of food by appearance or color[18]. However, research has shown that color is not a reliable indicator of thoroughly cooked food. Failure to cook food adequately may be seen as a food preference rather than a food safety issue by the respondents[19].

Other storage practices identified in this study was storing cooked food openly and not in separate place. This practice was improper because the

environment condition could contaminate the foods during storage such as there were kitchen floor were made from soil, kitchen wall were made of wood/bamboo and hard cement, kitchen ceiling were made of tile, kitchen's door; window; and ceiling were not really closed, garbage in the kitchen, garbage outside the house, open garbage bins in the kitchen and outside the house, animal in the kitchen, dirty cooking and eating utensils the kitchen, child's feces in the house surroundings; gutter; and pond next to the house. The sources of food contamination are numerous: night soil, domestic animals, flies, unclean utensils and pots, and also polluted environment caused by lack of sanitation, dust, dirt, etc[20]. Households may regard children's feces as innocuous, but evidence suggests that they are as hazardous as those of adults and may contain high concentrations of pathogens. Outdoor defecation by children and adults can attract flies and also contaminate water sources. This situation is particularly critical when foods are consumed without reheating and when reheating temperatures are typically well below levels capable of destroying pathogens. If knowledge of food hygiene is low, the reasons for reheating food may simply be to make it warm and improve palatability, rather than to destroy pathogens[1].

In this study looks like improper preparation of home-prepared foods or improper hygiene practices maybe has more contribution to the incidence of diarrhea compared to street foods. Other study[1] also concluded that the majority of children under five years of age are unlikely to be significantly affected by these food outlets, since their foods are usually prepared and stored at home.

This study also described other practices of food handlers that may contribute risk to the food. Those practices are: improper fruits washing prior to consumption, improper dish washing, chew children's food prior to feeding, unhygienic procedure of checking temperature of children's food, usage of the same cutting board and knife for meat and fruit without washing in between the activity, not cleaning kitchen before food preparation, improper hand washing and drying, improper storage of drinking water, preparation of hot water from water dispenser machine, improper garbage disposal treatment, and bottle feeding practices. Those practices could cross contaminate the children's food[20]. As for bottle feeding practice was not recommended by WHO[21]. Improper wash of

plates and spoons used for serving food may also contribute to post-cooking contamination of the food[1].

Knowledge of specific food-handling principles was more prevalent than the corresponding safe hygiene practices. The disparity may relate to lack of experience or risk-taking behavior[19]. There are also possible role of psychological determinants such as habit, optimism, trait worry, and internal locus of control in consumer behavior regarding food preparation[22]. Availability of facility does not guarantee that the facility was used by the food handlers[23].

Illusion of control can also be a barrier prior to HACCP implementation. This is because they may be unaware of the risks and underestimate the risks. Also, risks judgments are often "optimistically biased" and individuals believe that they have greater control over a potentially hazardous situation (and hence are at reduced risk from the hazard) than a comparable other one[5].

The food handlers were also not fully aware of the principles of food hygiene, or fail to recognize the relationship between diarrhea and food contamination. Customary practices are also sometimes incompatible with the principles of food safety. Inadequate safe water supply and lack of sanitation facilities increases the likelihood of food contamination. The availability or low price of food is given priority to the detriment of quality and the safety aspects often neglected. The shortage of fuel and the lack of cold storage facilities and time results in the preparation of large quantities of food, which is often insufficiently cooked and stored at ambient temperatures and consumed at subsequent meals throughout the day.

CONCLUSIONS

In conclusions, HACCP approach does useful for domestic food preparation. It is important to note that there are potential benefits in studying the HACCP approach to obtain information on domestic hazards and risks and this can be used to formulate realistic control measures and provide information on which specific education programs can be based. Educational efforts among food handlers should include the link between specific critical control point and appropriate practices, the most-current research-based scientific facts associated

with food safety, and preferred delivery methods. Such educational efforts will support safe food handling at home that will result in continued independence of consumer in their homes. Thus, HACCP approach can be used as a potential tool for the purpose of preventing diarrhea disease occurrence.

RECOMMENDATIONS

On the basis of CCP, the main educational messages for ensuring food safety are: (1) cook thoroughly; (2) eat cooked food as soon as serve; (3) reheat cooked food after 2 hours of storage in room temperature and after addition of ingredient; (4) read expiry date of package food before consumption; (5) observe the package condition before purchasing; and (6) wash hands by soap in running water.

Markets, health centers/health posts, mosques, and homes would be an effective place to reach the food handlers with food safety education. Face to face programs by educators from producers, health centers/health posts, and local authorities provide more exposure time to explain scientific facts, provide demonstrations and hands-on experiences, and allow food handlers to ask questions. Media campaigns and videotapes provide an excellent opportunity to focus on safe food preparation and handling practices. Media campaigns can reach large number food handlers in their homes. Written educational pieces provide a good opportunity to focus on all food safety practices because they provide educators with more space to explain the growth of microorganisms and their link to inappropriate practices. Government policies are also needed.

Further research should be conducted about validation of the HACCP plan. Pathogens testing are also need to be conducted. Study in further research design should be conducted to see the causal relationships among factors associated with food preparation and handling practices. Study on proportion of control measures violation that contributes to incidence of children's diarrhea at home should be also conducted. There should be also further research on studies to evaluate the effectiveness of proposed food safety interventions, with the goal of identifying strategies that not only can improve knowledge and motivate food handlers but also strategies that can affect the food handlers to practice safe food

preparation and handling. Program for ensuring good knowledge among food safety educators is also needed. Furthermore, the impact and efficacy of health education interventions need to be evaluated and, if needed, improved.

ACKNOWLEDGEMENT

This study was funded by SEAMEO, DIPA, and PT. TPS Food. Author is very grateful to advisors and resource person from SEAMEO who gave many useful suggestions and whose critical comments have greatly improved the paper.

Table 1. 10 foods mostly consumed by 6-24 months old children by areas

Type of food	Frequency in			Total (n(%))	Rank
	Housing	Rural	Slum		
Spinach soup	17	23	23	63 (30)	1
Cooked rice	18	18	19	55 (26)	2
Vegetable soup	22	15	14	51 (24)	3
Instant porridge formula	22	15	5	42 (20)	4
Biscuit	13	12	9	34 (16)	5
Ready to eat rice porridge	3	15	12	30 (14)	6
Fried *tempe*	3	8	13	24 (11)	7
Nasi tim	14	7	1	22 (10)	8
Fried fish	11	8	2	21 (10)	9
Egg omelet	4	3	9	16 (8)	10

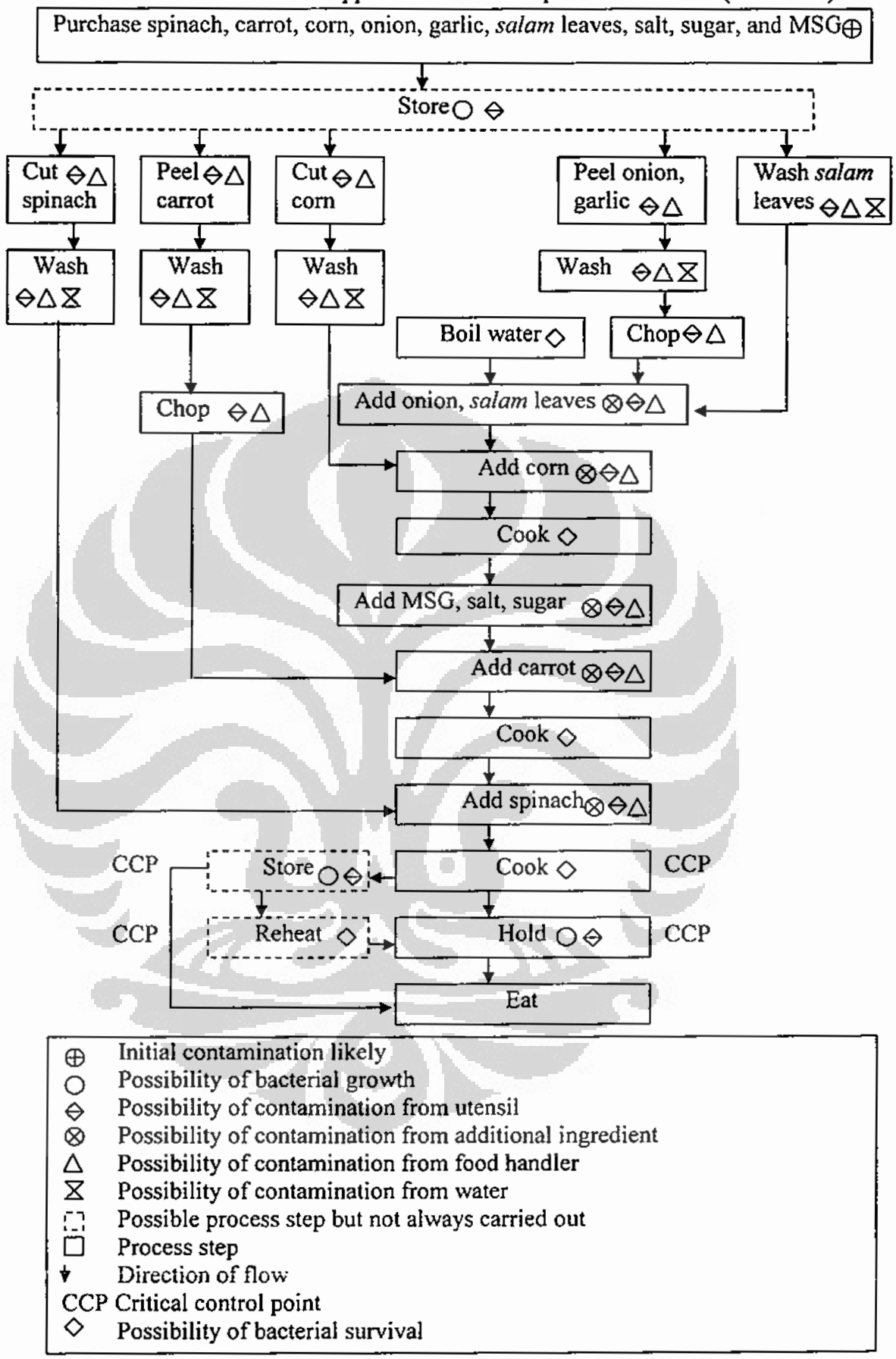


Figure 1. Flow diagram of spinach soup

Table 2. HACCP data sheet for spinach soup

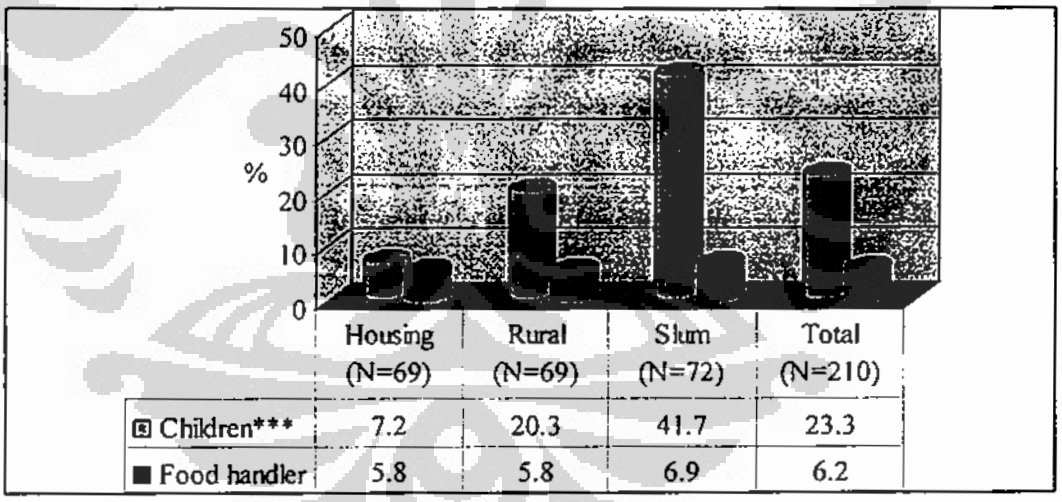
Food	Hazards	Critical Control Points	Control Measures	Monitoring
Spinach soup	Pathogens survive inadequate cooking; spores survive	Cooking	Cook thoroughly	check for indication of heat e.g. bubbling, or check for texture changes e.g. become softer
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not dip finger to child's food	Check appearance of food for spoilage; ensure personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Do not reheat, but consume directly, throw away when there is indication of spoilage	Check appearance of food for spoilage
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

