EFFECT OF THE TIME OF INTRODUCING COMPLEMENTARY FOOD ON STUNTING IN THAI CHILDREN AGED 24 MONTHS

SHRIJANA JOSHI

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PRIMARY HEALTH CARE MANAGEMENT FACULTY OF GRADUATE STUDIES MAHIDOL UNIVERSITY 2012

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entitled

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Shrijana Joshi
Ms. Shrijana Joshi
Candidate

Aroonsri Mongkolchati
Lect. Aroonsri Mongkolchati,
Ph.D.
Major advisor

J. Chompikul
Assoc. Prof. Jiraporn Chompikul,
Ph.D.
Co- advisor

A. Mutchimwong
Asst. Prof. Auemphorn Mutchimwong,
Ph.D.
Acting Dean
Faculty of Graduate Studies
Mahidol University

Supattra Srivanichakorn
Lect. Supattra Srivanichakorn,
M.D., M.P.H.(Health Development),
Dip. Thai Board of Preventive Medicine
(Epidemiology)
Program Director
Master of Primary Health Care
Management
ASEAN Institute for Health Development
Mahidol University

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was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Primary Health Care Management
on
May 15, 2012

Shrijana Joshi
Ms. Shrijana Joshi
Candidate

Prof. (Emeritus) Sirikul Isaranurug,
M.D.,Dip. Thai Board of Pediatrics
Chair

J. Chompikul
Assoc. Prof. Jiraporn Chompikul,
Ph.D.
Member

Aroonsri Mongkolchati
Lect. Aroonsri Mongkolchati,
Ph.D.
Member

A. Mutchimwong
Asst. Prof. Auemphorn Mutchimwong,
Ph.D.
Acting Dean
Faculty of Graduate Studies
Mahidol University

Supattra Sr
Lect. Supattra Srivanichakorn,
M.D., M.P.H.(Health Development),
Dip. Thai Board of Preventive Medicine
(Epidemiology)
Director
ASEAN Institute for Health Development
Mahidol University

ACKNOWLEDGEMENTS

It is my pleasure to express my thanks to all those who contributed in many ways to the success of this study and made it an unforgettable experience for me. First and foremost, I would like to express my sincere gratitude to my advisor Lecturer Dr Aroonsri Mongkolchati for the continuous support of my Masters research, for her patience, motivation, and immense knowledge from the initial to the final level which enabled me to develop an understanding of the subject much better than before. Her guidance helped me in all the time of research and writing of this thesis.

Besides, I would like to thank my co-advisor Assoc. Prof. Jiraporn Chompikul for her encouragement, insightful comments, and ever ready to help attitude.

My sincere thanks also goes to the Prospective Cohort Study of Thai Children committee, for offering me the dataset and giving me this great opportunity and exposure to such national-level dataset, and to the respondents who participated in PCTC project.

I thank my fellow batch mates in Asean Institute for Health Development for the wonderful journey throughout the year and for the exciting moments we worked together before deadlines.

Finally, I would like to express my love and gratitude to my beloved family for their understanding, endless love and supporting me spiritually throughout the duration of my study.

Shrijana Joshi

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SHRIJANA JOSHI 5438178 ADPM / M

M.P.H.M.

THESIS ADVISORY COMMITTEE: AROONSRI MONGKOLCHATI, Ph.D., JIRAPORN CHOMPIKUL, Ph.D.

ABSTRACT

This study was conducted to determine the association between complementary food practice and stunted children aged 24 months. The study sample included a total of 4,245 children from a cohort study of Thai children. 60 twin infants and 18 with abnormalities were excluded. Then, the remaining 4,167 children were considered for data analysis. Chi-square tests and multiple logistic regressions were used for identifying influential predictors for child stunting at 24 months.

The results showed 13.95% of the children were stunted according to Thai reference and 16.48% as per 2006 WHO reference. After adjusting for confounding factors, the study showed that prolonged breast feeding was significantly associated with child stunting from both the WHO (RR=2.70, 95% CI=1.77-4.10) and Thai references (RR=2.31, 95% CI=1.48-3.60). By using the WHO reference, this study found that children who were introduced to pork before four months (RR=4.72, 95% CI=1.11-20.19) had the highest risk to be stunted at 24 months. And, by using the Thai reference, it was found that children who were introduced to whole eggs before four months (RR=2.76, 95% CI=0.56-3.54) had the highest risk to be stunted at 24 months. Earlier introduction of complementary foods creates a risk of child stunting. Various health education and intervention programs as well as research projects focusing on the improvement of feeding practices are recommended.

KEYWORDS: CHILDHOOD STUNTING / INFANT GROWTH /TIME OF INTRODUCTION OF INFANTS FOOD / COMPLEMENTARY FOOD

94 pages

CONTENTS

CONTENTS (cont.)

CONTENTS (cont.)

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ANC	Antenatal Care Clinic
BF	Breastfeeding
CDC	Center for Disease Control and Prevention
CF	Complementary Feeding
DALY	Disability-adjusted life years
HAZ	Height- for-age Z-score
LAZ	Length- for-age Z-score
LBW	Low Birth Weight
MCH	Maternal and Child Health
MDG	Millennium Development Goal
NCHS	National Center for Health Statistics
PCTC	The Prospective Cohort Study of Thai Children
UNICEF	United Nations Children's Fund
WHO	World Health Organization

CHAPTER I
INTRODUCTION

1.1 Rationale and Justification

The functional classification for child malnutrition proposed by Waterlow (1) is useful in deciding the appropriate interventions for treatment of malnutrition. Children with the required height-for-age but lacking the required weight-for-height, i.e. wasted, are classified as acutely malnourished and children lacking the required height-for-age, i.e. stunted, are classified as chronically malnourished. According to Waterlow, child malnutrition could be in the form of stunting, wasting or both stunting and wasting. It is useful for curative interventions but it does not provide any clue for prevention of such conditions. It does not mention the vulnerable time period during which appropriate measures can be taken to prevent child malnutrition (stunting).

However, it is evident from many longitudinal studies that the first two years of a child's life make up a critical time period during which there is a risk for faltering growth, deficiencies of certain micronutrients, and common childhood illnesses such as diarrhea. It is the peak time for optimal growth, health and behavioral development of children (2). At the same time, this is also the time of greatest vulnerability. Most of the formation and development of the brain take place within this period of two years. It is therefore of great importance to supply adequate nutrients to the child such as providing the right amount of carbohydrates, protein, essential fatty acids, and vitamins and minerals (3). A child is at risk of malnutrition from the time she/he is exposed to complementary foods (4). Inappropriate feeding practices with high infection rates can cause malnutrition in children of this age (2). This makes the time during the transition from reliance on breast milk to the addition of complementary food susceptible in terms of linear growth. It can also have a measurable and lasting impact on growth, incidences of disabilities, and susceptibility to various infections (3).

Food given during weaning which is lacking in nutrients causes various childhood infections and reduced linear growth velocity (5). Complementary feeding should be appropriate in order to prevent malnutrition in children (6). Undernourished children are vulnerable to infection and are more likely to lose their lives to diseases like diarrhea, pneumonia, measles and malaria (7). Furthermore, the risk of obesity in stunted children creates an even more complicated situation emphasizing the need to promote the understanding of appropriate complementary feedings among mothers and caregivers of young children (8).

Stunting is a form of malnutrition which can hamper the immune function, retard development and also impair cognitive function creating dysfunctions in human life. Once established, it may also cause long-term consequences in adults in terms of body size, work and reproductive performances, and moreover impose a greater risk of chronic diseases (9), impairing the overall health of a person. Moreover, stunted children are more likely to get sick and die than underweight or wasted children (10).

Maternal and child undernutrition, which comprises underweight, stunting, wasting and deficiencies of essential vitamins and minerals, remain pervasive conditions causing over half of all childhood deaths and more than 10 percent of the total global disease burden (4, 11). Stunting accounts for almost 1.5 million global deaths (14.5%) and 12.6% of disability-adjusted life years (DALYs) in children under five years of age. By 2015, MDG4 has a target of reducing the mortality rate among children less than five years of age by two-thirds. Therefore, stunting has to be addressed in order to achieve MDG4 (3).

Child stunting can occur due to various circumstances and determinants including antenatal, intra-uterine and postnatal malnutrition (12). Timely introduction of complementary foods can be effective interventions in preventing stunting (13). Along with socio-demographic factors (14-17), continued breastfeeding (6, 15, 18), dietary diversity (6, 15, 18-21), timely introduction of complementary feeding (19), and feeding frequency (6, 15, 18, 20) are important predictors of stunting.

According to the WHO Child Growth Standards, stunting is a condition when a child has a height-for-age less than -2 SD. WHO has reported that about 171 million children are stunted globally with the rate in Asia and Africa being the highest. Undernutrition poses a serious challenge in the survival of the children. In response to

this public health challenge, WHO has recommended nutritional guidelines for feeding infants and young children saying that if followed properly, they can help prevent about 20% of deaths in children under five. In addition, WHO also says that stunting and obesity can be dealt with by giving appropriate feeding to young children (22, 23). After six months of exclusive breastfeeding, WHO has recommended starting giving complementary feedings to the child (22).

Approximately one-third of children less than five years of age in developing countries are stunted (low height-for-age), and large proportions are also deficient in one or more micronutrients. Recent data show that just over half of six-to-nine–month-olds are breastfed and given complementary foods and only 39 per cent of 20-23-month-olds are provided with continued breastfeeding (24).

The time and type of complementary food given determines the occurrence of stunting among children, emphasizing the importance of appropriate feeding practices (25). Early introduction of complementary feedings is found to be significantly associated with increased risk for various infections and is also associated with low length for age (26). Adequate and timely complementary feeding can prevent this situation, ensuring growth and development of children from six months to two years of age (24). It is believed that optimal young child feeding—continued breastfeeding until the child is at least 2 years old, together with age-appropriate, nutritionally adequate and safe complementary foods—can have a major impact on child survival, with the potential for preventing an estimated 19 per cent of all under-5 deaths in the developing world, more than any other preventive intervention (27).

In an attempt to establish the variability among and within nations in the prevalence of stunting and to evaluate the national factors associated with stunting in 70 countries in Africa, Latin America and Asia, including Thailand, Frongillo, Onis et al. found that most national variability for stunting was explained by national factors and geographic region. In addition to female literacy, health expenditure and gross national product at the national level, in individual cases, some possible factors could be micronutrient deficiencies, inadequate protein intake, prenatal nutrition and parasitic infection (28).

Preventive, population-based approaches, aimed primarily at improving the nutritional status of mothers and young infants are desirable since, interventions during the earliest periods of life are likely to have the greatest impact in preventing child malnutrition. For that, a strong focus on complementary feeding and continued attention to the protection and promotion of breastfeeding remain key components for tackling the problem (29). Reinforcing programmatic health and nutrition interventions is thought to contribute to a major reduction in child undernutrition (11).

The prevalence of low length-for-age is generally highest during the second or third year of life (30), although in some settings, it may occur as early as 3-6 months. In these circumstances, low length-for-age is said to reflect a continuous process of "failing to grow" or "stunting", whereas in older children, it reflects "having failed to grow" or "being stunted" (31).

A previous study from the Prospective Cohort Study of Thai Children (PCTC) has revealed the prevalence and incidence of stunting in infants using WHO growth standard. Child stunting prevalence, using by new reference, in this sample varied from 6.0-16.6%. The percentage decreased from the time at birth to 6.0%. Also the association between stunting and demographic characteristics has been studied (32).