Table 3. General characteristic of the households by areas

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Children's sex: male	38 (55.1)	38 (55.1)	42 (58.3)	118 (56.2)
Food handlers: mother	67 (97.1)	65 (94.2)	69 (95.8)	201 (95.7)
grandmother	1 (1.4)	4 (5.8)	2 (2.8)	7 (3.3)
housemaid	1 (1.4)	0 (0)	1 (1.4)	2 (1.0)
Children's age: 6-12 months	25 (36.2)	26 (37.7)	22 (30.6)	73 (34.8)

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Food handler's age ≤ 30 years***	20 (29)	37 (53.6)	51 (70.8)	108 (51.4)
Father's age ≤ 30 years***	9 (13.2) (N=68)	22 (32.8) (N=67)	32 (45.7) (N=70)	63 (30.7) (N=205)
Number of children: U5 = 1 child**	45 (65.2)	55 (79.7)	66 (91.7)	166 (79)
5-15 years old = 1 child	54 (78.3)	57 (82.6)	62 (86.1)	173 (82.4)
Household members ≤ 4 people*	29 (42)	35 (50.7)	48 (66.7)	112 (53.3)
Ownership of (%):				
- TV***	69 (100)	64 (92.8)	53 (73.6)	186 (88.6)
- Radio***	54 (78.3)	32 (46.4)	19 (26.4)	105 (50.0)
Ownership of refrigerator: Yes***	66 (95.7)	28 (40.6)	17 (23.6)	111 (52.9)

*Chi square test (p<0.05)
**Chi square test (p<0.01)
***Chi square test (p<0.001)



***Chi-square test (p<0.001)

Figure 2. Diarrhea status in the last 2 weeks by areas

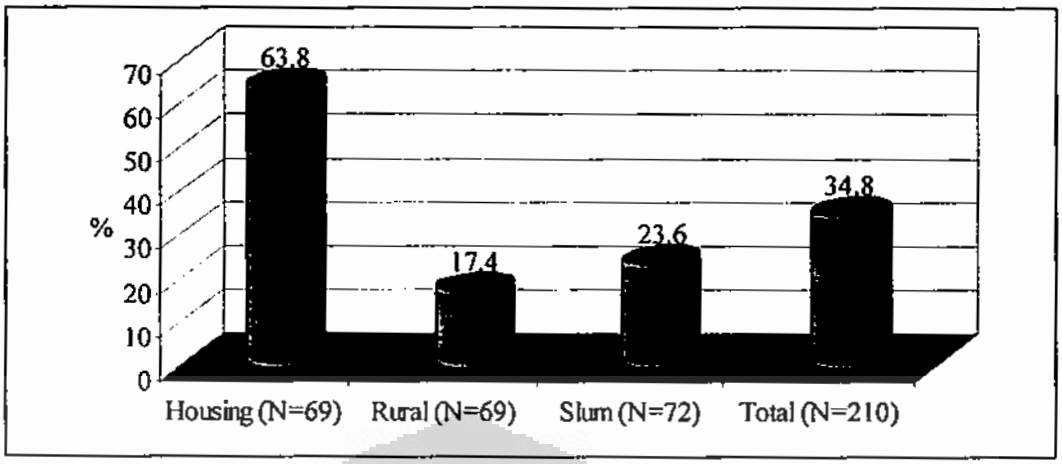


Figure 3. Food handler's perception on diarrhea due to food and hygiene by areas (Chi-square test ($p<0.001$))

Table 4. Food handler's knowledge

Correct responses	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
		n(%)		
Cooked food storage and reheating	43 (62.3)	45 (65.2)	37 (51.4)	125 (59.5)
Hand washing	6 (8.7)	8 (11.6)	11 (15.3)	25 (11.9)
Hand drying	21 (30.4)	13 (18.8)	14 (19.4)	48 (22.9)
Washing fruits***	65 (94.2)	54 (78.3)	47 (65.3)	166 (79)
Thorough cooking*	61 (88.4)	49 (71)	56 (77.8)	166 (79)
Addition of ingredients***	37 (64.9)	11 (27.5)	5 (8.2)	53 (33.5)
Cleanliness of place of purchasing	60 (87)	56 (81.2)	53 (73.6)	169 (80.5)
Read expire date***	43 (62.3)	32 (46.4)	21 (29.2)	96 (45.7)
Observe broken package**	44 (63.8)	32 (46.4)	25 (34.7)	101 (48.1)

*Chi square test ($p<0.05$)
**Chi square test ($p<0.01$)
***Chi square test ($p<0.001$)

Table 5. Food handler's attitude

Attitude statement (N=210)	Strongly agree	Agree	Disagree	Strongly disagree
Preparing food whilst suffering from flu/typhus/wound in hand is acceptable	2 (1)	126 (60)	61 (29)	21 (10)
It is acceptable for child to eat food containing raw egg	0 (0)	17 (8.1)	130 (61.9)	63 (30)

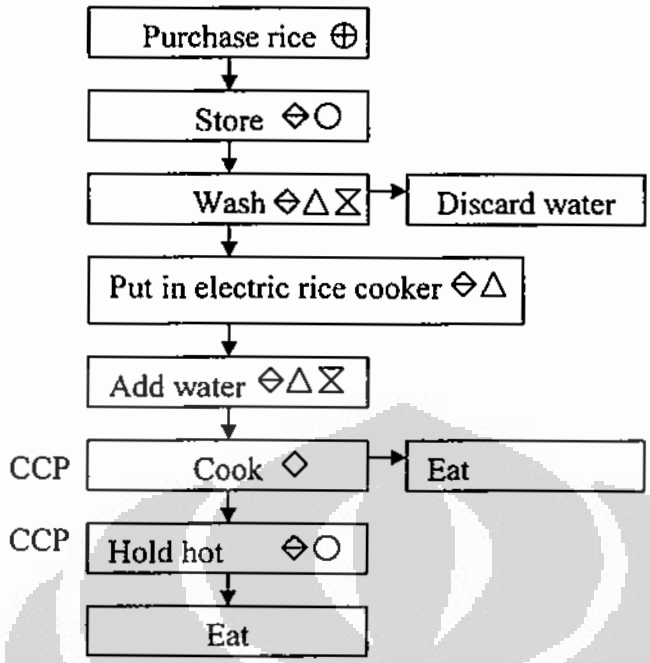
Attitude statement (N=210)	Strongly agree	Agree	Disagree	Strongly disagree
It is acceptable for child to eat fish/chicken/meat that has been cooked rare or medium rare	1 (0.5)	30 (14.3)	140 (66.7)	39 (18.6)
Cooked foods, once cooled should be refrigerated or frozen immediately if stored	21 (10)	131 (62.4)	57 (27.1)	1 (0.5)
It is alright to leave cooked food for child on a kitchen work surface overnight	1 (0.5)	15 (7.1)	154 (73.3)	40 (19)
It is acceptable to reheat child food until warm	7 (3.3)	135 (64.3)	61 (29)	7 (3.3)
It is essential to reheat stored food before consumed by child	43 (20.5)	152 (72.4)	15 (7.1)	0 (0)
It is alright to add celery into chicken porridge without reheating again	3 (1.4)	85 (40.5)	106 (50.5)	16 (7.6)
It is important to read expire date on food packaging	115 (54.8)	87 (41.4)	8 (3.8)	0 (0)
It is essential to purchase child food from a clean place	102 (48.6)	107 (51)	0 (0)	1 (0.5)
It is not necessary to wash hand before taste child food with finger	4 (1.9)	13 (6.2)	135 (64.3)	58 (27.6)
It is important to wash hand before preparing child food	71 (33.8)	134 (63.8)	4 (1.9)	1 (0.5)
It is better to use tissue to dry child hand rather than clothes/hand towel	19 (9)	119 (56.7)	70 (33.3)	2 (1)

Table 6. Food handler's practices

	Housing (N=69)	Rural (N=69)	Slum (N=72)	Total (N=210)
	n (%)			
Addition of ingredient	21 (33.9) (N=62)	27 (42.9) (N=63)	24 (34.8) (N=69)	72 (37.1) (N=194)
Store cooked food in room temperature for more than 2 hours	42 (79.2) (N=53)	45 (84.9) (N=53)	46 (76.7) (N=60)	133 (80.1) (N=166)
Not Reheating after storage in room temperature for more than 2 hours	33 (62.3)	37 (82.2)	31 (67.4)	94 (70.7)
Consume half cooked egg*	6 (8.7)	16 (23.2)	18 (25)	40 (19.0)
Not reading expire date***	9 (13.4)	29 (42.6)	46 (64.8)	84 (40.8)
Not observe broken package	50 (74.6)	57 (83.8)	60 (84.5)	167 (81.1)
Wash hands before food preparation	33 (47.8)	29 (42)	21 (29.2)	83 (39.5)

*Chi square test ($p<0.05$)

***Chi square test ($p<0.001$)

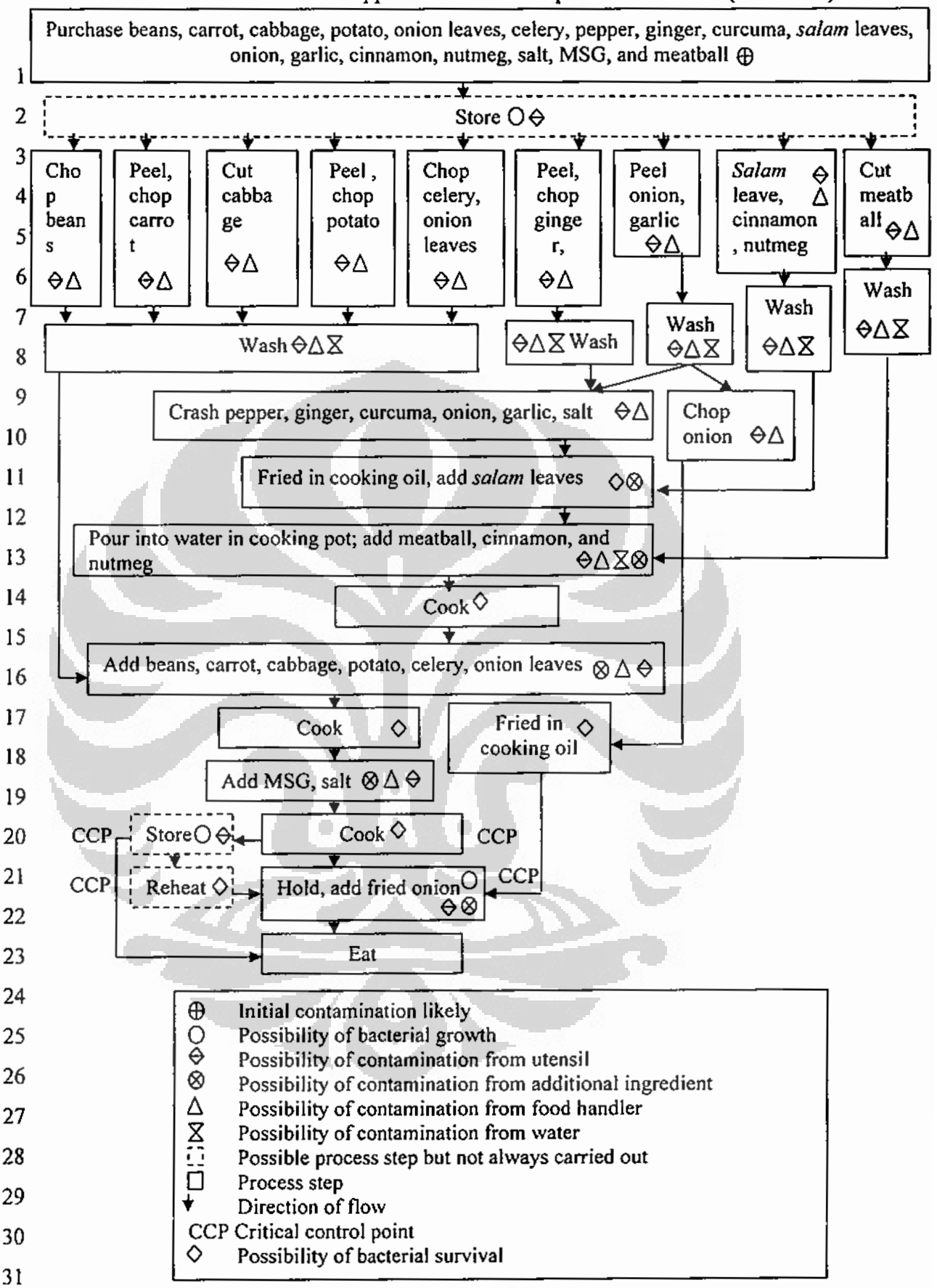


⊕ Initial contamination likely
○ Possibility of bacterial growth
◈ Possibility of contamination from utensil
⊗ Possibility of contamination from additional ingredient
△ Possibility of contamination from food handler
⧖ Possibility of contamination from water
⬚ Possible process step but not always carried out
□ Process step
↓ Direction of flow
CCP Critical control point
◇ Possibility of bacterial survival