Infant and young child feeding practices directly affect the nutritional status (stunting) of children under two years of age and, ultimately, impact child survival (33). There are chances of becoming stunted even if children are optimally breastfed if they do not receive required quantities of quality complementary foods after six months of age (34).

Infant feeding practices also constitute a major component of child caring practices apart from socio-cultural, economic and demographic factors. Somehow, these practices constitute one of the most neglected determinants of young child malnutrition in spite of their important role in the growth patterns of children (35). Early introduction of food may result in poor nutrition outcomes increasing risk of infections and illnesses in children (36, 37). But introducing solid foods after six months is also not considered optimal as it may cause deficiency of some micronutrients resulting suppressed growth and feeding problems (37). Improving infant and young child feeding practices in children 6-24 months of age is therefore

critical in improving nutrition, health and development of children. However the research conducted in this area has been very rare in Thailand. Up to now, very few studies have been conducted on the time of introduction of complementary feeding and feeding practices (38).

The current study is the secondary analysis of data from the Prospective Cohort Study of Thai Children. PCTC was one of the rare population-based prospective study. It is believed that this research provides a better understanding of affects of the time of introduction of complementary foods in children below 24 months of age, thereby helping to improve feeding practices in order to give these children the best start in life so that they can grow up to be healthy and well-adjusted physically, intellectually and socially.

1.2 Research question

What is the effect of the time of introducing complementary food on stunting in Thai children aged 24 months?

1.3 Research objectives

1.3.1 General objective

To determine the association between complementary food practice and stunted Thai children aged 24 months.

1.3.2 Specific objectives

1.3.2.1 To determine the prevalence of child stunting at 24 months by using Thai growth standard.

1.3.2.2 To determine the frequency distribution of time of introduction of complementary feeding.

1.3.2.3 To examine the association between time of introduction of complementary food and child stunting at 24 months.

1.4 Conceptual framework

Independent Variables

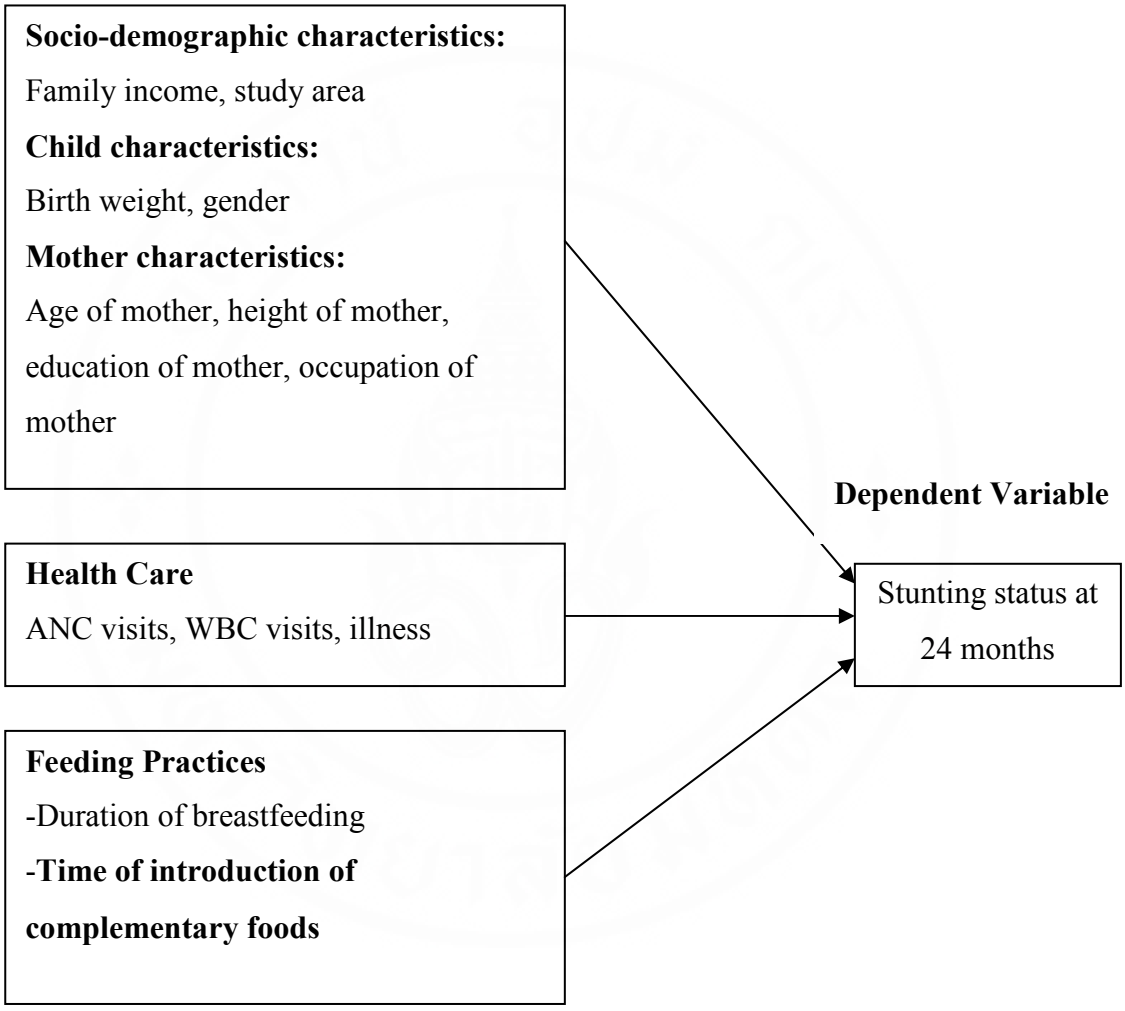

Figure 1.1 Conceptual framework

1.5 Research hypothesis

- There is an association between the time of introduction of complementary food and child stunting.

1.6 Operational definitions

Stunting: defined as height-for-age of children aged 24 months, below minus two standard deviations from the median height-for-age of the standard reference population. The same cutoff was used to define stunting for both the references, i.e., New WHO reference and Thai growth reference. Stunted status included two categories, i.e., yes and no

- **Child**

Birth weight: categorized into birth weight less than 2,500 grams at birth as low birth weight and birth weight equal to or above 2,500 grams

Gender: male or female

- **Mother**

Age of mother: means the age of the child's mother in complete years

Height of mother: refers to the height in cm of a mother measured at the time of first ANC visit; categorized into two cutoffs, i.e. <150 cm and ≥150cm

Education of mother: mother's level of education; categorized as informal/primary level and secondary or higher level

Occupation: the occupation is defined as what the mother is doing in her daily life; this includes involvement of mother in income-generating activities; categorized as Housewife/student, Agriculture/construction labor/ fishermen and Shopkeeper/professional/clerk

- **Health Care**

Antenatal Checkup: the periodical medical checkup during pregnancy; categorized as < 4 times or ≥ 4 times

Well Baby Clinic: the place in the hospital where clients/mothers are provided services regarding vaccinations, health education, counseling and treatment; categorized as < 4 times or ≥ 4 times

Illness: refers to hospitalization at 24 months

- **Feeding Practices**

Duration of Breastfeeding: categorized into breastfeeding beyond one year of age and breast feeding up to or less than one year (39)

Time of introduction of complementary feeding: the time when complementary food is introduced to the child; it consisted of three categories cut-off i.e. <4 months, 4-6 months and >6 months

The complementary foods are: rice, cereal, chicken, liver, yolk, whole eggs, fish, pork, leafy vegetables, other vegetables, banana, fruit juice, orange, papaya and oil.

1.7 Limitations of the study

- This study was only concerned with the feeding practices and did not calculate the quantity of food intake.
- The study did not assess the knowledge of mothers regarding time of introduction of complementary foods.
- The study did not assess the frequency and amount of the children's meals and dietary diversity.
- Some associations between the time of introduction of individual complementary food and stunting were not significant statistically due to small sample size in individual food category. This effect on the result could have occurred, also due to homogeneity of population. Hence, larger sample size would be helpful to find out the difference of phenomenon.
- It was not known whether the feeding of individual food items was continued or stopped once it was introduced to the child. Food which were introduced only once and then if stopped feeding may not have any effect on stunting.

CHAPTER II
LITERATURE REVIEW

The present study aimed to examine the association between the time of introducing complementary food and stunting in Thai children. Literatures were reviewed for the definition of stunting, various international growth standards used around the world, global and Thai situation of childhood stunting, complementary feeding practices in children, models for the determinants of nutritional status and relationship between study factors and child stunting.

2.1 Definition

2.1.1 Defining stunting

Length and age are important variables in anthropometric assessment. Length and age used together provide information about the nutritional status of a child below two years in terms of stunting (40). Stunting indicates the chronic restriction of a child's potential growth reflecting the cumulative effects of inadequate food intake and poor health conditions that result from endemic poverty. It has been linked with lower educational achievement and cognitive ability. It is also important to note that children who become stunted during their first two years of life and who put on weight later in childhood are at high risk of chronic diseases related to nutrition. Therefore the ability to reduce the prevalence of stunting in children below five years of age can lead to the success of sustainable actions to alleviate poverty. Hence, progress made towards the achievement of MDG Goal 1, i.e., Eradicate Extreme Poverty and Hunger, can be monitored by reports on the prevalence of stunting in children below five years of age (34). There is a considerable variation in the prevalence of stunting among the less developed countries worldwide ranging from 5% to 65%. Recent trends in developing countries show that the prevalence of stunting

starts to rise at about three months of age and then slows at around two years of age (41). Hence, for children below two years, low height-for-age reflects a continuing process of failing to grow, whereas for older children; it reflects a state of having failed to grow. This emphasizes the fact that optimal nutrition up to two years for a child could be an important intervention in addressing stunting (3).

WHO child growth standards of length for age is as follows:

Table 2.1 WHO child growth standards of length for age

Z-scores of length for age	Nutritional status
≥+3SD	tall
+2SD - < + 3SD	slightly tall
-2SD - < + 2SD	average height
-3SD - < - 2SD	slightly short
<-3SD	short

Source: WHO-Child guideline standard

2.2 Growth Measurement

The linear growth of children up to two years is measured in terms of length-for-age (42). There is some disagreement regarding the use of local versus international reference data. Some researchers highlight the usefulness of local growth reference data in minimizing genetic influences, therefore advocating the use of local standards derived from ethnically similar but privileged groups living in the same country. On the other hand, other researchers suggest that the advantages of one universal reference drawn from a well-defined and accurately sampled population overshadow the problems of genetic influence (43, 44).

Following this disagreement regarding biased reference data, the U.S. CDC and the WHO, in May 2000 and April 2006, respectively, released new growth charts to replace the 1977 NCHS reference. The CDC 2000 charts are as the recommended anthropometric references for the United States. Also the WHO multicenter growth reference data is especially useful for monitoring the growth of children during the first five years of life (45). The European Union, by conducting its

own multicenter longitudinal multicenter Euro-Growth study has developed European growth reference data (46). The growth Reference Review Group in the United Kingdom has recommended using UK90 cross-sectional growth reference data for both screening and surveillance of samples of U.K. children (47).