Annex Figure 4. Flow diagram of cooked rice

Annex Table 7. HACCP data sheet for cooked rice

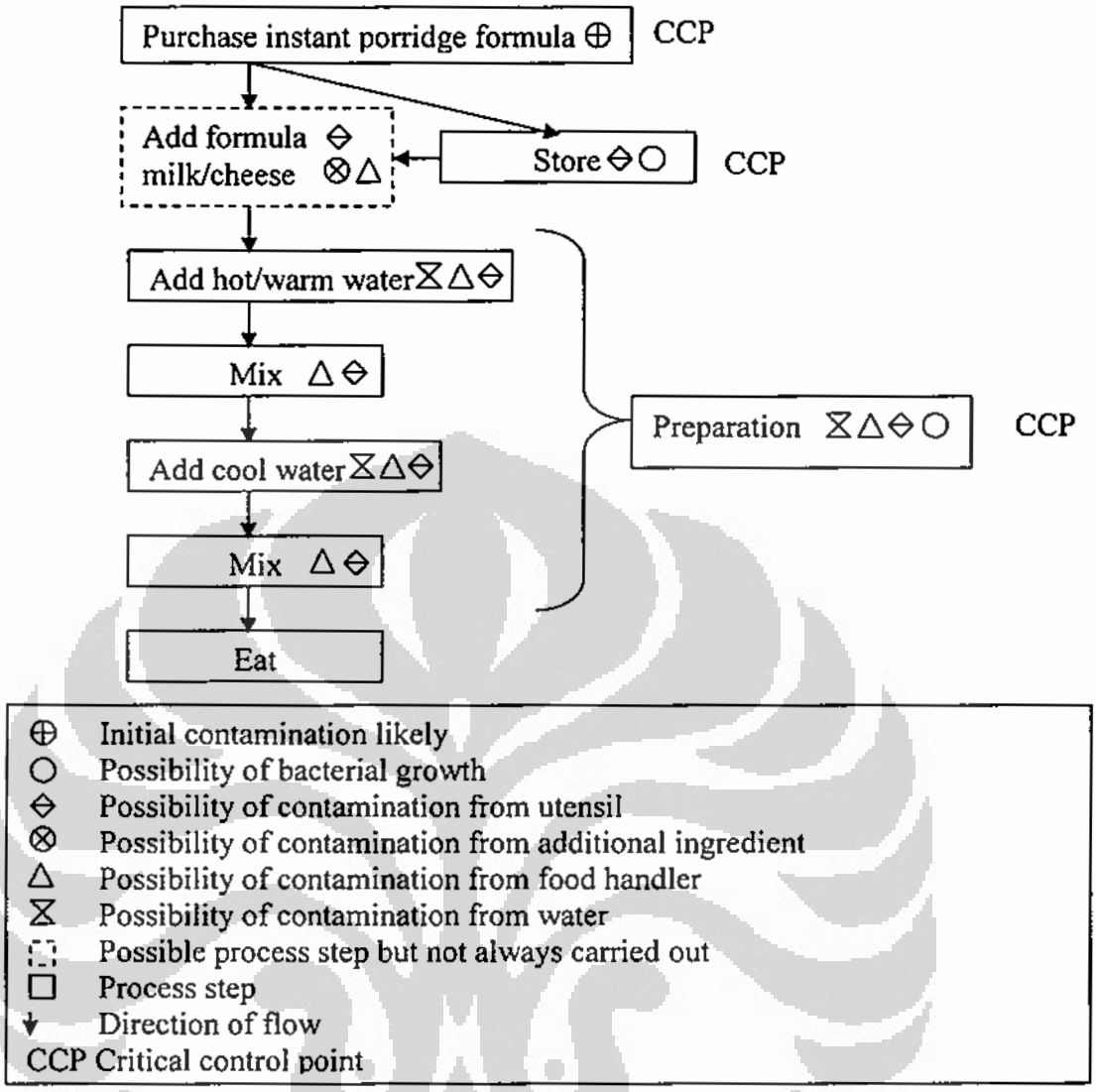
Food	Hazards	Critical Control Points	Control Measures	Monitoring
Rice cook by electric rice cooker	Pathogens survive inadequate cooking; spores survive	Cooking	Cook thoroughly; follow the cooking operation manual if any	Ensure the rice cooker operates properly
	Bacterial growth	Hot holding	Eat promptly after cooking; do not store too long	Check appearance of food for spoilage



Annex Figure 5. Flow diagram of vegetable soup

Annex Table 8. HACCP data sheet for vegetable soup

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Vegetable soup	Pathogens survive inadequate cooking, spores survive	Cooking	Cook thoroughly	Check for indication of heat e.g. bubbling, or check for texture changes e.g. become softer
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not dip finger to child's food	Check appearance of food for spoilage; ensure personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Check for indication of heat e.g. bubbling
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

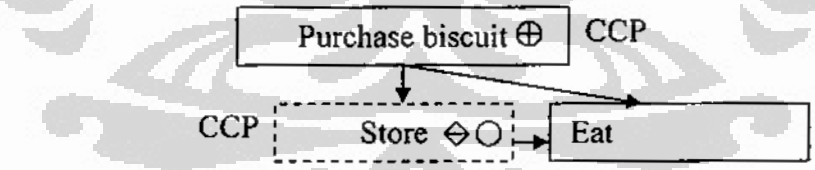


Annex Figure 6. Flow diagram of instant porridge formula

Annex Table 9. HACCP data sheet for instant porridge formula

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Instant porridge formula	Pathogens present	Purchasing	Purchase food that hasn't been expired and in good package condition	Ensure to read expiry date and observe broken package
	Contamination due to break in package; high	Dry-storage	Store in dry place; protect foods from contamination, throw	Observe storage practices

Food	Hazards	Critical Control Points	Control Measures	Monitoring
	moisture that resulting bacterial growth during storage		away when there's indication of spoilage	
	Cross contamination from ingredients, food handlers, equipment.	Addition of ingredients	Do not add milk/cheese that have been expired or spoilage, wash hands	Ensure food and personal hygiene
	Cross contamination from food handlers, water, or equipment during preparation, bacterial growth	Preparation	Use hot water, do not use cool water, use clean utensils; eat food promptly; avoid working with food if suffering from illness; wash hand before preparation and before feeding, do not dip finger to child's food, do not use hot water from dispenser machine, use boiled water	Ensure hygiene practices; observe for signs of illness

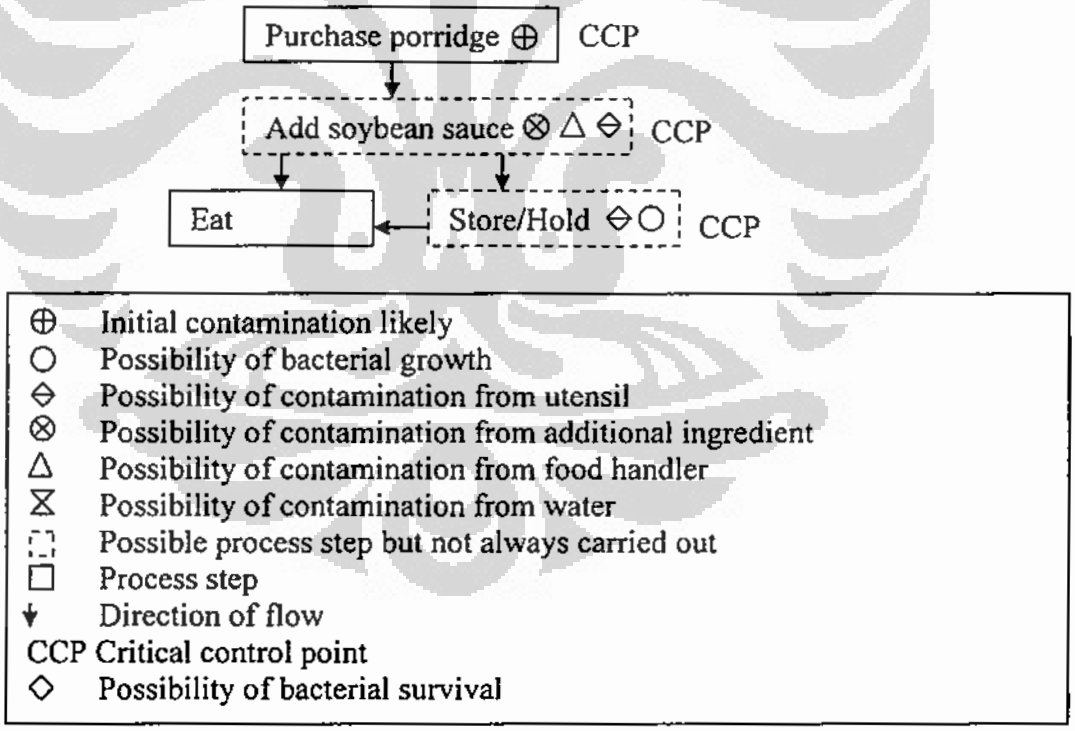


⊕ Initial contamination likely
○ Possibility of bacterial growth
◇ Possibility of contamination from utensil
⬚ Possible process step but not always carried out
□ Process step
↓ Direction of flow
CCP Critical control point

Annex Figure 7. Flow diagram of biscuit

Annex Table 10. HACCP data sheet for biscuit

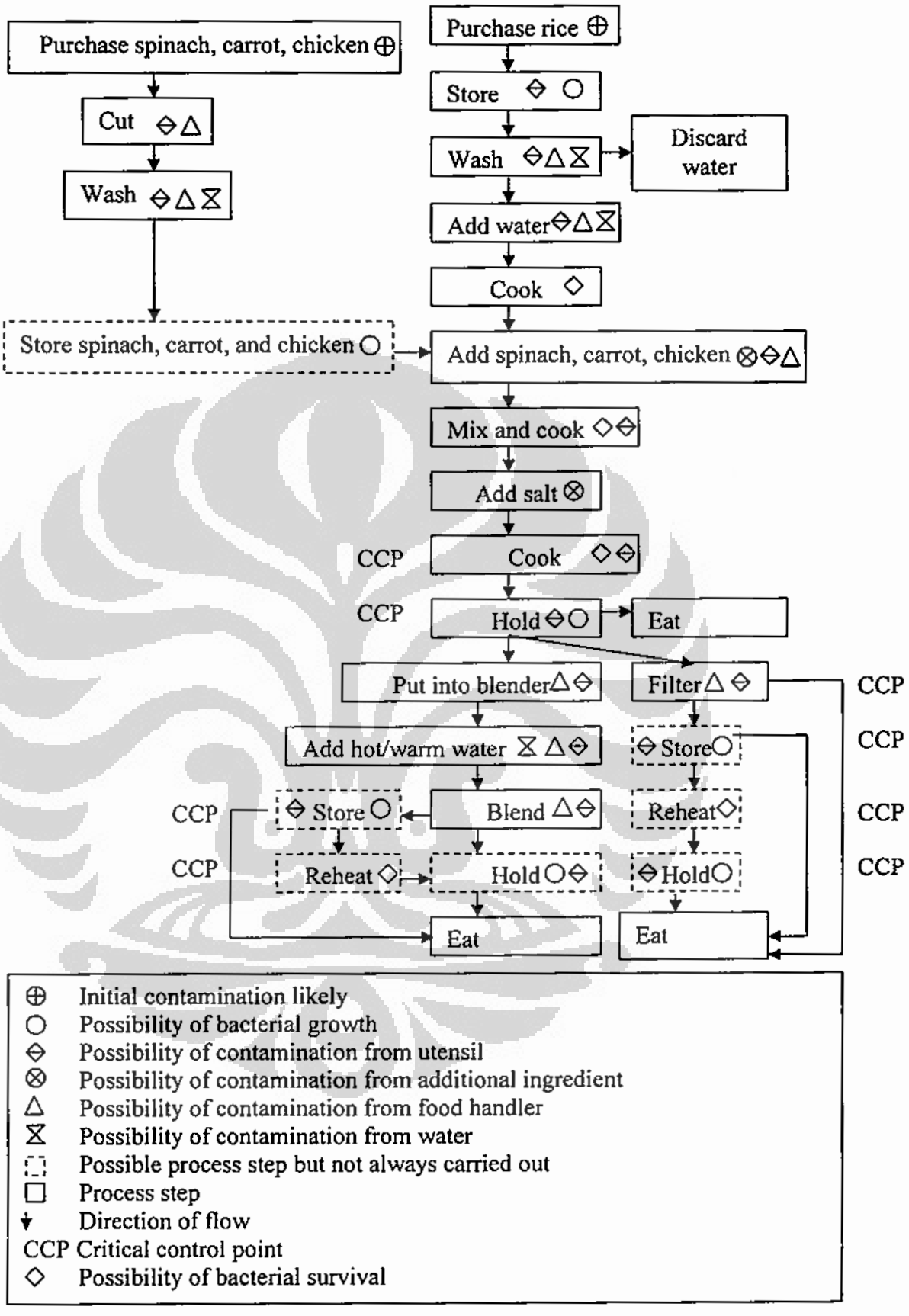
Food	Hazards	Critical Control Points	Control Measures	Monitoring
Biscuit	Pathogens present	Purchasing	Purchase food that hasn't been expired and in good package condition, check the expired date	Ensure to read expiry date and observe broken package
	Contamination due to break in package; high moisture that resulting bacterial growth during storage	Dry-storage	Store in dry place; protect foods from contamination	Observe storage practices



Annex Figure 8. Flow diagram of ready to eat rice porridge

Annex Table 11. HACCP data sheet for ready to eat rice porridge

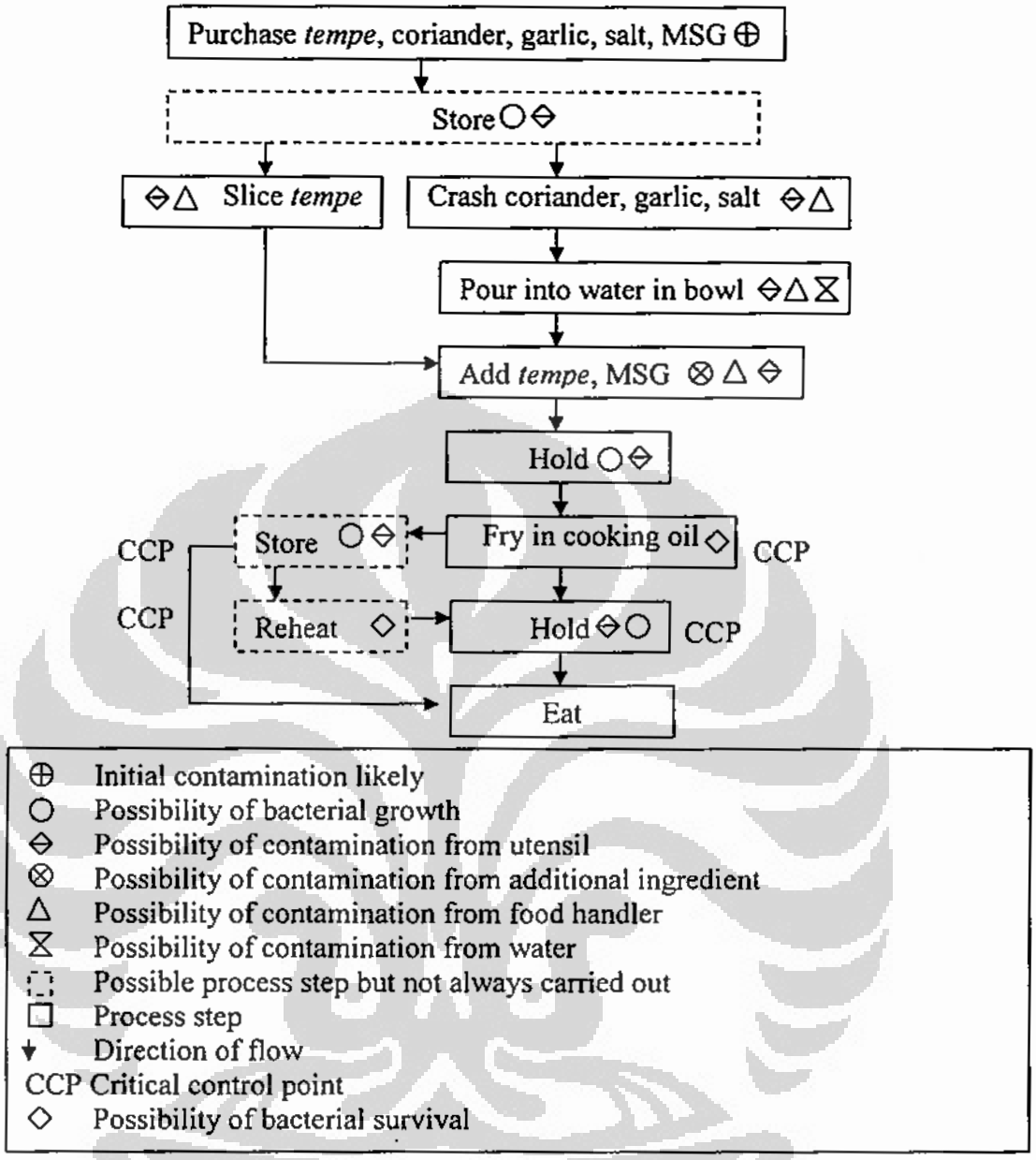
Food	Hazards	Critical Control Points	Control Measures	Monitoring
Ready to eat rice porridge	Pathogens present, cross contamination from food handlers or equipment during preparation;	Purchasing	Purchase from reliable vendors with adequate protection from dust and flies; use clean serving utensils	Check appearance of food for spoilage, check hygiene behavior of vendor with regard to utensils used and personal hygiene
	Bacterial growth	Holding	Eat directly as soon as purchased; wash hand before feeding, use clean eating utensils, do not dip finger to child's food	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Cross contamination from ingredients, food handler, equipment, bacterial growth	Addition of ingredients	Do not add raw ingredients without heat treatment	Ensure food and personal hygiene
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene



Annex Figure 9. Flow diagram of *nasi tim*

Annex Table 12. HACCP data sheet for *nasi tim*

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Nasi tim	Pathogens survive inadequate cooking; spores survive	Cooking	Cook thoroughly	check for indication of heat e.g. bubbling, or check for texture changes e.g. become softer
	Cross contamination from equipment; bacterial growth	Blending	Blend while it's still hot; use clean equipment; wash hand before blending	Ensure personal and equipment hygiene
	Cross contamination from equipment; bacterial growth	Filtering	Filter while it's still hot; use clean equipment; wash hand before filtering	Ensure personal and equipment hygiene
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not dip finger to child's food	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Check for indication of heat e.g. bubbling

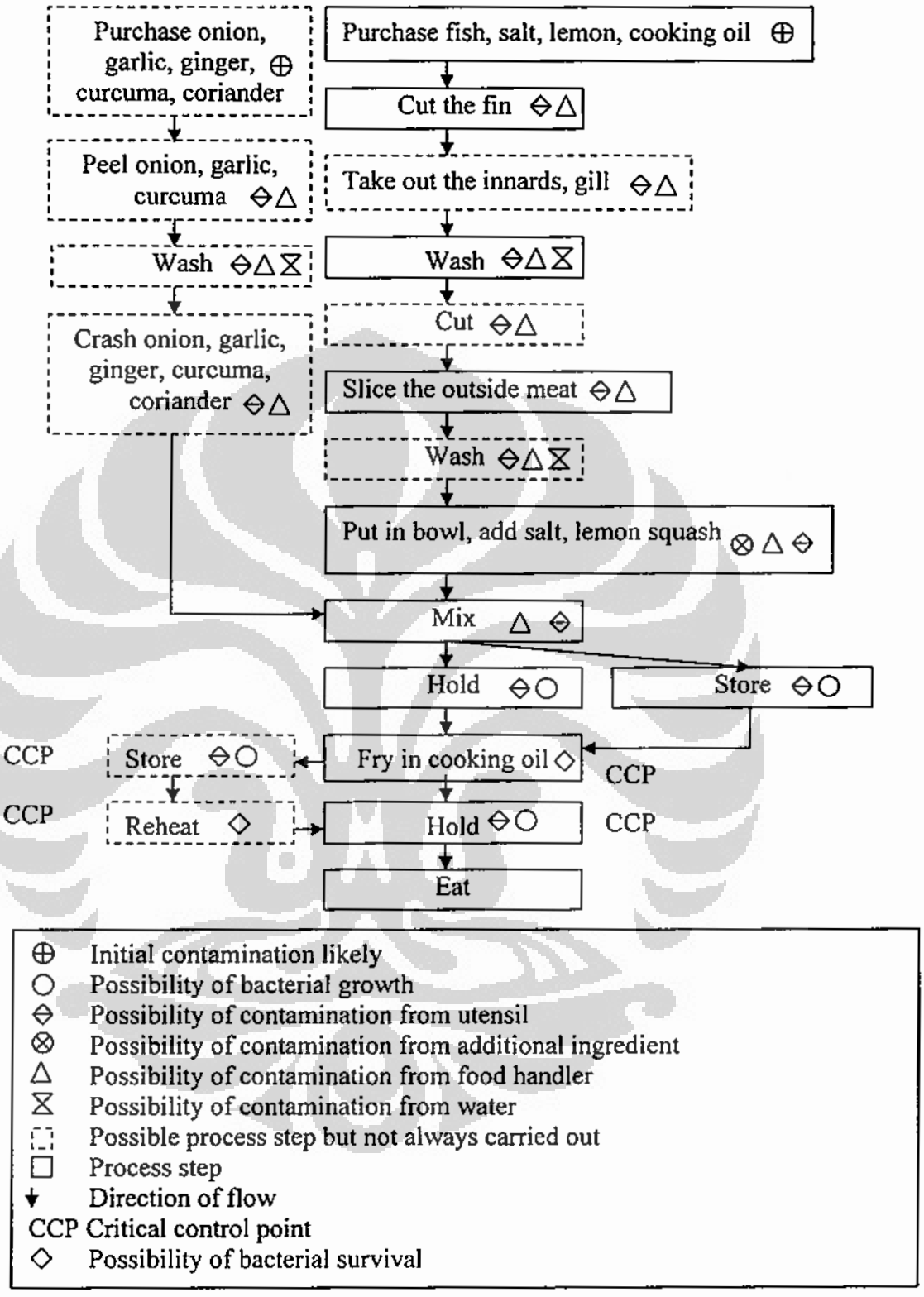


Annex Figure 10. Flow diagram of fried *tempe*

Annex Table 13. HACCP data sheet for fried *tempe*

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Fried *tempe*	Pathogens survive inadequate frying	Frying	Cook thoroughly	check for color changes e.g. become darker
	Bacterial growth	Holding	Eat promptly after	Check appearance of