2.3 Situation of childhood stunting

2.3.1 Global situation

Undernutrition is a serious public health problem that needs to be addressed urgently in order to improve child health. Undernutrition has both individual and transgenerational effects on human functions. It affects the health of an individual by making this individual prone to various infections. It may also be passed on to offspring, producing a strong effect on physical, mental and social well-being. Overall, it threatens the survival of humans, damaging their productivity and ability to limit the consequences of poverty (48).

Stunting reflects chronic nutritional deficiency, aggravated by illness. It thus more accurately reflects nutritional deficiencies and illnesses that occur during the most critical periods for growth and development in early life. The latest available data show that in the developing world the number of children under five years old who are stunted is close to two hundred million, i.e. about one in three, which indicates the number of children from six to 24months is also high. The global burden of stunting is far greater compared to other forms of undernutrition, with the number of stunted children making up more than half of the total number of children under five years. Twenty-four countries bear 80 percent of the developing world's burden of undernutrition as measured by stunting, making it an important public health issue. In Africa and Asia, stunting rates are particularly high, at 40 per cent and 36 per cent respectively. More than 90 per cent of the developing world's stunted children live in Africa and Asia (27).

2.3.2 Situation in Thailand

2.3.2.1 Thai Health Profile

According to the Thailand Health Profile Report 2005-2007, the infant mortality rate is 11.3 per 1,000 live births and the child mortality rate is 10.4 per 1,000 live births, which is lower than the global average but still higher than the rate in some countries in the same region such as Singapore and Malaysia. Although the nutritional status of preschool children has improved overall, the situation of children in the Northeastern and Northern regions is quite different from the other regions. Preschool children in hill tribes in particular show a risk almost eight times greater than that for Bangkok (49) children. In Thailand, 43% of children are introduced to complementary foods at the proper time, i.e. six months, with continued breastfeeding and just 19% of children are provided continued breastfeeding at two years. Stunting prevalence is quite different in urban and rural areas. It is 11% in urban areas but 17% in rural areas according to WHO Child Growth Standards and the ratio of urban to rural according to stunting prevalence is 0.6 (50).

2.3.2.2 WHO Records about malnutrition in Thailand

The percentage of under five children suffering from moderate and severe stunting is about 16 % per WHO Child Growth Standards (51). The stunting prevalence is 16% in males and 15% in females. The male to female ratio is 1.1. Thailand comprises about a 0.4% share of the developing world's stunting burden. It ranks forty-first among the countries reporting stunting (50).

2.3.2.3 Previous studies in Thailand

Previous studies in PCTC have found the prevalence of stunting increases with age, i.e. at birth it was 6.0%, at six months, it was 6.9%, at 12 months, it was 9.5%, at 18 months, it was 14.6%, and at 24 months, it was 16.6%. Stunting prevalence among Thai children is two times higher than the world average (32). The prevalence of malnutrition among children aged one to five years in the slums of Bangkok was 18.1% by height-for-age (52). In a study conducted by Prasong et al. in the Karen hill tribe children of Northern Thailand aged one to six years, malnutrition in children was found to be 73% by height-for-age (53). Panpanich et al. found the prevalence of stunting among the children aged 1-24 months in hill tribe to be 25.4% and that in Thai children 12.1% (54). In another study in rural areas of

Chiang Mai, for children aged up to six months, the prevalence of stunting was 7.7% in the exclusively breastfed children, 8.5% in partial/non-breastfed children and for children aged between seven and 12 months, it was 7.7% in exclusively breastfed children and 9.8% in partial/non-breastfed children. Also, children above one year in both groups were more likely to suffer from malnutrition, indicating poor weaning practices (55).

2.4 Complementary Feeding Practices in Children

Child feeding practices are multidimensional and they change rapidly within short age intervals in the first years of life (56). The characteristics of breast milk help prevent infections, ensure the growth and health of children, making it suitable as the main meal for children during the first year of life and an important food during the second year (23). It provides about one-half of an infant's energy needs up to the age of one year, and up to one-third during the second year of life (57). However, usually after six months, breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed to fill the gap between the total nutritional needs of the child and the amounts provided by breast milk (23, 56). This is the time to start the complementary feeding of the child (56). Complementary foods should meet more than 90% of the iron requirements of a breast-fed infant and should also provide bioavailable iron (38). Both food and feeding practices influence the quality of complementary feeding, and mothers and families need support to practice good complementary feeding (57).

Complementary feeding, the transition from exclusive breastfeeding to family foods, is supposed to be practiced typically from six to 24 months, which is considered as a crucial period of life. Early childhood is also the time when malnutrition starts in many children. It is estimated that two children out of every five are stunted in low income countries. For the complementary food to be meaningful, it should be started at the proper time, i.e. after six months of exclusive breastfeeding. A variety of foods should be provided frequently so as to be adequate for the child's growing demand (58). It is assumed that dietary diversity improves diet quality. The diet of children should include a wide range of foods besides basic staple foods (5).

Complementary foods can be of two types, i.e. specially prepared foods and usual family foods that are modified to make them easy to eat and provide enough nutrients (23).

2.5 UNICEF conceptual framework for the determinants of nutritional status

The conceptual framework for this study is based on the UNICEF conceptual framework for the determinants of nutritional status. This framework, which was developed in 1990 as a part of UNICEF's nutritional strategy (59), provides a holistic and pragmatic approach. The UNICEF nutrition conceptual frame work is designed to help facilitate the process of assessing, analyzing and deciding on what actions to take at all levels of society to resolve nutrition problems. This is also known as the "Triple A" process (Assessment, Analysis, Action). Most innovatively, the framework emphasizes the development of the concept of maternal and child care (60). It classifies the causes of under nutrition into three categories that account for the complexity of the nutritional status of children: (i) basic causes at the societal level; (ii) underlying causes at the household/family level; and (iii) immediate causes. Factors at one level influence other levels.

The outcome of the study, i.e. stunting, was measured by length for age. Immediate determinants were the feeding practices, i.e. duration of breastfeeding and time of introduction of complementary feeding; and illness status at 24 months. The underlying determinants were socio-demographic, child and mother factors. The basic determinants like ethnicity was presented by study area, which includes hill tribe area and non- hill tribe area. However, the underlying determinants explaining quality of care like health status of care giver and resources for health, like sanitation, access to clean water were not included in the conceptual framework of the current study.

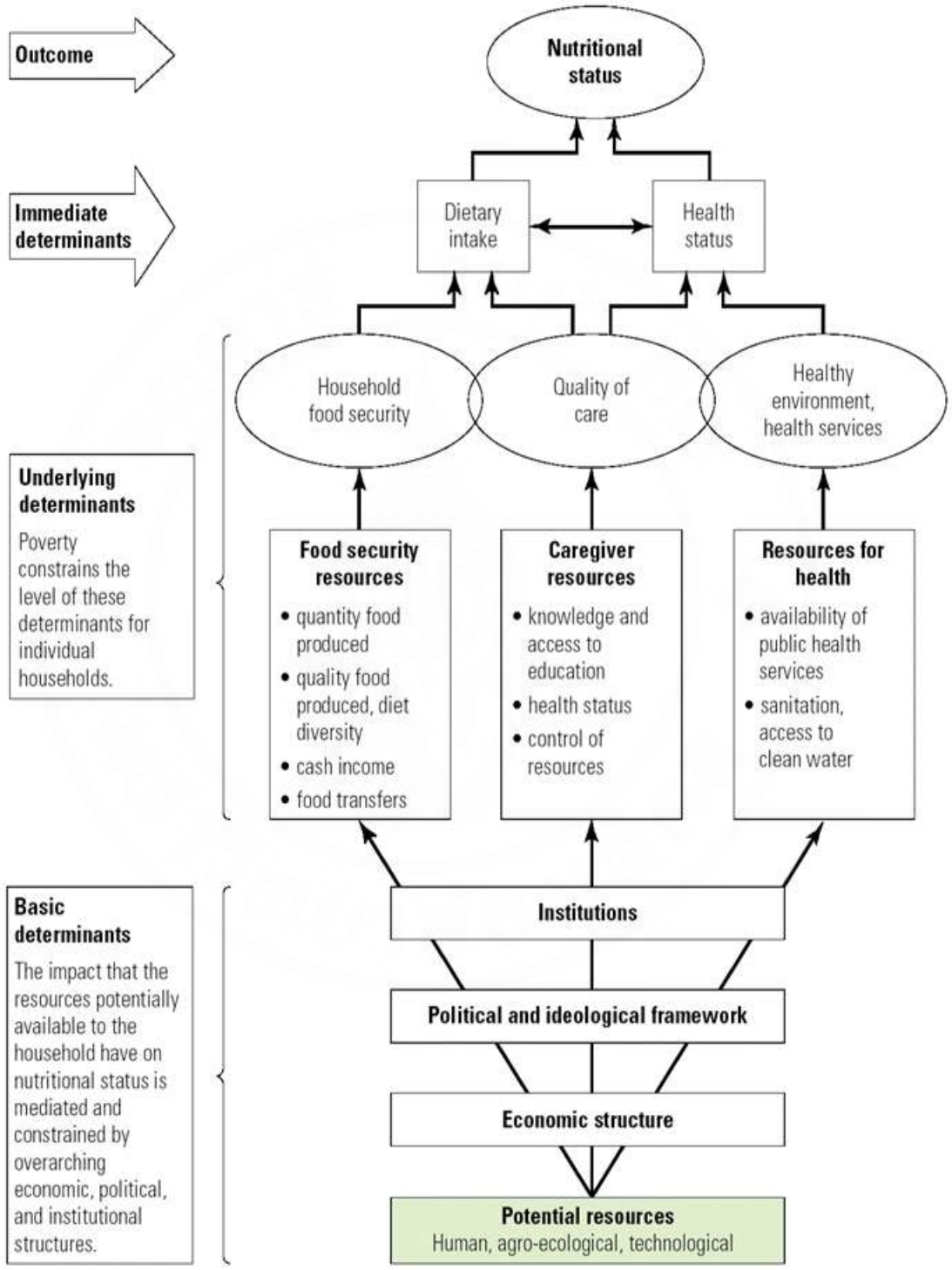

Figure 2.1 The UNICEF Conceptual Framework of the Determinants of Nutritional Status

Sources: Jonsson 1993; Smith and Haddad 2000; and UNICEF 1990 (61)