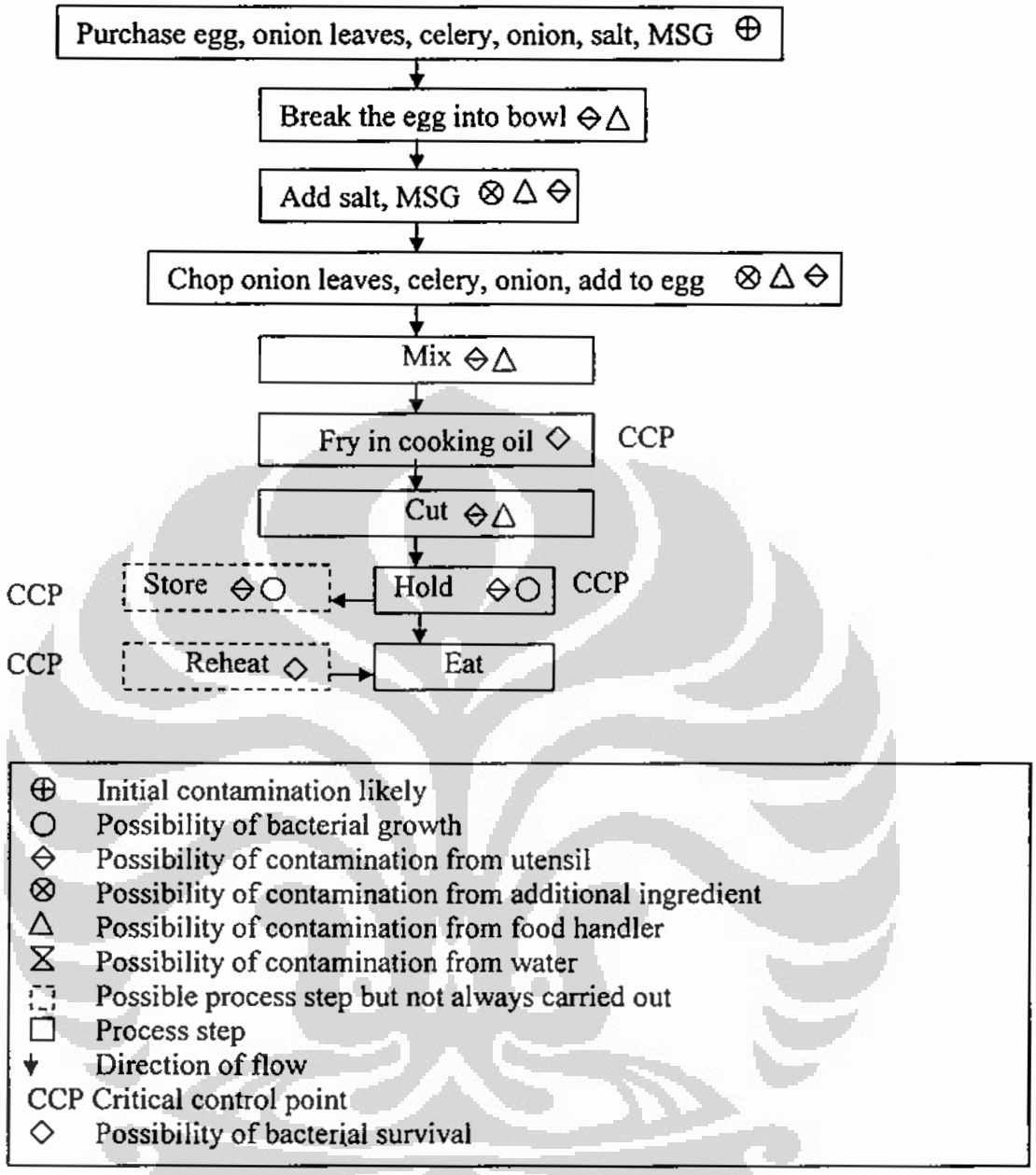
Food	Hazards	Critical Control Points	Control Measures	Monitoring
			preparation; wash hand before feeding, use clean serving utensils, do not touch food by finger/hand	food for spoilage; observe personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Ensure reheating for reasonable length of time
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene



Annex Figure 11. Flow diagram of fried fish

Annex Table 14. HACCP data sheet for fried fish

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Fried fish	Pathogens survive inadequate frying	Frying	Cook thoroughly	Check for color changes e.g. become darker
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not touch food by finger/hand	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Ensure reheating for reasonable length of time
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene



Annex Figure 12. Flow diagram of egg omelet

Annex Table 15. HACCP data sheet for egg omelet

Food	Hazards	Critical Control Points	Control Measures	Monitoring
Egg omelet	Pathogens survive inadequate frying	Frying	Cook thoroughly	Check for color changes e.g. become darker; observe coagulation

Food	Hazards	Critical Control Points	Control Measures	Monitoring
	Cross contamination from equipment; bacterial growth	Cutting	Use clean equipment; wash hand before cutting	Ensure personal and equipment hygiene
	Bacterial growth	Holding	Eat promptly after preparation; wash hand before feeding, use clean serving utensils, do not touch food by finger/hand	Check appearance of food for spoilage; observe personal and serving utensils hygiene
	Heat-stable toxins survive reheating; pathogens survive inadequate reheating	Reheating	Reheat thoroughly	Ensure reheating for reasonable length of time
	Spores germinate and resulting cells multiply if food stored for several hours	Storing	Eat promptly after preparation; use clean storage utensils	Check appearance of food for spoilage; ensure personal and storage utensils hygiene

REFERENCES

1. Ehiri, J. E., Azubuike, M. C., Ubbaonu, C. N., Anyanwu, E. C., Ibe, K. M., & Ogbonna, M. O. (2001). Critical control points of complementary food preparation and handling in Eastern Nigeria. *Bulletin of the World Health Organization*, 79, 423–433.
2. Unusan, N. (2007). Consumer food safety knowledge and practices in the home in Turkey. *Food Control*, 18, 45-51.
3. *Dinas kesehatan Kota Bekasi.* (2008). *Profil Kesehatan Kota Bekasi 2008 (data 2007)*. Bekasi: Author.
4. Motarjemi, Y. (2000). Research priorities on safety of complementary feeding. *Pediatrics*, 106 (5), 1304-1305.
5. Panisello, P. J., & Quantick, P. C. (2001). Technical barriers to Hazard Analysis Critical Control Point (HACCP). *Food Control*, 12, 165-173.
6. Griffith, C. J., & Worsfold, D. (1994). Application of HACCP to food preparation practices in domestic kitchens. *Food Control*, 5 (3), 200-204.
7. Kikafunda J. K., Walker A. F., & Tumwine, J. K. (2003). Weaning foods and practices in Central Uganda: A cross-sectional study. *African Journal of Food, Agriculture, Nutrition and Development*, 3 (2).
8. Bryan, F. L. (1992). *Hazard analysis critical control point evaluations: A guide to identifying hazards and assessing risks associated with food preparation and storage*. Geneva: World Health Organization.
9. Michanie, S., Bryan, F. L., Fernandez, N. M., Vizcarra, M. M., Taboada, D., Navarros, O., Alonso, A. B., & Santillan, L. (1988). Hazard analyses of foods prepared by inhabitants along the Peruvian Amazon River. *Journal of Food Protection*, 51 (4), 293-302.
10. Bryan, F. L., Michanie, S., Vizcarra, M. M., Navarros, O., Taboada, D., Fernandez, N. M., Requejo, E. G., & Munoz, B. P. (1988). Hazard analyses of foods prepared by inhabitants near Lake Titicaca in the Peruvian Sierra. *Journal of Food Protection*, 51 (5), 412-418.
11. Theodoros, H. V., & Arvanitoyannis I. S. (2008). Application of ISO22000 and comparison to HACCP for processing of ready to eat

vegetables: Part I. *International Journal of Food Science and Technology*, 43, 1729–1741.

12. Richards, J., Parr, E., & Riseborough, P. (1993). Hospital food hygiene: The application of Hazard Analysis Critical Control Points to conventional hospital catering. *Journal of Hospital Infection*, 24, 273-282.
13. Michanie, S., Bryan, F. L., Alvarez, P., & Olivo, A. B. (1987). Critical control points for foods prepared in households in which babies had salmonellosis. *International Journal of Food Microbiology*, 5, 337-354.
14. Blackburn, C. W., & McClure, P. J. (Ed.). (2002). *Food borne pathogens: Hazards, risk analysis and control*. Cambridge, England: Woodhead Publishing Limited.
15. United States Department of Agriculture. (2006). *How temperatures affect food*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.
16. United States Department of Agriculture. (2006). *Cutting boards and food safety*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.
17. United States Department of Agriculture. (2006). *Basics for handling food safely*. Food Safety Information. Food Safety and Inspection Service. United States Department of Agriculture.
18. Badrie, N., Gobin, A., Dookeran, S., & Duncan, R. (2006). Consumer awareness and perception to food safety hazards in Trinidad, West Indies. *Food Control*, 17, 370-377.
19. Altekruse, S. F., Street, D. A., Fein, S. B., & Levy, A. S. (1995). Consumer knowledge of food borne microbial hazards and food handling practices. *Journal of Food Protection*, 59 (3), 287-294.
20. Motarjemi, Y., Käferstein, F., Moy, G., & Quevedo, F. (1993). Contaminated weaning food: A major risk factor for diarrhea and associated malnutrition. *Bulletin of World Health Organization*, 71 (1), 79-92.

21. World Health Organization. (2000). *Complementary feeding, family foods for breastfed children.* Department of Nutrition for Health and Development. France: Author.
22. Fischer, A. R. H., & Frewer, L. J. (2008). Food-safety practices in the domestic kitchen: Demographic, personality, and experiential determinants. *Journal of Applied Social Psychology*, 38 (11), 2859-2884.
23. Jevšnik, M., Hlebec, V., & Raspor, P. (2008). Food safety knowledge and practices among food handlers in Slovenia. *Food Control*, 19, 1107-1118.

1. Scope and editorial policy

1.1 **Content.** The mission of the *Bulletin of the World Health Organization* is "to publish and disseminate scientifically rigorous public health information of international significance that enables policy-makers, researchers and practitioners to be more effective; it aims to improve health, particularly among disadvantaged populations".

The *Bulletin* welcomes unsolicited manuscripts, which are initially screened in-house for originality, relevance to an international public health audience and scientific rigour. Manuscripts passing the initial screening are sent blindly for peer review. After the reviews have been received, the editorial advisers decide on the manuscript's acceptability for publication in the *Bulletin*. Accepted papers are subject to editorial revision, including shortening of the text and omission of tables and figures if appropriate. The word limits shown below do not include the abstract (where applicable), tables, figures and references. The principal types of manuscripts are outlined below.

1.1.1. Unsolicited manuscripts

Research, Policy & practice, and Lessons from the field manuscripts must be accompanied by two paragraphs indicating what they add to the literature:

- a brief explanation of what was already known about the topic concerned;
- a brief outline of what we know as a result of your manuscript.

Research. Methodologically sound primary research of relevance to international public health. Formal scientific presentations of not more than 3000 words, with a structured abstract (see below, 2.8) and not more than 50 references; peer reviewed.

Systematic reviews in public health. Exhaustive, critical assessments of published and unpublished studies (grey literature) on research questions of relevance to public health policy and practice. Reviews should be prepared in strict compliance with MOOSE or QUOROM (PRISMA) guidelines or with Cochrane's complementary guidelines for systematic reviews of health promotion and public health interventions. Not more than 3000 words and 50 references, plus a 250-word structured abstract (see below, 2.8). All studies included and excluded in the review should be shown in a flow diagram that will not count towards the word limit if published as an appendix only in the electronic version of the journal or on the authors' URL. Peer reviewed.

Policy & practice. Reviews, debates or hypothesis-generating papers; not more than 3000 words, with a non-structured abstract (see below, 2.8) and not more than 50 references; peer reviewed.

Lessons from the field. Papers that capture experiences and practice gained in solving specific public health problems in developing countries, with a structured abstract (see below, 2.8); not more than 1500 words and not more than 15 references, with no more than one table and one figure (see also: http://www.who.int/bulletin/volumes/84/1/3.pdf).

Perspectives. Views, hypotheses or discussions (with a clear message) of an issue of public health interest; up to 1500 words, no more than six references.

Reporting of results of studies should follow best practices, as outlined in the following guidelines:

- CONSORT for reports of randomized trials (http://www.equator-network.org)
- TREND for reports of non-randomized evaluations of interventions (http://www.trend-statement.org/asp/trend.asp)
- STARD for studies of diagnostic accuracy (http://www.equator-network.org)
- MOOSE for meta-analysis of observational studies (http://www.equator-network.org)
- QUOROM (PRISMA) for systematic reviews and meta-analyses of randomized trials (http://www.equator-network.org)
- STROBE for the reporting of observational studies in epidemiology (http://www.equator-network.org)
- Clinical trials sponsored by pharmaceutical companies should follow specific guidelines (available at: http://www.gpp-guidelines.org). All human trials that are phase 2a and above must be registered with a clinical trial registry (http://www.who.int/ictrp/en). Information on trial registration is available at: http://www.who.int/bulletin/volumes/83/9/645.pdf
- Cochrane's guidelines for systematic review of health promotion and public health interventions (http://www.ph.cochrane.org).

Letters. Useful contributions referring to something published recently in the *Bulletin*; 400–850 words, maximum six references. Letters are also edited and may be shortened.

1.1.2. Commissioned manuscripts

The categories of articles shown below are normally commissioned by the editors. Authors wishing to submit an unsolicited manuscript to be considered for one of these categories should first contact the editorial office (see below, 2.1).

Editorials. Authoritative reviews, analyses or views of an important topic related to the month's theme or a topical subject; not more than 800 words, maximum 12 references.

Commentaries. Explanatory or critical analysis of an individual article; not more than 800 words, maximum 12 references.

Round tables. Consist of a base paper on a controversial subject of current public health importance (not more than 2000 words and an abstract) and a debate on it by several discussants, who are invited to contribute not more than 500 words each.

Public health classics. A landmark public health paper or publication is reproduced, accompanied by a commentary of up to 1500 words.

Books & electronic media. Reviews of a book, web site, film, play, CD-ROM, etc. of public health interest; 400–800 words, no references.

1.2 **Ethical issues.** The World Health Organization publishes the results of research involving human subjects only if it has been conducted in full accordance with ethical principles, including the provisions of the World Medical Association Declaration of Helsinki (as amended by the 59th General Assembly, Seoul, The Republic of Korea, October 2008; available at: http://www.wma.net/e/policy/b3.htm) and the additional requirements, if any, of the country in which the research was carried out. Any manuscript describing the results of such research that is submitted for publication must contain a clear statement to this effect, specifying that the free

and informed consent of the subjects or their legal guardians was obtained and that the relevant institutional or national ethical review board approved the investigation. The *Bulletin* is a member of the Committee on Publication Ethics (COPE; see: http://www.publicationethics.org.uk). Issues involving publication ethics may be referred to this Committee by the editors.

1.3 **Competing interests.** A competing interest arises when a professional judgement concerning a primary interest (such as patients' welfare or the validity of research) may be influenced by a secondary interest (such as financial gain or personal rivalry). We ask all authors to disclose at the time of submission any competing interests that they may have. Examples of types of competing interests may be found at: http://www.icmje.org. Further information on competing interests is available at http://www.who.int/bulletin/volumes/83/9/645.pdf.

1.4 **Funding.** Authors should declare sources of funding for the work undertaken, affirm that they have not entered into an agreement with the funding organization that may have limited their ability to complete the research as planned, and that they have had full control of all primary data.

1.5 **Appeals process.** Authors who wish to appeal against a decision to reject their paper should follow the procedures outlined in an editorial published in the *Bulletin* (see: http://www.who.int/bulletin/volumes/83/9/645.pdf).

2. Preparation and submission of manuscripts

2.1 **Correspondence.** Manuscripts should be submitted to the *Bulletin* via our submissions web site (http://submit.bwho.org), where full information is given. Queries about online submissions should be sent to the following e-mail address: bulletin.submit.ask@who.int. Authors who experience difficulties in using the online submission system should seek assistance by contacting the editorial office.

2.2 **Uniform requirements.** Manuscripts should be prepared in accordance with the Uniform Requirements for Manuscripts Submitted to Biomedical Journals established by the Vancouver Group (International Committee of Medical Journal Editors, ICMJE). The complete document, updated October 2007, is available at: http://www.icmje.org.

2.3 **Languages.** Manuscripts should be submitted in English. The *Bulletin* is published in English; the abstracts are translated into Arabic, French and Spanish. Authors who have difficulty in preparing their manuscript in English should contact the editorial office for advice.

2.4 **Authorship.** Authors should give their full names and the name and address of their institutions. If possible, only one institution per author should be given. In accordance with the "Uniform requirements" (see above, 2.2), each author should have participated sufficiently in the work being reported to take public responsibility for the content; each author should provide a description of his or her contribution to the work being reported. The full postal and e-mail address of the corresponding author will be published unless otherwise requested. The *Bulletin* encourages submissions from authors in developing countries, and in line with this policy at least one author should be a national of the country where the study was carried out and have an affiliation there.

2.5 **Licence for publication.** If a manuscript is accepted for publication, the author(s) will be asked to sign a statement granting exclusive licence for publication to the World Health Organization. A copy of the statement is available at: http://submit.bwho.org/journals/bullwho/forms/licence.pdf. Authors are responsible for obtaining permission to reproduce in their articles any material enjoying copyright protection. The letter granting such permission should be sent to the editorial office.

2.6 **Automatic links.** All links inserted by the automatic reference and footnote facilities of word-processing software must be removed before the manuscript is submitted. Footnotes are not permitted and such material should be inserted into the main text.

2.7 **Tables and figures.** Tables and figures should be used only if they enhance understanding of the text. In the text, tables and figures should be numbered consecutively (e.g. Table 1, Fig. 1). They should be presented with clear, concise titles at the end of the text and not incorporated or embedded into it. Abbreviations or acronyms should be avoided but if used must be explained. Graphs or figures, which should be presented in two-dimensional and not pseudo three-dimensional "perspective" format, should be clearly drawn and all the data identified.

2.8 **Abstracts.** Abstracts, which should be clearly written to highlight the text's most significant points, should be provided for the following types of papers: Research, Systematic reviews, Policy & practice, base papers for Round tables and Lessons from the field. The abstract, which should not exceed 250 words, appears in English at the beginning of the paper and is translated into Arabic, French and Spanish for publication at the end of the paper. Accuracy of the translations is the responsibility of the *Bulletin*. For Research papers and Systematic reviews, the abstract should be structured: Objective, Methods, Findings, Conclusion. For Lessons from the field papers the abstract should be structured: Problem, Approach, Local setting, Relevant changes, Lessons learned.

2.9 **Bibliographic references.** Authors are responsible for the accuracy of all references, which should be verified at: http://www.ncbi.nlm.nih.gov: these are not checked by the editors. References should be numbered consecutively as they occur in the text (in superscript roman type, preferably at the end of a sentence) and listed in numerical order at the end of the text. The *Bulletin* adheres closely to the Vancouver style of references (see http://www.icmje.org, updated October 2007). The first six authors of a work should be named, followed by "et al." if there are more than six.

2.10 **Maps.** Use of maps should be avoided, but should their use be necessary authors are requested to use the relevant UN-approved maps, which can be downloaded from: http://www.un.org/Depts/Cartographic/english/htmain.htm ■

UNIVERSITAS INDONESIA
FAKULTAS KEDOKTERAN

Jalan Salemba Raya No. 6 Jakarta Pusat
Pos Box 1358 Jakarta 10430
Kampus Salemba Telp. 31930371, 31930373, 3922977, 3927360, 3912477, 3153236, Fax. : 31930372, 3157288, e-mail : office@fk.ui.ac.id

NOMOR : 433 /PT02.FK/ETIK/2008

KETERANGAN LOLOS KAJI ETIK

ETHICAL — CLEARANCE

Panitia Tetap Penilai Etik Penelitian, Fakultas Kedokteran Universitas Indonesia dalam upaya melindungi hak asasi dan kesejahteraan subyek penelitian kedokteran, telah mengkaji dengan teliti protokol berjudul:
The Committee of The Medical research Ethics of the Faculty of Medicine, University of Indonesia, with regards of the Protection of human rights and welfare in medical research, has carefully reviewed the proposal entitled:

"ANALISA BAHAYA TITIK KENDALI KRITIS (HACCP) PADA PRAKTEK PENYIAPAN DAN PENANGANAN MAKANAN PENDAMPING ASI DI KOTA BEKASI".

Peneliti Utama : LINA ROSPITA,SPi
Name of the principal investigator

Nama Institusi : SEAMEO-TROPMED UI

dan telah menyetujui protocol tersebut di atas.
and approved the above mentioned proposal.

Jakarta, 22 Desember 2008

Chairman
Ketua

Prof. Dr. dr. Agus Firmansyah, SpA(K)

-Peneliti wajib menjaga kerahasiaan identitas subyek penelitian.

RINCIAN INFORMASI UNTUK SUBYEK

TENTANG PENELITIAN

Judul penelitian:
"Analisa Bahaya Titik Kendali Kritis (HACCP) pada praktek penyiapan dan penanganan Makanan Pendamping ASI di Kota Bekasi"

Pendahuluan:

Pada usia 6 bulan anak-anak sudah harus diberikan makanan pendamping ASI (MP-ASI). Praktek pembuatan MP-ASI yang tidak bersih dan sehat dapat menyebabkan makanan tersebut tercemar oleh virus dan kuman, sehingga anak-anak dapat terserang diare bila mengkonsumsi makanan tersebut. Diare (buang air besar yang cair 3 kali atau lebih) merupakan penyebab utama terjadinya kesakitan dan kematian pada anak di bawah usia lima tahun (balita) di negara berkembang termasuk di Indonesia dan Bekasi khususnya.

Karena itu bagaimana perilaku pengasuh dalam pembuatan MP-ASI, informasi terkait tingkat pengetahuan, status sosial ekonomi, dan fasilitas kebersihan juga sangat penting untuk sebagai masukan berbagai pemangku kepentingan dalam menyampaikan pesan kesehatan yang tepat bagi masyarakat. Untuk itu studi ini perlu dilakukan.

Penelitian akan dilakukan dalam 2 tahap, yaitu: tahap 1) diskusi kelompok dan wawancara pada kader dan ibu-ibu untuk mengetahui jenis MP-ASI, praktek pembuatan dan penanganan MP-ASI serta tingkat pengetahuan, keadaan sosial ekonomi, dan fasilitas kebersihan yang dimiliki; tahap 2) pengamatan langsung terhadap praktek pembuatan dan penanganan MP-ASI untuk menentukan titik kendali kritis pada pembuatan MP-ASI.

Tujuan dari penelitian:
Penelitian ini bertujuan untuk melakukan studi HACCP dan mengetahui faktor-faktor yang berhubungan dengan praktek ibu-ibu dalam mempersiapkan dan menangani makanan pendamping ASI bagi anak-anak berusia 6-24 bulan di Kota Bekasi.

Ibu atau pengasuh yang dapat berpartisipasi dalam penelitian adalah yang memiliki anak berusia 6-24 bulan. Pelaksanaan penelitian akan dilaksanakan di beberapa kecamatan di Kota Bekasi.

Penelitian ini tidak menimbulkan masalah etik yang sangat berarti, karena tidak terdapat pengambilan apapun pada subyek. Seluruh informasi yang diperoleh dari hasil penelitian ini akan disimpan dan dirahasiakan dan akan digunakan hanya untuk tujuan penelitian.