2.6 Nutrition throughout the life cycle

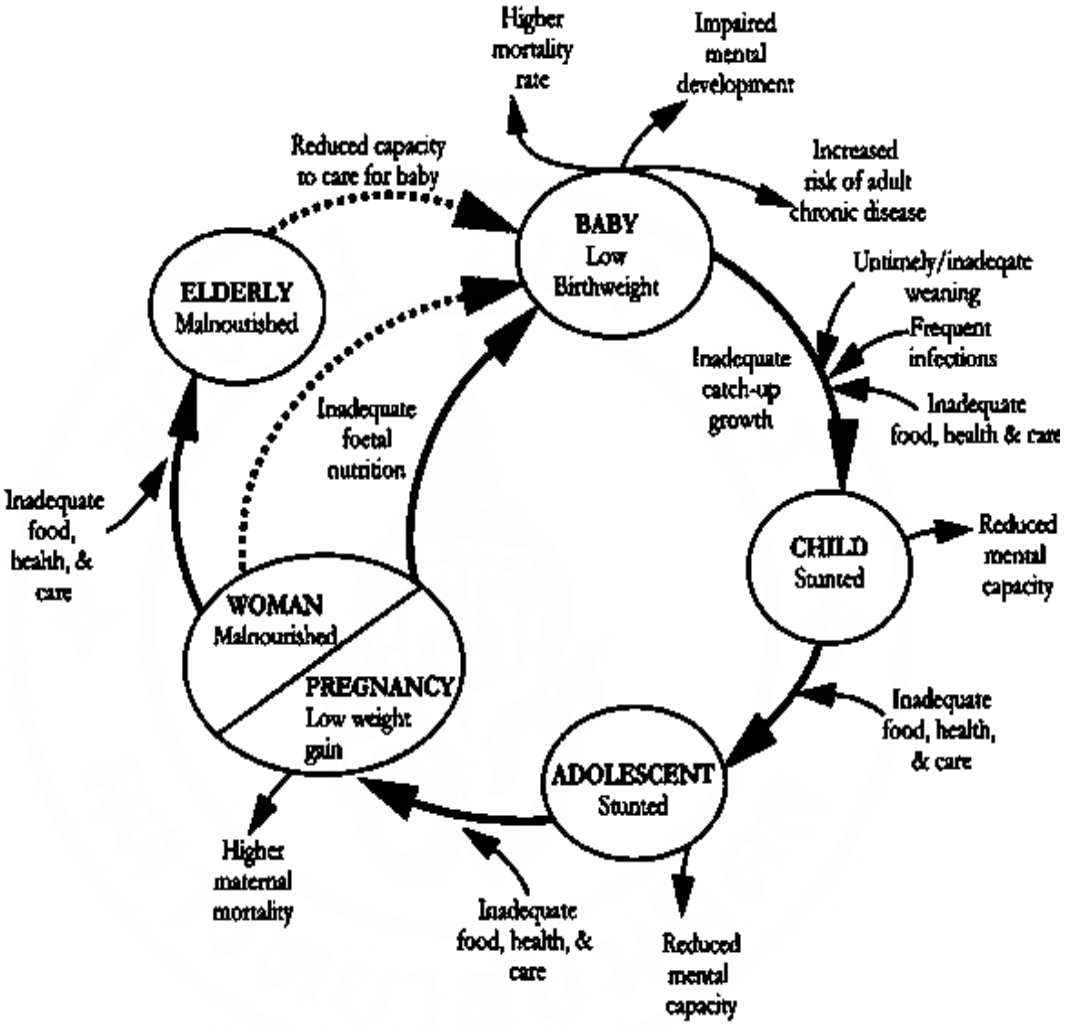

Figure 2.2 Nutrition throughout the life cycle (62)

The life cycle provides a set of challenges which can further lower already fragile health conditions of young children and adults with marginal nutritional status and thin margins of survival. This provides a strong framework for understanding the complex and interrelated causes of malnutrition which can aggravate what are already huge and stubborn problems for good nutrition.

2.7 Relationship between study factors and child stunting

2.7.1 Sociodemographic factors

Family Income: Food availability is essential for the promotion and protection of the health of children. Specifically, height deficit has been observed in families with comparatively low income (32, 52, 63-65). These findings agree with the findings of another study conducted in Africa where the mean height-for-age index was linked to the economic level of the family (63, 66).

Study Area: Peoples' residences also seem to influence the occurrence of stunting. Children residing in mountainous areas have been found to be at high risk of stunting (67). Although the overall nutritional status of preschool children in Thailand has improved, preschool children in the Northern and Northeastern regions are more likely to be malnourished than those in other regions. A previous study on PCTC also showed the highest rate of prevalence and incidence of stunting among children residing in the northern hill region (32). Also, Panpanich et al. found that the prevalence of stunting among the children in hill tribes was greater than that for the children of other parts of Thailand. (54). In Bolivia too, households in rural areas had a higher percentage of children with stunted growth compared to households in urban areas (68).

2.7.2 Child Factors

Child age: Child age is strongly associated with linear growth (15, 55, 67). Prevalence of stunting is found to increase with age (18, 66, 69). A study in Nepal also showed that children of more than 12 months of age were more likely to be stunted than younger children (70).

Low birth weight: Studies have shown that weight at birth is a strong predictor of stunting (71, 72). Low birth weight increased the odds of stunting 3.8-fold (64). The prevalence of stunting has been found to be significantly higher among infants with low birth weight (65-67, 73-75).

Order of birth: The higher the birth order, the higher is the prevalence of stunting (70). Meanwhile, being a first or a single child decreases the risk of stunting (67).

Gender: The findings of a study conducted in Sub-Saharan Africa demonstrated that across the 10 countries in Sub-Saharan Africa, male children were consistently more likely to become stunted than their female counterparts (33). This was in agreement with the findings of similar studies (32, 66, 67, 73) in which males had nearly twice the risk of developing severe stunting (HAZ <-3) at one year of age (71). In Bolivia, male children were about 20% more likely to be stunted than female children (68). Similarly a few other studies showed no evidence of gender bias in stunting (17, 70). Some studies found stunting more common among girls as compared to boys (65, 76).

2.7.3 Mother-related Factors

Education of mother: An educated mother has more opportunities to be informed of, and be aware of health care, better nutrition, and child development as compared with uneducated mothers. The mother's level of education has a positive relationship on children's height-for-age (17, 32, 63, 65, 67, 70, 76). A study in Brazil found the strong effect of maternal schooling on child's growth. It showed that the children whose mothers were illiterate were 17 times more prone to have a growth deficit than children whose mothers had at least 11 years of schooling (64). In Bolivia, 56% of the children with uneducated mothers were stunted compared to only 19% of children with highly educated mothers (68). The findings of other studies in Africa also demonstrate the significance of maternal education in child growth and development (63, 66). A previous study in Thailand also showed that lower maternal education is a potential risk factor for lower height-for-age (52).

Occupation of mother: Children of working mothers seem to have decreased likelihood of stunting (73) whereas unemployment mother's being a housewife or unemployed acted as a risk factor for stunting (52). Another study in Brazil did not find any association of maternal occupation with child stunting (64).

Age of mother: The children of mothers younger than 20 were almost twice as likely to show stunting (64). This is in agreement with the findings in Brazil which found a mother's age of <20 was associated with stunted children under five years of age (75). In one study, children born to mothers aged more than 20 were found to have a decreased likelihood of stunting (73). The percentage of children with retarded growth was found to increase with a maternal age over 35 in Bolivia (68).

Height of mother: Mother's height is significantly linked to the height-for-age index and stunting (25, 63, 77). A mother with a height of <150 cm was significantly more likely to have stunted children (71, 78, 79).

Marital Status: Social measures also show a reduced likelihood of stunting in cases of a married mother and a mother who cohabited with a partner (73) .

Total number of living children: Household size is not generally significantly correlated with the nutritional status of children (17) but a study in Libya showed large family size as a determinant for child stunting (67).

2.7.4 Health Care Services

A positive relationship has been found between the use of health services by mothers and height-for-age measures of nutritional status (17).

ANC visit: Antenatal care during pregnancy is important as it aims a healthy baby at the end of the pregnancy. Ideally, a mother should make her first ANC visit after conception and continue these visits throughout the pregnancy. Pregnant mothers can get various preventive care services during the ANC visit, such as regular checkups, tetanus toxoid (TT) injections, and delivery care (80). The antenatal visits done by mothers also have a significant association with stunting of the children (76). Absence or poor follow-up during pregnancy increases the chance of stunting (67). More frequent prenatal care is found to be protective against stunting (74). One study found that 68% of children whose mothers did not go for prenatal checkups were stunted (81). According to a recent WHO report, 80% of the women in Thailand make

four or more antenatal care visits. On average, it is 52% in the WHO South-East Asia Region (82).

Well baby Clinic visit: The continuum for maternal, newborn and child health refers to continuity of individual care which is necessary in pregnancy, childbirth and also in the postnatal period in settings other than the family such as outreach services and clinical care (83). Mothers should have access to Maternal and Child Health educational, medical and nutritional programs mainly because they are viewed as a vehicle for improving child health and survival (84). Incomplete immunization of children leaves the child vulnerable to infections which increase the chances of child stunting (67). It has been found that 50% of the children who did not receive immunization and whose mothers did not have prenatal checkups were stunted (81). One study showed that the mother's awareness of oral rehydration therapy also reduces the likelihood that a child will be stunted by about 22% (68).

Infection and illness: Recurrent and infectious diseases such as diarrhea, pneumonia, and measles are major child health problems in developing countries in Asia. The prevalence of malnutrition was found highest in children with acute respiratory infections (61.3%) or diarrhea (89.8%) (85). The occurrence of diarrhea was found to be significantly associated with stunting in children aged less than two years (60). A study showed that 19% of malnutrition was caused by diarrhea and 24% of malnutrition was caused by ARI (86). A high number of illness episodes during infancy was one of the predictors of severe stunting at one year (71). The children who had to be admitted to the hospital during the first year of life had higher chances of growth retardation (64).

2.7.5 Feeding practices

Beginning at six months, an infant can eat pureed, mashed or semi-solid foods. By eight months most infants can also eat finger foods. By 12 months, most children can eat the same types of foods as consumed by the rest of the family (87). The food prepared from a limited number of local staple cereals and legumes does not contain sufficient nutrients for the child (88). In one study, more than 50% of the

energy requirements of children below two years was provided by carbohydrates alone, followed by fats and then protein. Furthermore, complementary food covered just 15%, 20%, and 27%of the recommended iron intake for children aged 6-8, 9-11 and 12-23 months respectively (72). Inappropriate weaning practices can also be a cause of stunting (71).

Dietary Diversity: Dietary diversity is associated with LAZ when all age groups were provided with higher dietary diversity, translating into better mean LAZ and thus confirming its potential usefulness as an indicator of the quality of complementary feeding (18). Growth of infants can be accelerated by providing nutritionally complementary foods. If complementary foods lack diversity, they cannot fulfill the daily energy requirements of a growing child (72).

A study by Rah et al. in Bangladesh showed that high dietary diversity was associated with reduced odds of being stunted among children aged six to 24 months (21). A study by Zhang et al. found associations between length for age and dietary diversity (6). Likewise, another study found that dietary diversity was consistently and positively associated with height-for-age outcome measures (89).

Prolonged breastfeeding: The World Health Organization recommends exclusively breast-feeding a child for the first six months and then continued breastfeeding for two years and beyond along with introduction of complementary foods (90). Thailand also adopted this guideline and changed its previous recommendation of exclusive breastfeeding from four to six months to six months in 2003 (91). Breast milk is the main food for infants and it helps to reduce infection and child mortality and supports the growth of a child up till six months of age (92-94). But the advantages of breastfeeding and nutritional status in older children has been controversial (95).

Usually, prolonged breastfeeding is defined as breastfeeding beyond one year of age and has been reported to be associated with a higher risk of undernutrition (39, 96). One study found prolonged breastfeeding to be associated with poorer anthropometric status in children from families in the middle and upper income

brackets (96). Some studies found inverse association between breastfeeding status and gains in height, reflecting reverse causality (97, 98).

Study by Ntab et al showed current breastfeeding was significantly associated with linear growth over the preceding seven months, i.e., breast-fed children had significantly greater age-adjusted height increments than weaned children (15). In Bolivia, among children living in rural areas, the stopping of breastfeeding by six months of age doubled the likelihood that the child would be stunted in comparison with those who received continued breastfeeding beyond six months. The benefits of breastfeeding are most pronounced among children living in rural poverty (68).