Manfaat penelitian ini :

Penelitian ini menjadi dasar untuk meninjau kembali apakah ibu-ibu sudah mempraktekkan prosedur kemanan makanan dalam pembuatan MP-ASI bagi anak berusia 6-24 bulan. Dan untuk mengetahui tahapan mana dari proses pembuatan makanan tersebut yang merupakan titik kritis sehingga perlu dikendalikan untuk menghindari atau menghilangkan bahaya kontaminasi terhadap makanan tersebut, agar dapat menekan kejadian diare.

Pengetahuan keamanan pangan ibu/pengasuh serta faktor lain yang mempengaruhi perilaku ibu/pengasuh akan dikaji, sehingga dapat menjadi masukan bagi pembuat keputusan serta pemangku kepentingan yang lain yang terkait dalam menurunkan tingkat kesakitan diare di Bekasi. Hasil penelitian juga berguna dalam usaha pemberdayaan ibu dan keluarga, serta bagi pengembangan promosi kesehatan yang tepat daerah Bekasi khususnya

Setiap ibu atau pengasuh dapat menanyakan penjelasan lebih lanjut mengenai tujuan penelitian, prosedur penelitian, manfaat dan kerugian serta tindakan pencegahan apabila kerugian tersebut menjadi masalah. Keikutsertaan ibu atau pengasuh ditandai dengan penandatanganan surat persetujuan keikutsertaan (*informed consent*). Partisipasi ibu atau pengasuh bersifat **sukarela** dan mereka dapat mengundurkan diri kapan saja selama waktu penelitian tanpa ada sanksi apapun juga.

Apabila diperlukan penjelasan lebih lanjut, dapat menghubungi:
Lina Rospita SPi.

SEAMEO TROPMED RCCN - UI
Gedung SEAMEO TROPMED Kampus UI Salemba
Jl. Salemba Raya No. 6 Jakarta Pusat
Telepon: 31902950; 31930205
Fax: 3913932
HP: 08128710032

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

No	Food	Raw ingredients	Additional ingredients[a]	Texture[b]	Preparation duration	Sign of already cooked[c]	Storage practice[d]	Storage duration	reheating[e]	Reheating equipment[f]	Rehet until?[g]	Place of purchasing[h]
	toge, daun singkong, daun katuk, kc. merah, jamur, wortel, kc. pjg, brokoli, kembang kol)											
14	*Sayur asem*											
15	*Sayur lodeh*											
16	*Acar*											
17	*Urap*											
18	*Sayuran disantan (daun singkong, daun katuk, kc. panjang, kembang kol, sawi, nangka, rebung)*											
19	*Tauco*											
20	*Tumis sayuran campur (buncis, brokoli, tahu, sawi, bakso, kc. panjang, kangkung, wortel, toge,*											

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

No	Food	Raw ingredients	Additional ingredients[a]	Texture[b]	Preparation duration	Sign of already cooked[c]	Storage practice[d]	Storage duration	reheating[e]	Reheating equipment[f]	Rehet until?[g]	Place of purchasing[h]
	bayam, oncom, lenca, kembang pepaya, jamur)											
21	*Sayur dikukus (labu siam, wortel, nangka)*											
22	*Rebus-rebus (jagung, ubi jalar, singkong, telur)*											
Protein sources food												
23	*Ayam ungkep*											
24	*Lauk goreng (ikan, ati ayam, ampela, tahu, tempe, kentang, sosis, nugget, makaroni, telur bulat, telur ceplok)*											
25	*Orek tempe*											
26	*Telur dadar*											
27	*Ayam (goreng) kecap*											
28	*Ayam tepung*											

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

No	Food	Raw ingredients	Additional ingredients[a]	Texture[b]	Preparation duration	Sign of already cooked[c]	Storage practice[d]	Storage duration	reheating[e]	Reheating equipment[f]	Reheat until?[g]	Place of purchasing[h]
	(Kentucky)											
29	*Ikan, ayam, telor rebus, telor ceplok, tempe, tahu, kentang, soun disantan*											
30	*Kikil*											
31	*Belut*											
32	*Babat*											
33	*Ikan teri*											
34	*Kerang*											
35	*Udang*											
36	*Pindang ikan*											
37	*Semur (daging, ayam, telur rebus, tempe, tahu, kentang)*											
38	*Semur/Telur ceplok kecap*											
39	*Pepes ikan, ayam, tahu*											
40	*Ikan, ayam bakar*											
41	*Soto*											
42	*Rawon*											
43	*Ayam kuning*											

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

No	Food	Raw ingredients	Additional ingredients[a]	Texture[b]	Preparation duration	Sign of already cooked[c]	Storage practice[d]	Storage duration	reheating[e]	Reheating equipment[f]	Rehet until?[g]	Place of purchasing[h]
	tanpa santan											
Snack												
44	*Pisang, singkong, ubi jalar, tape, talas goreng*											
45	*Tempe mendoan*											
46	*Tahu isi goreng*											
47	*Keripik*											
48	*Kerupuk*											
49	*Bakwan sayuran, jagung*											
50	*Perkedel kentang, jagung*											
51	*Combro (isi oncom, ampas kedelai)*											
52	*Misro*											
53	*Getuk*											
54	*Agar-agar*											
55	*Bolu kukus*											
56	*Bolu panggang*											
57	*Kue (adonan terigu+mentega, goreng)*											

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

No	Food	Raw ingredients	Additional ingredients[a]	Texture[b]	Preparation duration	Sign of already cooked[c]	Storage practice[d]	Storage duration	reheating[e]	Reheating equipment[f]	Rehet until?[g]	Place of purchasing[h]
58	*Donat*											
59	*Kue pisang kukus*											
60	*Kue abuk (singkong)*											
61	*Terigu campur kelapa muda*											
62	*Susu kedelai*											
63	*Es*											
64	*Buah*											
Ready to eat food that has possibility of further preparation e.g. addition of ingredients after heat treatment, storage, reheating, etc. (the grey column no need to fill in)												
65	*Bubur ayam*											
66	*Bakso*											
67	*Bubur kc.ijo*											
68	.....											
69	.....											
Package food												
70	*bubur instant seperti nestle, dll*											
71	*mie instant atau dibuat dadar telur*											
	Corned beef/ayam,											

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

No	Food	Raw ingredients	Additional ingredients[a]	Texture[b]	Preparation duration	Sign of already cooked[c]	Storage practice[d]	Storage duration	reheating[e]	Reheating equipment[f]	Reheat until?[g]	Place of purchasing[h]
	sarden, dll	[redacted]										[redacted]
72	*Nugget, sosis, dll*											
73	*Agar-agar*											
74	*Minuman instant (jelly drink, susu, teh, soda, dll)*											
75	*Roti tawar*											
76	.....											
77	.....											

Keterangan:
[a] (1) onion leaves; (2) celery; (3) abon; (4) soybean sauce; (77) others (please mention)
[b] (1) liquid; (2) semi solid; (3) solid
[c] (1) boil; (2) soft texture; (3) hot; (4) change color; (77) others (please mention)
[d] (1) turn off the stove, cover the food, then put on the stove[a]/on the kitchen surface[b]/on the dining table[c]/in the food cabinet[d]/ others (please mention);
(2) the food put in to plate/bowl, cover, then put on the stove[a]/on the kitchen surface[b]/on the dining table[c]/in the food cabinet[d]/ others (please mention);
(66) NA (if directly eaten); (77) others (please mention)
[e] (1) Yes; (2) No
[f] (1) stove; (2) rice cooker/magic jar; (66) NA (if not reheated); (77) others (please mention)
[g] (1) boil; (2) warm; (66) NA (if not reheated); (77) others (please mention)
h (1) mobile vegetable vendor; (2) shop next to home; (3) traditional market; (4) supermarket; (5) mobile food vendor; (77) others (please mention)

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

1. What is raw/uncooked food usually consumed by child?
.....
66. NA (not consume raw/uncooked food) [ ]

2. What is half cooked food usually consumed by child?
.....
66. NA (not consume half cooked food) [ ]

3. Does child use bottle for drinking or eating? [ ]
1. Yes 2. No (go to no.7)

4. what food/drink usually give by bottle feeding to child?
..... [ ]
66. NA (not using bottle)

5. How do you clean the bottle? [ ]
1. wash by cool water 3. no wash, directly boil
2. wash by warm water 4. wash and boil
5. wash then steam 6. brush
7. not cleaning the bottle (go to no.7)
66. NA (not using bottle) 77.other, please mention:.....

6. What do you use to clean the bottle ? [ ]
1. water only 2. water+soap 77. other, please mention:.....
66. NA (not using bottle / not cleaning the bottle)

7. When you want to buy package food/drink for child, what do you do/observe to the food before decided to buy the food?

	(1) Yes / (2) No
Read expiry date	
Check the package broken or not	
Directly purchase	
other, please mention:.....	

(66) NA (not consume package food/drink) [ ]

8. Do you use the same cutting board for fish/chicken/meat/sausage and raw fruit/vegetables which is eaten by child? [ ]
1. Yes 2. No (go to no.11)
66. NA (not using cutting board for child's food)

9. When do you clean the cutting board?

	(1) Yes / (2) No
After used for fish/chicken/meat/sausage and before used for fruit/vegetables	
Only after finished all preparing/cooking activities	
other, please mention:.....	

66. NA (not using cutting board for fish/chicken/meat/sausage) [ ]

10. What do you use to clean the cutting board **(when doing activities no.9)**? [ ]
1. water only 3. brush and wash with water 4. wipe only
2. water+soap 66. NA (not using cutting board for child's food)
77. other, please mention:.....

Household code: ☐ ☐☐ ☐☐☐
A B C

11. Do you use the same knife for fish/chicken/meat/sausage and raw fruit/vegetables which is eaten by child? 1. Yes 2. No (go to no.14) ☐

12. When do you clean the knife?

	(1) Yes / (2) No
After used for fish/chicken/meat/sausage and before used for fruit/vegetables	
Only after finished all preparing/cooking activities	
other, please mention:.....	

13. what do you use to clean the knife **(when doing activities no.12)**?
1. water only 2. water+soap 4. wipe only
3. brush and wash with water 77. other, please mention:..... ☐

14. when do you clean the kitchen surface?
1. before preparing/cooking food 3. only after preparing/cooking food
2. before and after preparing/cooking food 77. other, please mention:..... ☐

15. What do you use to clean the kitchen surface?
1. water only 2. water+soap
3. wipe with wet clothes 4. brush and wash with water
77. other, please mention:..... ☐

16. Fruit and vegetables was eaten by child: **(read the options except no.66 and no.77)**:
1. after purchased 2. after wash with cool running water
3. after wash with cool water in bowl
4. after wipe with clothes
5. after wash with warm water in bowl
6. after wash with warm running water
66. NA (child not consume fruit) 77. other, please mention:..... ☐

17. Do you give traditional herb to be drink by the child (e.g. leaves or spices such as daun saga, daun rambutan, daun kapuk, air kencur, air kunyit, air jahe, etc.)?
1. Ya 2. Tidak ☐

18. What water do you use **(when preparing no.17)**?
1. tap water 2. boiled water from water pot/thermos ☐
66. NA (no traditional herbs was given)

19. How do you wash your hands?
1. cool running water 3. cool water in bowl
2. warm running water 4. warm water in bowl
5. wipe with wet clothes 6. wipe with wet tissue
77. other, please mention:..... ☐

20. What do you use to wash your hand?
1. water only 2. water+soap 3. none (if only wipe) ☐

21. Do you usually play/touch pets e.g. cats,chicken, etc?
1. Yes 2. No ☐

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

22. Does the child usually play/touch pets e.g. cats,chicken, etc? 1. Yes 2. No [ ]

23. When do you usually wash your hand?

	Yes (1) / No (2) / NA (66)
Before preparing/cooking food for child	
After preparing/cooking food for child	
Before feed the child	
Before taste child food by finger	
When hands dirty	
When hands sticky	
other, please mention:.....	