Breastfeeding for more than 12 months was associated with stunted growth in children from birth to 23 months in Nicaragua (65). Similarly, breastfeeding beyond the age of 19 months was found to be associated with malnutrition (99). One study found the tendency towards malnutrition in breastfed children above one year of age is higher than that in non-breastfed children. However, the risk of dying was six times higher in non-breastfed malnourished children than in similarly malnourished breastfed children, signifying the importance of breastfeeding in improving survival but not nutritional status (100).

Meal frequency: The minimum feeding frequency recommended or the number of times a child must be fed with complementary food depends on his/her age and whether the child is being breastfed or not. A breastfed infant six to eight months old needs two to three meals a day, and a breastfed infant nine to 23 months needs three to four meals a day. Depending on the child's appetite, one to two nutritious snacks may be offered. For non-breastfed infants and children from birth to 23 months, meals should be given four to five times per day, with one to two snacks as desired (92). One study found an association between length-for-age and meal frequency but there was no association between length-for-age and food frequency (6).

Time of introduction of complementary feeding: After six months of age, it becomes increasingly difficult for breastfed infants to meet their nutritional needs from human milk alone (92). Hence, the timely introduction of complementary foods during infancy is important from both a nutritional and a developmental point of

view (38). Furthermore, most infants are developmentally ready for other foods at about six months. To start with, WHO recommends giving thick porridge and well-mashed foods for children six to eight months. Food for children aged nine to 11 months should be finely chopped or mashed and foods that can be picked up by a child. In the same way, family foods, chopped or mashed according to necessity, are to be given to children 12-23 months (87).

The guidelines further suggest the initial use of baby rice mixed with the infant's normal milk, followed by the gradual introduction of vegetables, then fruits, cheese, yoghurt or fromage frais, and lean meat, all in pureed form. At seven to eight months of age, more texture could increasingly be introduced into all foods, together with soft finger foods and wheat and soy products. After nine months of age, egg and fish could be offered to the child, but nut products would not be included in the diet until beyond one year of age. These guidelines focus on the necessity for disseminating accurate information about appropriate weaning foods and practices designed to prevent infant malnutrition, problems with development, or longer-term eating and health problems (101).

However, evidence for the optimal timing for the introduction of individual complementary foods is lacking, and recommendations vary widely between countries. For example, most countries recommend that whole cow's milk not be introduced as a drink before the age of 12 months, whereas Denmark, Sweden, and Canada state that whole cow's milk can be introduced from the age of nine to 10 months. The suggested age for the introduction of fish or egg whites also differs considerably, with several countries recommending that they can be introduced at four to six months, whereas others recommend waiting until nine or 12 months (38).

The basic ingredient of complementary foods is usually the local staple. Staples are cereals, roots and starchy fruits that consist mainly of carbohydrates and provide energy. Cereals also contain some protein, but roots such as cassava and sweet potato, and starchy fruits such as bananas and breadfruit contain very little protein (87).

In Thailand, the introduction of semi-solids prior to three months of age has been found to be common (102). Especially in rural areas, the starting age is as early as one month, reducing the overall duration of breastfeeding (103, 104). Most

people believe that their children need more than breast milk for growth and they also have a tradition of giving rice and bananas to children even before one month age, which leads to an early introduction of complementary food. Premasticated glutinous rice is a common traditional food introduced early to children in Northeast Thailand. Also 60% of infants receive fish, egg and pork by the second year of life (105).

According to the findings of a study in Africa, complementary foods were introduced to children at four months or younger. The most popular first solid food was maize meal porridge. Foods of animal origin such as meat, chicken, fish and eggs were consumed either once a week or less. Liver was not consumed by infants aged younger than one year. The most consumed fruits by children under two years of age were bananas and oranges. The food intake reflected a high intake of vitamin and carbohydrate-rich foods, and irregular intakes of fruit and vegetables, especially those rich in vitamin A. The diet also lacked regular intake of foods of animal origin. These kinds of dietary behavior led to the occurrence of low vitamin A status, anemia and frequent sicknesses like diarrhea among children. Also there was a significant prevalence of stunting among children (106). Another study found varied times of introduction of complementary feeding. It found 33.8% infants being introduced to complementary feedings by six months, 36.8% between seven and nine months and 28.3% after nine months (66).

A prospective cohort study in Bangladesh found that 2.4% of infants were given complementary foods at one month of age. At six month of age, two-thirds (66.7%) of infants were fed with complementary foods, which increased to 95% at nine months of age (107). Most of the children were given infant cereal as the first solid food at the age of four to six months (108). Inappropriate weaning patterns presented three times the risk for being severely stunted (HAZ<-3) at 12 months of age (71).

A longitudinal study conducted in the U.S. of 24-hour recall data for children aged between two and 24 months found that out of 58 infants, rice cereal had been introduced to 11 infants and fruits had been introduced to seven infants at two months of age. A substantial drop occurred in the number of children receiving breast milk between four and six months. At six months, rice had been introduced to more than 50% of infants and 16 out of 58 were given oatmeal. Fruits like pears and apples

and vegetables like peas, potatoes, squash, carrots, and green beans were also introduced to a few infants at this time. At the age of 12 months, dairy products like cheese and yogurt were introduced to about 15% of infants. Similarly, cereals like toasted oats, bread, whole-wheat crackers, graham toast and fruits like apple, grapes, peaches, pineapples, watermelons and bananas were also introduced to some. Vegetables such as green beans, broccoli, and mashed potatoes were given and meats like chicken and beef were given to the infants. At the age of 24 months, children were given additional dairy products like ice cream, fruits like oranges, vegetables like French fried potatoes and poultry products like eggs, pork, and hot dogs (109).

A cohort study conducted among Malawian infants found that the mean age for introduction of local porridge to the infants was 3.4 months and that, for other solid foods like vegetables, staples or fruit, the age was 4.5 months. Furthermore, it also found that the early introduction of complementary food was significantly associated with low length-for-age at nine months (26).

Figures from different European countries indicated a wide variation in the age for introduction of complementary foods, with several showing marked departures from the current WHO recommendation to introduce complementary feeding only from the seventh month onward. For example, in the UK 2005 Infant Feeding Survey, 51% of infants were reported to have received complementary foods before four months (110). Similarly, 34% of mothers in Italy reported introducing complementary foods before four months and the first solids introduced were fruits (73.1%) and cereals (63.9%). Vegetables, meat/poultry and milk products were introduced as first solids in 40.3%, 13.7% and 9.2% of cases, respectively. At four and six months of age, 34.2% and 85.5% of infants, respectively, had been introduced solids. All infants received solid foods by the age of nine months. Fluids were introduced at the median age of 2.2 months. The median age for the introduction of fruit juice was 4.9 months. At the age of six months, 81.3% of infants consumed fruit juice. The mean age for the introduction of fruit was 4.3 months; vegetables, 4.9 months; legumes 7.3 months; gluten-free cereals 5.1 months; cereals with gluten 5.5 months; meat 5.6 months; milk products 6.5 months; eggs 8.3 months; fish nine months; and the age for the introduction of any solid was 4.3 months. No infants had eggs or fish given as their first solid food (111).

In a recent longitudinal survey carried out in UK, it was found that complementary foods were introduced to a majority of infants between the ages of three and four months. The first foods consumed during complementary feeding were plain rice, flavored baby rice, plain rusks and other cereals (112).

A study done in Kenya showed that exclusive breastfeeding was rarely practiced beyond three months. Porridge was introduced during the first month of life for 23% of children, and by four months for 86%. Fruit was introduced between three and six months for the majority of children. About 15% of mothers gave fruit to their children before three months of age and, at the other extreme, about 15% delayed offering fruit until 12 months of age or later. This study also found that late introduction of cereal (>6 months versus earlier) was significantly and positively related to Height for Age (89).

A study from the U.S. showed that between four and five months, most infants were introduced to solid foods; and from six months onward, >80% of the infants consumed solid foods on a daily basis. By three months of age 18% of the infants were consuming infant cereal, and by four months of age 40% were doing so. Infants were introduced to infant cereal at a median age of slightly more than four months and to other cereals at a median age of ~eight months. Similarly, fruits and vegetables were introduced into the infants' diet at a median age of between five and six months, and by seven-and-a-half months, >90% of the infants were consuming fruits and vegetables. The median age at which infants were introduced to meat or to a combination foods containing meat was ~eight months, and by the age of one year, nearly 97% of all the infants were consuming meat or meat substitutes, including 60% who were consuming eggs, 25% who were consuming peanuts or peanut butter, 18% who were consuming fish or shellfish, and 6% who were consuming soy products. Dairy foods, such as cheese and yogurt, were introduced to infants at a median age of ~10 months. By one year of age, approximately half of the infants were consuming French fries and candy, cookies, or cake, although only 15% were consuming sweetened drinks such as soda or juice drinks (113).

In Europe, the median age for the introduction of solid foods was 19 weeks. About 7% of the children were introduced to solid food before the end of the

third month of life. By the age of six months, 97% of all children had been introduced to solids (114).

Water: More than 60% of the infants were introduced to water during the first month of life (106).

Researchers suggest that stunting increases with an increase in age (18), as it is the outcome of chronic malnutrition. So children under two years should be fed with highly nutritious food, especially foods that provide energy. In addition, the feeding practice introduced during this period also determines the dietary preferences of the children at later stages of life (115). Therefore, the first two years of a child's life are not only crucial in terms of growth and development, but also significantly associated with ascertaining the nutritional status of the child. Thus the aim of this study was to assess current feeding practices and find their association with stunting, together with possibly related child and family characteristics.

Out of nine longitudinal studies, three found children being fed complementary food by six months and six showed evidence of introducing complementary food by four months. This shows that in practice, the time for introducing complementary food was before six months. Hence, on this basis, this study classified introduction of complementary food into the following groups: <4months, four-to-six months, >six months for comparison with the outcome variable, i.e. stunting.

Interpretation of the literature review

- Composition of complementary food seems to be continuously changing over time, depending on the age of the children.
- A majority of children in developing countries were given local cereal-based porridges as their first solid food.
- The common characteristic of complementary food given to children in developing countries was that it had a high proportion of carbohydrates. So, the dietary bulk characteristics of complementary food could be among the important factors contributing to the etiology of protein-energy malnutrition.
- Most of the mothers started to complement breastfeeding with solid foods at an early age, i.e. before six months. This led to a cessation of optimum

breastfeeding, which was compensated for by increased dietary diversity or feeding frequency.