24. Does your child usually hold foods by her/himself/eat by his/her own hands? (including fruits) 1. Yes 2. No [ ]

25. When does your child usually wash hands?

	Yes (1) / No (2) / NA (66)
Before eating	
When hands dirty	
When hands sticky	
other, please mention:.....	

26. (if the answer of no. 23 are when hands dirty/sticky) when does your hands usually dirty/sticky?
.....

27. (if the answer of no. 25 are when hands dirty/sticky) when does the child hands usually dirty/sticky?
.....

28. how does the child wash hands?
1. with cool running water 3. with cool water in bowl
2. with warm running water 4. with warm water in bowl
5. wipe with wet clothes 6. wipe with wet tissue
77. other, please mention:..... [ ]

29. What do you use to clean child's hand?
1. water only 2. water+soap 3. none (if wipe only) [ ]

30. How do you usually dry your hand?
1. wipe with disposable tissue 2. wipe with clothes
3. using electric hand dryer 4. air dried
77. other, please mention:..... [ ]

31. How do you usually dry the child hand?
1. wipe with disposable tissue 2. wipe with clothes
3. using electric hand dryer 4. air dried
77. other, please mention:..... [ ]

32. When you are suffering from flu/typus/wound in hand, who usually prepare/cook child's food?
1. still yourself 2. others who is not ill
66. NA (never been ill) [ ]

Household code: ☐ ☐☐ ☐☐☐
A B C

33. How do you wash the child cooking/eating utensils?
1. on the sink with running water 2. on the sink with water in bucket
3. on the floor with running water, clean utensils put on the floor
4. on the floor with running water, clean utensils put on the bucket
5. on the floor with water in bucket, clean utenils put on the floor
6. on the floor with water in bucket, clean utenils put on the bucket
77. other, please mention:..... ☐

34. Do you chew the child food prior to consumption?
1. Yes 2. No ☐

35. How do you check the temperature of child's food prior to feeding?

	(1) Yes / (2) No
take a little portion with spoon and put it in the mouth (use the same spoon to feed the child)	
take a little portion with spoon and put it in the palm (spoon touch the palm)	
dip a finger into the food	
other, please mention:.....	

E. Food handler's knowledge
(Please read the options except no.88 and no.99, ask respondent to choose only one correct option according to their knowledge)

1. If you cook fried chicken in the morning and the food will be eaten in the afternoon. Which practice is correct according to your knowledge:
1. Put in the refrigerator while still hot, store until afternoon, then eat
2. Put on the plate/bowl on dining table, cover, cool, and then put it into refrigerator, fried again before eating
3. Turn off the stove and leave the food there until afternoon, then eat
4. Store the food in plate/bowl and leave it on the kitchen or dining table until afternoon, then eat
77. other, please mention:.....
88. Do not know 99. No answer ☐

2. After handling raw meat, poultry, or fish, according to your knowledge which practice is acceptable to clean your hands by:
1. wiping them on a towel, clothes, or tissue
2. wash in cool water 77. other, please mention:.....
3. wash with soap and cool water 88. Do not know
4. wash with soap and warm water 99. No answer ☐

3. According to your knowledge, which one is the proper way of hands drying?
1. wiping with disposable tissue 88. Do not know
2. wiping with clothes or towel 99. No answer ☐
77. other, please mention:.....

4. According to your knowledge which correct practice of eating fruits:
1. eaten directly as purchased 88. Do not know
2. eaten once after wash in running water 99. No answer ☐
3. eaten once after wash in a bowl or pail of water
77. other, please mention:.....

Household code: ☐ ☐☐ ☐☐☐
A B C

5. According to your knowledge, which food is safe to be eaten by child?
1. half cooked egg 2. rice porridge
77. other, please mention:.....
88. Do not know 99. No answer ☐

6. If cooked rice porridge then add with daun bawang/seledri, then the food was eaten by child, do you think the practice is correct?
1. Yes 2. No
88. Do not know 99. No answer ☐

7. If yes, why do you think it is correct?
.....

8. According to your knowledge, what kind of place which is proper to buy child's food? (only for ready to eat food or fruit which directly eaten by child)
.....

9. Why do you think it is a proper place?
.....

10. According to your knowledge, what is the condition of the package food so it is safe to be consumed by child?
.....

11. According to your knowledge, how is the proper way of storing package food which was already half consumed (biscuit/bread/instant porridge formula, etc)? **(please mention the example of the food)**
.....

12. According to your knowledge, how is the correct way of cleaning cooking and eating utensils of the child?
.....

F. Exposure to information about food and personal hygiene

1. Have you ever received any information about safe food preparation and handling practices (e.g. hand washing commercial, hand washing posters, etc.?
1. Yes 2. No (go to section H) ☐

2. Please mention what kind of information that you received and its sources.

Information	Sources[a]

Remarks: [a]Sources: (1) TV; (2) Radio; (3) PKK; (4) health officer (doctor, nurse, health center, health post cadre, etc); (5) Newspaper; (6) leaflet; (7) banner; 66. NA (no information received); (77) others (please specify)

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

G. Food handler's attitude

Please tell the following words to the respondent:
"Next, I will read some statements, then please answers strongly agree (1), agree (2), disagree (3), or strongly disagree (4) to the following statements" (Tell the respondents to relax and think carefully before answering)

No	Statements	SS (1)	S (2)	TS (3)	STS (4)
1	Knife that has been used for cutting fish/chicken/meat no need to wash before using it for cutting fruit for child				
2	Cutting board that has been used for cutting fish/chicken/meat no need to wash before using it for cutting fruit for child				
3	It is alright to taste food with fingers				
4	It is not necessary to clean child bottle before using it				
5	It is acceptable for child to eat food containing raw egg				
6	It is alright to clean kitchen surface without soap				
7	It is important to cover cooked food for child during storage				
8	It is acceptable to reheat child food until warm				
9	Cooked foods, once cooled should be refrigerated or frozen immediately if stored				
10	If foods are not having bad smell, it is acceptable to be eaten by child				
11	It is alright to add daun bawang/seledri into chicken porridge without reheating again				
12	It is essential to reheat stored food before consumed by child				
13	Ready to eat food purchased from mobile food vendor must be safe to be eaten by child				
14	It is important to follow food handling instructions on product packaging				
15	It is important to read expire date on food packaging				
16	It is essential to purchase child food from a clean place				
17	It is important to wash fruit before it is consumed by child				
18	It is not necessary to wash hand prior to child feeding				
19	it is not necessary to wash hand before taste child food with finger				
20	It is important to wash hand before preparing child food				
21	It is important to wash hand after preparing child food				
22	Preparing food whilst suffering from flu/typhus/wound in hand is acceptable				
23	It is alright to wipe hand with clothes/hand towel				
24	It is acceptable for child to eat fish/chicken/meat that has been cooked rare or medium rare				
25	It is alright if child drink unboiled water				
26	Diarrhea in children can be caused by eating uncooked foods				

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

27	It is better to use tissue to dry child hand rather than clothes/hand towel				
28	It is important to wash child eating utensils with soap				
29	It is alright to leave cooked food for child on a kitchen work surface overnight				
30	Frozen food that has been defrosted should not be refrozen				

Remarks: SS=strongly agree; S=agree; TS=disagree; STS=strongly disagree

H. Cooking, storage, hygiene, and safe water facility

1. Type of cooking fuel for child's food:
   1. kerosene 3. firewood
   2. LPG 77. Others, please specify: ..... [ ]

2. Sources of water for uncooked food preparation e.g. fruit juice, pop ice blender, instant porridge formula, mie gelas, pop mie, dll): (please mention the food)
   1. unboiled water from well, water pump, tap, or mobile vendor (choose one) [ ]
   2. boiled water from well, water pump, tap, or mobile vendor (choose one)
   3. gallon non refill 4. gallon refill
   66. NA (not consume uncooked food)
   77. others:please specify: ..... [ ]

3. Source of water for washing child's fruit:
   1. unboiled water from well, water pump, tap, or mobile vendor (choose one)
   2. boiled water from well, water pump, tap, or mobile vendor (choose one)
   3. gallon non refill 4. gallon refill
   66. NA (not consume uncooked food)
   77. others:please specify: ..... [ ]

4. Source of water for washing the child's cooking or eating utensils:
   1. well 2. hand pump
   3. tap 4. mobile vendor [ ]
   5. boiled water from well, water pump, tap, or mobile vendor (choose one)
   6. gallon non refill 7. gallon refill
   66. NA (not wash) 77. others:please specify: ..... [ ]

5. Source of child's drinking water:
   1. unboiled water from well, water pump, tap, or mobile vendor (choose one)
   2. boiled water from well, water pump, tap, or mobile vendor (choose one)
   3. gallon non refill 4. gallon refill
   66. NA (not consume uncooked food)
   77. others:please specify: ..... [ ]

6. If the drinking water from gallon, do you reboil the water?
   1. yes 2. No 66. NA (not gallon water) [ ]

7. how do you prepare hot water for child:
   1. by dispenser 2. boil on the stove [ ]

Household code: [ ] [ ][ ] [ ][ ][ ]
A B C

8. if the hot water not from dispenser, where do you store the hot water?
1. thermos 2. remain in the kettle
66. NA (hot water from dispenser) 77. others:please specify: ..... [ ]

9. if the drinking water not from gallon, where do you store the drinking water?
1. water pot 2. remain in the kettle
66. NA (hot water from dispenser) 77. others:please specify: ..... [ ]

10. Place of defecation for the whole family:
1. Latrine 2. on the surrounding ground
3. river 4. empang 77. Other, please specify: ..... [ ]

11. Where do you dispose the child's feces?
1. Latrine 2. on the surrounding ground 5. gutter
3. river 4. empang 77. Other, please specify: ..... [ ]

12. Latrine ownership:
1. private 2. public [ ]

13. (If using latrine) condition of latrine:
1. without closet and septic tank 3. with closet and septic tank
2. with closet but no septic tank 66. NA (no latrine available) [ ]

14. When do you dispose the kitchen garbage:
1. immediately after preparing/cooking food
2. when the garbage bin already full 77. Other, please specify: .....
3. the day after (garbage left over night in the kitchen) [ ]

15. Garbage disposal treatment/services:
1. Regular garbage disposal services 2. throw to river
3. Dig hole 4. Throw on the surrounding of the house
77. Other, please specify: ..... [ ]

16. What insects/animals have ever entered the kitchen?
1. rat 2. flies 3. cockroach 4. cat 5. chicken
66. NA (no insects/animals ever entered the kitchen)
77. Other, please specify: ..... [ ]

17. What kind of cooking or eating utensils that you don't have and borrow from someone else for child? [ ]
1. stove 2. cooking pot 3. frying pan 4. cutting board 5. spoon
66. NA (never borrowed/already have) 77. Other, please specify: .....

Household code: ☐ ☐☐ ☐☐☐
A B C

I. Observation of the cooking, eating, storage, and hygiene facility

	Yes (1) / No (2) / 66 (NA)
Sunlight enter kitchen	
Garbage in the kitchen	
Garbage outside the house	
Flies/animals in the kitchen	
Dirty cooking utensils	
Dirty eating utensils	
Dish washing soap	
Clothes detergent/soap	
Handwashing/bath soap	
Floor cleaning agent	
Garbage cover in the kitchen	
Garbage cover outside the house	
Separate cooked food storage	

	Opened (1) / Closed (2) / NA (66, if not available)
Drinking water storage	
Cooked food storage	
Cooked rice storage	
Storing place for clean cooking utensils	
Storing place for clean eating utensils	
Garbage place in the kitchen	
Garbage place outside the house	
Kitchen door	
Kitchen window	
Kitchen ceiling	

1. type of kitchen
1. indoor 2. outdoor ☐

2. type kitchen surface:
1. wood/bamboo 2. tile 3. soft cement 4. rough cement ☐

3. type of kitchen floor:
1. wood/bamboo 2. tile 3. soft cement 4. rough cement
5. soil ☐

4. type of kitchen wall:
1. wood/bamboo 2. tile 3. soft cement 4. rough cement
5. zinc ☐

5. type of kitchen ceiling:
1. tile 2. concrete cement 3. zinc 4. wood/bamboo/triplex
5. asbestos ☐