- The high prevalence of stunted rates observed in rural areas of Thailand at 24 months suggests that linear growth retardation has an early onset, which can be dealt with by the appropriate timing of introduction of complementary food.
- In summary, the literature to date presented variations in the association (positive or negative) of time of introduction of complementary food of children with stunting in different countries. In Thailand, very few studies were done on this topic. The lack of information in this area was particularly pronounced for children of six-24 months, which is the critical period in determining nutritional status. Further, the existing research done on stunting from PCTC did not address the possible influence of feeding practices on stunting. The current study, following WHO and Thai Growth standards for infant and young child feeding practices after six months of age addressed these research gaps while also describing the current feeding practices in order to determine if they were according to the guidelines or not.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Study Design

The current study was secondary analysis of data from a population-based cohort study. This study was conducted to examine the association between time of introduction of complementary food and stunting in Thai children aged 24 months by using information of the participants from the Prospective Cohort Study of Thai Children (PCTC). PCTC was an observational prospective cohort study. The study did not involve any intervention. This study was community-based in four different rural areas and hospital-based in an urban area. A rural Thai sample was formed by selecting four cohorts, each from a chosen district in the four different regions and an urban sample from a hospital in Bangkok. Eligible districts had to be accessible year-round, to average between 800 and 900 births annually, and had to have a hospital director and research assistants committed to the long-term management of the project. The study was designed to explore long-term effects from the perinatal period to young adulthood in Thailand. This project was supported by Ministry of Public Health, the Thailand Health Research Fund, the Health System Research Institute and the World Health Organization. The PCTC offered a unique opportunity to address the issue, as the study featured a highly representative sample of children from five selected districts and included important questions on complementary food practice as well as extensive list of background characteristics on the families.

3.2 Study population and area

The cohort study included children born in four selected community-based districts in different regions and the Bangkok metropolitan area between July 1, 2000, and June 30, 2002. The design of the follow-up for the study population in this study is given in Appendix A. Anthropological measurements were taken from birth to two

years of age by physicians and especially trained research assistants every six months. The study areas comprised four community-based rural areas: 1) Nan district, Nan province, in the north; 2) Kranuan district, Khon Kaen province, in the northeast; 3) Panomtuan district, Kanchanaburi province, in the west; and 4) Thepa district, Songkhla province, in the south. The urban hospital-based area is from Ramathibodi Hospital, Mahidol University, Bangkok, the capital city of Thailand.

Figure 3.1 Study Areas in five regions

The Five Study Sites

Each of the four study sites outside Bangkok was selected from districts located in the provinces of different regions of Thailand.

- In the mountainous North, the urban Muang (Central) district of Nan province was selected. Thirteen percent of the population consists of mountain-dwelling tribal people. Buddhism was the predominant faith (84%) although animism (12.9%) and Christianity (2.2%) accounted for significant minorities. Most people worked in businesses or small (1.6 %) farms, sales, services or labor.

- In the arid, planar Northeast, a rural location in the Kranuan district of Khon Kaen province was selected. In this region, Thai and Laotian cultures were blended. Most people were subsistence farmers whose main crops were sugar cane, lowland rice, corn and cassava (for animal feed). Nearly all (98%) were Buddhists.
- In the lowland paddies of the Central region (an area bounded by low mountains), the rural Panomtuan district in Kanchanaburi province was selected. Mixed farming was common: lowland rice, corn and vegetables were grown and pigs, chicken and cattle were raised. Almost all (99%) the local people were adherents of Buddhism.
- The South, a humid peninsula, supported rubber plantations, forestry and fisheries. Thepa district in Songkhla province was selected. People worked in agriculture and fishing. The region was 68% Muslim and 31% Buddhists. (The area was subject to periodic sectarian violence.)
- Bangkok is the capital, the government, business and industrial centre. The large urban population may exceed 10 million. This was the only hospital-based study site, i.e. Ramathibodi Hospital. All pregnant women, permanent residents of Bangkok, who agreed to participate in the entire longitudinal study, were enrolled. Most lived in crowded areas; approximately half in slums and half in crowded apartments. Most (94%) were Buddhist, while other (2.6%) and Christian (2.2%) constituted significant minorities.

The principle purpose of the PCTC was to trace the development of Thai children within the Thai socio-cultural context. The present study particularly looked for socio-demographic information, feeding practices information and child stunting at 24 months for all the eligible participants from all five regions.

Sample: A total of 4,245 children, born from July 1, 2000, to June 30, 2002 in the study area, who were eligible for the PCTC project owing to parental consent during the mothers' pregnancy were included in the current study. Sixty infants were twins and eighteen had some abnormalities. Four thousand one hundred sixty seven children remained for analysis but anthropometric measurements were available for 3,707 children.

Inclusion criteria

The PCTC was a nationwide study, especially focused on the rural parts of Thailand. Inclusion criteria for the study areas were the voluntary participation of the hospital director and his/her willingness to participate. PCTC asked the agreement of all participants by using the consent form shown in appendix E. All 4,245 children were included in the current study.

Exclusion criteria

- Children having significant birth defects and suffering from any special illness or congenital deformities.
- Children infected with HIV/AIDS.
- Children belonging to Burmese, Laotian, and Karen tribes who frequently migrate to other places.
- Mothers who were not willing to participate in the study.
- Dead infants and infants who died within 24 months after birth.
- Children delivered as twins.

3.3 Sampling technique

All pregnant women residing in the five study areas, who do not plan to migrate at least for five years, were recruited in the PCTC. The eligible children were included with parental consent in the PCTC. The present study included all 4,245 infants from the PCTC.

3.4 Research instruments and data collection procedure

Data were collected from all subjects within the selected sites, including secondary data regarding community and demographic variables. Data were collected from the community, mothers, fathers, other family members and children, using standard procedures to ensure validity and reliability. The pretesting of the questionnaire was done on 25 respondents in each of the PCTC study areas. The

details on the data collection instruments used in PCTC with the variables retrieved for this study are given in appendix B.

A questionnaire was used to interview the caregivers in the community at 28 days, three months, and every six months until 24 months. Parents or caregivers were interviewed about the illnesses and vaccinations of infants at various ages from birth to -24 months. Parents or caregivers were interviewed about infant feeding practices, etc. to recheck the consistency of outcome from both records. Data on infant feeding practices were collected every six months by well-trained research assistants.

Data for the time of introduction of complementary food were recorded by using a food calendar. A colorful pictorial food calendar was provided to each mother immediately after birth of child. The food calendar had stickers of individual food items. Mothers were instructed to stick the food sticker corresponding to the month as soon as the food item was introduced to the child in order to avoid recall bias. The food calendar used to collect data on time of introduction of complementary foods is shown in appendix C.

The questionnaire used in the PCTC was based on health practice recommendation for pregnant women made by Department of Health, Ministry of Public Health. Later, it was reviewed by the panel of experts. After refinement, a group of assistant researchers was trained to use it. Then they tried out the questionnaire before using it to collect data under the observation of the researchers.

Socio-demographic information and especially data was gathered on child-feeding practices, and yearly growth measurements for height-for-age at 24 months was also acquired. The required dataset was accessed from the PCTC upon the approval of the board members of the PCTC as well as the ethics committee of Mahidol University.

3.4.1 Outcome Measurement

The PCTC project growth instrument was used to measure the recumbent length of all participant children, using a portable board with a fixed headboard and movable footboard (1m/0.1 cm); length was recorded to the nearest 0.1cm. The research assistants were trained to use the equipment and then record the results on the case report form.

Each child's nutritional status was expressed as a number of standard deviations (Z scores) above or below the median for the reference population, taking into account age and sex. 2006 WHO-Anthro software (116) was used to process the data (age in days and height) and generate Z-scores for each child. The software was developed to monitor growth and development in individuals and populations for use in the WHO Child Growth Standards .The WHO Child Growth Standards confirm that children born anywhere in the world and given an optimum start in life have the potential to develop within the same range of height and weight(117). Along with that, Z-scores calculated using the Thai Growth Standard was computed using INMU-Nutristat software, version 1.01, which was developed by the Institute of Nutrition, Mahidol University.

3.4.2 Variables of interest

Feeding practices of the infants, especially, breastfeeding duration and time of introduction of complementary food were the main interest variables for this study. Breast feeding duration was divided into less than or up to 12 months and more than 12 months. The food items included in the study were rice, cereal, chicken, liver, yolk, whole eggs, fish, pork, leafy vegetables, other vegetables, banana, fruit juice, orange, papaya and oil. The data showed that most of the infants were introduced complementary food within the time of 4-6 months. So, a three category cutoff, i.e. <4 months, 4-6 months and >6 months, was used to differentiate time of introduction of complementary food. Family income, study area, birth weight, gender, age of mother, education of mother, occupation of mother, height of mother, ANC, well baby clinic and illness at 24 months were considered as probable confounders in this study. Family income was divided into two categories, i.e. <25 percentile and ≥ 25 percentile (referent group). The study area was classified into hill tribe and non hill tribe (referent group). Birth weight was separated as <2500 grams for low birth weight and ≥ 2500 for normal (referent group). For gender, boy child was considered as referent. Age of mother was categorized as <20 years, 20-35 years (referent group) and >35 years. Education of mother was divided as informal/ primary and secondary/ higher (referent group). Occupation of mother was classified as housewife/ student (referent group), agriculture/ fishermen/ construction labor, shopkeeper/ professional/ clerk.

Height of mother was classified as <150cm and ≥150 cm (referent group). For ANC and well baby clinic, < 4 times versus ≥4 times (referent group) was used. For illness at 24 months, absence of illness was considered as referent group. For the dependent variable, the cutoff point of <-2 SD was used to determine stunted status of a child.

3.5 Validity and Reliability

In PCTC study, the inter-rater reliability was checked among the different research assistants. Linguistic and religious variation in the presentation of information had occurred among the religions of Thailand. Hence, research assistants were selected and well-trained to be sensitive to these. Monitoring and quality controls were set up from the beginning to ensure the study's reliability and validity. Re-interviews were conducted on a random sub-sample to check for consistency and to eliminate interviewer bias.

With regard to the nutrition variables, since they were the facts collected from the participants in a well planned manner, the reliability can be assured for the data of this study.

3.6 Data management:

Data cleaning and editing was done by using a statistical package. For the present study, length measurement at 24 months of age and the time of introducing different food items, along with other socio-demographic information were taken.

Scoring and Classification Criteria

The Thailand reference population as defined by the Ministry of Health (Thailand) together with the New Growth Reference WHO (2006) were used as the reference and two indices for height-for-age (HFA) were constructed based on the data about the child's age, sex and height. These indicators were compared with the Thai population as a reference and used in expressing growth either as a percentage of the median value or as a Z-score (number of standard deviations above or below the mean).

3.7 Data analysis

Four thousand two hundred forty five children were included in the present study. After excluding according to the criteria in the study, 3,707 children remained with anthropometric measurement. Z-scores for length-for-age was computed using WHO growth standards (World Health Organization, 2006) using AnthroPlus software, version 3.2.2 and the Thai Growth Standard in INMU-Nutristat software, version 1.01, which was developed by the Institute of Nutrition, Mahidol University. Then after, minitab and STATA software were used for analysis.

Socio-demographic information was presented using descriptive statistics, i.e. number and percentage. Chi-square test was used for determining the relationship between each independent variable and the dependent variable. Crude Relative Risk was used to show the strength of association with 95 percent confident interval. Since this was the study of rare outcomes, the use of an adjusted odds ratio to estimate an adjusted relative risk was allowed (118). Hence, multiple logistic regression was used to determine the relationship between all independent variables and the dependent variable. At first, the potential confounders were set in the model for predicting factors associated with stunting at 24 months. Then each food item was added in the model by forward elimination method until the best fitted model was obtained. The variables reduced from the final model for WHO reference were age of mother, occupation of mother, illness at 24 months, other vegetables and orange. Similarly, the variables reduced from the final model for Thai reference were occupation of mother, illness at 24 months, chicken, fruit juice, fish, pork and oil. Both the final models were significant which ensure that the included variables are capable of explaining the stunting effect at 24 months.

3.8 Protection of human subjects

The Prospective Cohort Study of Thai Children was approved by The National Ethics Committee, the Ministry of Public Health, on November 29, 2000, as shown in Appendix D. The present study was approved from the ethic committee of Mahidol University (COA. No. 2012/140.1004).

CHAPTER IV
RESEARCH RESULTS

This study was conducted to examine the association between complementary food practices and stunted Thai children aged 24 months, using information from the Prospective Cohort Study of Thai Children. A total of 4,245 children were included in this study. Height at 24 months was used to determine stunting status of the children. Other required information like socio-demographic, child, mother and health care characteristics, along with the time of introduction of complementary food were acquired from the Prospective Cohort Study of Thai Children.

Descriptive statistics were used to describe the socio-demographic, child, mother and health care characteristics, including feeding practices as well as outcome variable, i.e., child stunting at 24 months. Associations between child stunting at 24 months and independent variables were analyzed using chi-square test and multiple logistic regression. The results of the study are presented in this chapter.

1. Prevalence of child stunting at 24 months according to WHO standard and Thai standard.
2. Socio-demographic, child, mother, health care characteristics and complementary food practice.
3. Association of independent variables with child stunting at 24 months.
4. The predicting factors associated with child stunting at 24 months

4.1 Prevalence of child stunting at 24 months according to WHO standard and Thai standard

WHO –Anthro software and Nutristat software were used to process the data (age in days and height) and generate z-scores for each child according to WHO and Thai standard respectively. It was anticipated that these references may lead to differences in the estimation of prevalence of stunting at 24 months of age. The cutoff point of <-2 SD was used to determine stunted status of a child.

In comparing the two references, those of WHO and Thai, the data showed high stunting prevalence at the age of 24 months by WHO Reference. The 2006 WHO standard classified 16.48% (13.72% boys and 19.30% girls) children as being stunted at 24 months whereas it was just 13.95% (8.70% boys and 19.30% girls) according to Thai reference as shown in figure 4.1.

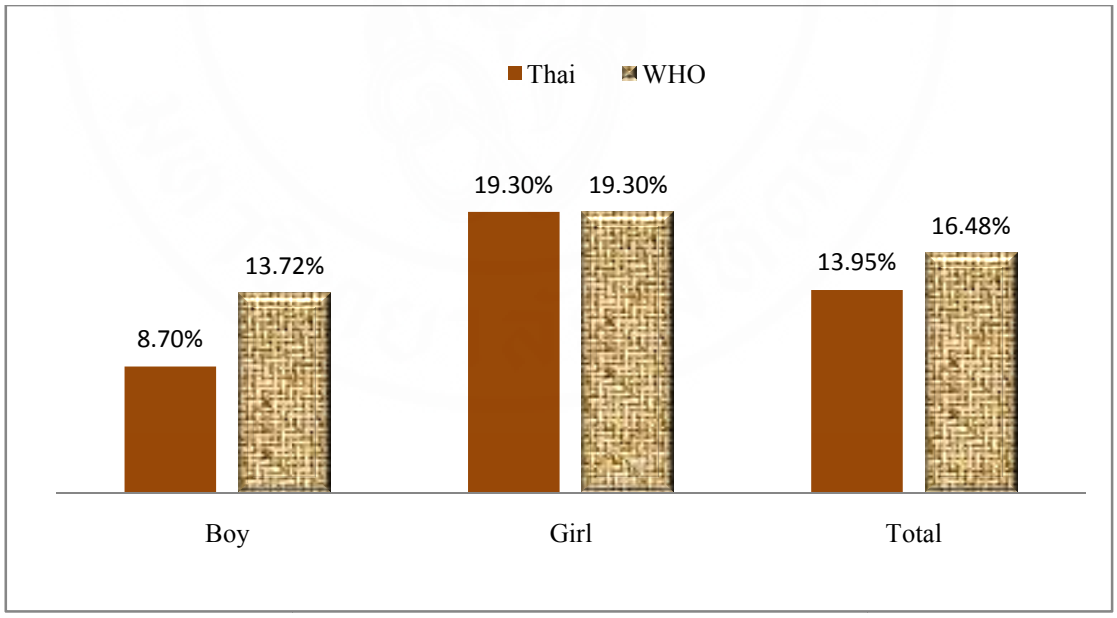

Figure 4.1 Prevalence of child stunting by gender comparing the Thai Growth with WHO new reference 2006

4.2 Socio-demographic, child, mother, health care characteristics and complementary food practice

4.2.1 Socio-demographic, child, mother and health care characteristics

The characteristics of the studied children are summarized on Table 4.1 and time of introduction of complementary food in Table 4.2. About one- fourth of the children were from families with lower income. Majority of the studied children were from non-hill area. Over 90% of children had birth weight 2500gm or more. The male and female ratio was nearly equal. Above three-fourth of mothers belonged to age group 20-35 years. Over half of mothers had informal or primary education. Only about 18% of mothers were either housewives or students. Around 86% of the mothers stood 150cm or more. Mothers attending ANC and well baby clinic more than four times were significantly higher. Only 11.23% children were reported to fall ill at 24 months.

Table 4.1 Frequency and percentage of socio-demographic, child and mother characteristics and health care

Variables	Number	Percentage
Socio-Demographic Characteristics		
Family income		
≥ 25percentile	2668	73.97
<25 percentile	939	26.03
Total	3607	100
Study area		
Non hill tribe	3593	96.92
Hill tribe	114	3.08
Total	3707	100
Child Characteristics		
Birth weight		
≥2500gm	3305	92.19
<2500gm	280	7.81
Total	3585	100

Table 4.1 Frequency and percentage of socio-demographic, child and mother characteristics and health care (cont.)

Variables	Number	Percentage
Gender		
Boy	1873	50.5
Girl	1834	49.5
Total	3707	100
Mother Characteristics		
Age of mother		
20-35 years	2874	78.06
<20 years	445	12.09
>35 years	363	9.86
Total	3682	100.01
Education of mother		
Secondary/ higher	1666	45.4
Informal/ primary	2004	54.6
Total	3670	100
Occupation of mother		
Housewife/student	650	17.63
Agriculture/construction labor/ fishermen	1988	53.92
Shopkeeper/ professionals/clerk	1049	28.45
Total	3687	100
Height of mother		
≥150 cm	3137	85.83
<150 cm	518	14.17
Total	3655	100
Health Care		
ANC		
≥ 4 times	3211	86.62
< 4 times	496	13.38
Total	3707	100

Table 4.1 Frequency and percentage of socio-demographic, child and mother characteristics and health care (cont.)

Variables	Number	Percentage
Well baby clinic		
≥ 4 times	2470	67.75
<4 times	1176	32.25
Total	3646	100
Illness at 24 months		
No	3233	88.77
Yes	409	11.23
Total	3642	100

4.2.2 Complementary food practice

Regarding feeding practice, about 41% of the children received breast milk over 12 months. The results showed that nearly 60% of the children were introduced banana before four months. Also, fruit juice was introduced before four months to majority of the children. The time of introducing rice, leafy vegetables, yolk and cereal for most of the children was 4-6 months. Other food items like chicken, orange, liver, papaya, whole eggs, fish, pork, other vegetables and oil were introduced after six months to most of the children.

Table 4.2 Frequency and percentage of time of introduction of complementary feeding

Variables		Number	Percentage
Feeding Practices			
Prolonged breastfeeding			
≤12 months		1631	58.86
>12 months		1140	41.14
Total		2771	100
Median=4	Q.D.=6.5	Min=0	Max=24
Rice			
4-6m		1889	55.15
<4m		1342	39.18
>6m		194	5.66
Total		3425	99.99
Median=4	Q.D.=1	Min=0	Max=13

Table 4.2 Frequency and percentage of time of introduction of complementary feeding (cont.)

Variables		Number	Percentage
Cereal			
4-6m		1276	39.19
<4m		1013	31.11
>6m		967	29.7
Total		3256	100
Median=5	Q.D.=2	Min=0	Max=13
Chicken			
4-6m		685	21.43
<4m		43	1.35
>6m		2468	77.22
Total		3196	100
Median=8	Q.D.=1	Min=2	Max=13
Liver			
4-6m		1423	44.23
<4m		127	3.95
>6m		1667	51.82
Total		3217	100
Median=7	Q.D.=1.5	Min=1	Max=13
Yolk			
4-6m		2278	68.93
<4m		499	15.1
>6m		528	15.98
Total		3305	100.01
Median=4	Q.D.=0.5	Min=1	Max=13
Whole eggs			
4-6m		706	22.41
<4m		56	1.78
>6m		2389	75.82
Total		3151	100.01
Median=8	Q.D.=1	Min=2	Max=13

Table 4.2 Frequency and percentage of time of introduction of complementary feeding (cont.)

Variables		Number	Percentage
Fish			
4-6m		1401	43.84
<4m		53	1.66
>6m		1742	54.51
Total		3196	100.01
Median=7	Q.D.=1.5	Min=2	Max=13
Pork			
4-6m		1082	33.14
<4m		73	2.24
>6m		2110	64.62
Total		3265	100
Median=7	Q.D.=2	Min=1	Max=13
Leafy vegetables			
4-6m		1627	50.2
<4m		163	5.03
>6m		1451	44.77
Total		3241	100
Median=6	Q.D.=1.5	Min=1	Max=13
Other vegetables			
4-6m		1424	43.79
<4m		165	5.07
>6m		1663	51.14
Total		3252	100
Median=7	Q.D.=2	Min=1	Max=13
Banana			
4-6m		1327	37.67
<4m		2023	57.42
>6m		173	4.91
Total		3523	100
Median=3	Q.D.=1	Min=0	Max=13

Table 4.2 Frequency and percentage of time of introduction of complementary feeding (cont.)

Variables		Number	Percentage
Fruit juice			
4-6m		1297	38.52
<4m		1479	43.93
>6m		591	17.55
Total		3367	100
Median=4	Q.D.=1	Min=0	Max=13
Orange			
4-6m		788	25.56
<4m		374	12.13
>6m		1921	62.31
Total		3083	100
Median=8	Q.D.=4	Min=1	Max=13
Papaya			
4-6m		936	29.74
<4m		130	4.13
>6m		2081	66.13
Total		3147	100
Median=7	Q.D.=2	Min=1	Max=13
Oil			
4-6m		597	18.43
<4m		30	0.93
>6m		2612	80.64
Total		3239	100
Median=9	Q.D.=1.5	Min=1	Max=13

Note: 13 means introduced after 12 months of age

4.3 Association of independent variables with child stunting

To find out the association of stunting at 24 months with independent variables, chi-square test was used as shown in Table 4.3 below.

S stands for stunted children.

Table 4.3 Association of socio-demographic, child and mother characteristics and health care with child stunting at 24 months

Variables	WHO Reference				Thai Growth Reference		
	Total	S (%)	Crude RR	95% CI	S (%)	Crude RR	95% CI
Socio-Demographic Characteristics							
Family income* **							
≥25 percentile	2668	325(54.90)	1		275(54.89)	1	
<25 percentile	939	267(45.10)	2.46***	2.13-2.84	226(45.11)	2.46***	2.10-2.89
Study area* **							
Non hill tribe	3593	545(89.20)	1		461(89.17)	1	
Hill tribe	114	66(10.80)	4.31***	3.61-5.13	56(10.83)	4.32***	3.52-5.30
Child Characteristics							
Birth weight* **							
≥2500gm	3305	485(82.20)	1		410(82.16)	1	
<2500gm	280	105(17.80)	2.60***	2.17-3.09	89(17.84)	2.60***	2.13-3.16
Gender* **							
Boy	1873	257(42.1)	1		163(31.53)	1	
Girl	1834	354(57.9)	1.39***	1.20-1.62	354(68.47)	2.20***	1.84-2.62
Mother Characteristics							
Age of mother* **							
20-35 years	2874	439(72.09)	1		360(69.77)	1	
<20 years	445	85(13.96)	1.28*	1.03-1.58	79(15.31)	1.45**	1.16-1.81
>35 years	363	85(13.96)	1.45**	1.18-1.79	77(14.92)	1.60***	1.28-2.00
Education of mother* **							
Secondary/ higher	1666	164(26.93)	1		141(27.33)	1	
Informal/primary	2004	445(73.07)	2.50***	2.11-2.95	375(72.67)	2.46***	2.05-2.95

Table 4.3 Association of socio-demographic, child and mother characteristics and health care with child stunting at 24 months (cont.)

Variables	WHO Reference				Thai Growth Reference		
	Total	S (%)	Crude RR	95% CI	S (%)	Crude RR	95% CI
Occupation of mother* **							
Housewife/student	650	99(16.26)	1		88(17.05)	1	
Agriculture/construction labor/ fishermen	1988	428(70.28)	1.62***	1.32-1.98	357(69.19)	1.53***	1.23-1.90
Shopkeeper/ professionals/clerk	1049	82(13.46)	0.51***	0.39-0.68	71(13.76)	0.50***	0.37-0.68
Height of mother* **							
≥150 cm	3137	406(67.55)	1		338(66.27)	1	
<150 cm	518	195(32.45)	3.01***	2.60-3.48	172(33.73)	3.20***	2.73-3.75
Health Care							
ANC**							
≥ 4 times	3211	508(83.14)	1		426(82.40)	1	
<4 times	496	103(16.86)	1.35**	1.12-1.64	91(17.60)	1.43**	1.16-1.75
Well baby clinic**							
≥ 4 times	2470	440(72.85)	1		374(73.19)	1	
<4 times	1176	164(27.15)	0.75**	0.64-0.89	137(26.81)	0.74**	0.62-.89
Illness at 24 months							
No	3233	530(87.31)	1		450(87.55)	1	
Yes	409	77(12.69)	1.21	0.97-1.50	64(12.45)	1.18	0.93-1.51

*, P <0.05; **, P <0.01; ***, P <0.001

As shown in the table 4.3, family income, study area, birth weight, gender, age of mother, education of mother, occupation of mother, height of mother, ANC, WBC were the factors which remained independently associated with stunting at 24 months according to both the references.

Families with income less than 25 percentiles had 2.46 times (95 %CI= 2.13-2.84) and 2.46 times (95 % CI=2.10-2.89) risk of their children getting stunted at 24 months as per WHO and Thai reference respectively. Children residing in hill area had 4.31 times (95 % CI=3.61-5.13) risk of getting stunted compare to the children in non-hill area according to WHO standard and it was 4.32 times (95 % CI=3.52-5.30) as per Thai standard. Children with low birth weight, i.e. below 2500gm had 2.59 times (95 % CI=2.17-3.09) and 2.60 times (95 % CI=2.13-3.16) risk of being stunted

at 24 months according to WHO and Thai reference respectively. The prevalence of stunting was higher in girls than in boys, regardless of the standard applied. Of the total stunted, 57.9% were girls making a girl child 1.39 times (95 % CI=1.20-1.62) vulnerable to stunting at 24 months in WHO reference. Whereas in Thai reference, 68.47% girls were stunted raising the risk to 2.20 times (95 % CI=1.84-2.62) for stunting at 24 months.

Child born to a mother below 20 years and above 35 years had 1.28 times (95 % CI= 1.03-1.58) and 1.45 times (95 % CI=1.18-1.79) risk of being stunted at 24 months respectively in comparison to mothers aged 20-35 years as per WHO standard. According to Thai reference, the risk of child stunting was 1.45 times (95 % CI=1.16-1.81) and 1.60 times (95 % CI=1.28-2.00) for mother's age below 20 years and more than 35 years respectively in comparison to mother's age within 20-35 years. Mothers having either informal or primary level education increased the chance of child stunting at 24 months by 2.50 times (95 % CI=2.11-2.95) with reference to mothers with secondary or higher level education according to WHO standard. According to Thai reference, chances of stunting was 2.46 times higher (95 % CI=2.05-2.95) for children whose mothers had informal or just primary level education in compare to mothers with secondary or higher level education. Relative risk of stunting, for children whose mothers being involved in agriculture, fishing or construction work was 1.62 times (95 % CI=1.32-1.98) and 1.53 times (95 % CI=1.23-1.90) more than housewife/ student mothers according to WHO and Thai reference respectively. Whereas, for shopkeepers, professionals and clerk mothers, there was protective effect for stunting, with significant association (p-value <0.001) from both the references. Children born to mother whose height was below 150cm were at risk for stunting at 24 months (RR=3.01, 95% CI=2.60-3.48 as per WHO standard) and (RR=3.20, 95 % CI=2.73-3.75 as per Thai reference).

Mothers who did not complete antenatal checkups i.e. below four times were risky for their child to be stunted at 24 months (RR=1.35, 95 % CI=1.12-1.64 as per WHO standard) and (RR=1.43, 95 % CI=1.16-1.75 as per Thai reference). Attending well baby clinic less than four times was not a risk factor for child stunting at 24 months.

Table 4.4 Association of time of introduction of complementary feeding with child stunting at 24 months

Variables	WHO Reference				Thai Growth Reference		
	Total	S (%)	Crude RR	95% CI	S (%)	Crude RR	95% CI
Feeding Practices Prolonged breastfeeding* **							
≤12 months	1631	121(32.79)	1		102(32.69)	1	
>12 months	1140	248(67.21)	1.77***	1.53-2.05	210(67.31)	1.78***	1.51-2.09
Rice							
4-6m	1889	307(54.63)	1		260(54.74)	1	
<4m	1342	213(37.90)	0.97	0.83-1.15	179(37.68)	0.97	0.81-1.16
>6m	194	42(7.47)	1.38*	1.04-1.85	36(7.58)	1.40*	1.02-1.92
Cereal* **							
4-6m	1276	174(31.64)	1		148(31.76)	1	
<4m	1013	207(37.64)	1.50***	1.25-1.81	176(37.77)	1.50***	1.22-1.84
>6m	967	169(30.73)	1.32**	1.08-1.60	142(30.47)	1.30*	1.05-1.61
Chicken*							
4-6m	685	123(23.16)	1		102(22.82)	1	
<4m	43	13(2.45)	1.68*	1.03-2.75	11(2.46)	1.71	0.99-2.97
>6m	2468	395(74.39)	0.94	0.78-1.13	334(74.72)	0.96	0.78-1.18
Liver* **							
4-6m	1423	194(36.26)	1		163(36.14)	1	
<4m	127	11(2.06)	0.59	0.33-1.06	10(2.22)	0.64	0.34-1.18
>6m	1667	330(61.68)	1.55***	1.31-1.82	278(61.64)	1.55***	1.29-1.86
Yolk* **							
4-6m	2278	344(65.15)	1		291(64.81)	1	
<4m	499	63(11.93)	0.81	0.63-1.05	54(12.03)	0.82	0.63-1.09
>6m	528	121(22.92)	1.60***	1.33-1.93	104(23.16)	1.63***	1.33-2.00
Whole eggs							
4-6m	706	131(25.24)	1		112(25.45)	1	
<4m	56	10(1.93)	0.96	0.53-1.73	8(1.82)	0.90	0.46-1.75
>6m	2389	378(72.83)	0.87	0.72-1.04	320(72.73)	0.86	0.70-1.05
Fish* **							
4-6m	1401	184(34.52)	1		150(33.33)	1	
<4m	53	6(1.13)	0.82	0.38-1.79	5(1.11)	0.84	0.36-1.98
>6m	1742	343(64.35)	1.56***	1.32-1.85	295(65.56)	1.65***	1.37-1.98
Pork* **							
4-6m	1082	132(24.81)	1		105(23.39)	1	
<4m	73	7(1.32)	0.74	0.36-1.53	5(1.11)	0.66	0.28-1.58
>6m	2110	393(73.87)	1.55***	1.29-1.87	339(75.50)	1.69***	1.37-2.07

Table 4.4 Association of time of introduction of complementary feeding with child stunting at 24 months (cont.)

Variables	WHO Reference				Thai Growth Reference		
	Total	S (%)	Crude RR	95% CI	S (%)	Crude RR	95% CI
Leafy vegetables* **							
4-6m	1627	205(38.25)	1		174(38.33)	1	
<4m	163	16(2.99)	0.72	0.44-1.17	15(3.30)	0.79	0.48-1.32
>6m	1451	315(58.77)	1.81***	1.54-2.13	265(58.37)	1.79***	1.50-2.14
Other vegetables* **							
4-6m	1424	167(30.53)	1		136(29.44)	1	
<4m	165	14(2.56)	0.66	0.39-1.12	11(2.38)	0.64	0.35-1.16
>6m	1663	366(66.91)	2.02***	1.71-2.41	315(68.18)	2.14***	1.78-2.59
Banana* **							
4-6m	1327	236(41.04)	1		192(39.83)	1	
<4m	2023	281(48.87)	0.77**	0.65-0.90	242(50.21)	0.81*	0.68-0.97
>6m	173	58(10.09)	1.86***	1.45-2.37	48(9.96)	1.89***	1.43-2.49
Fruit juice* **							
4-6m	1297	187(34.31)	1		166(36.01)	1	
<4m	1479	202(37.06)	0.97	0.80-1.16	166(36.01)	0.89	0.73-1.10
>6m	591	156(28.62)	1.93***	1.60-2.34	129(27.98)	1.80***	1.46-2.22
Orange* **							
4-6m	788	108(21.56)	1		93(22.20)	1	
<4m	374	44(8.78)	0.84	0.60-1.16	38(9.07)	0.84	0.59-1.20
>6m	1921	349(69.66)	1.40**	1.14-1.71	288(68.74)	1.34**	1.07-1.67
Papaya*							
4-6m	936	129(24.39)	1		112(25.11)	1	
<4m	130	19(3.59)	1.01	0.65-1.59	16(3.59)	0.98	0.60-1.61
>6m	2081	381(72.02)	1.37**	1.14-1.65	318(71.30)	1.32*	1.08-1.62
Oil							
4-6m	597	113(21.08)	1		90(19.87)	1	
<4m	30	3(0.56)	0.56	0.19-1.65	2(0.44)	0.47	0.12-1.81
>6m	2612	420(78.36)	0.82	0.68-0.99	361(79.69)	0.88	0.71-1.10

*, P <0.05; **, P <0.01; ***, P <0.001

As shown in the table, prolonged breast feeding was the factor which remained independently associated with stunting at 24 months according to both the references With regard to food items, cereal, chicken, liver, yolk, fish, pork, leafy vegetables, other vegetables, banana, fruit juice, orange and papaya were significantly associated with child stunting in chi-square test.

From both references, prolonged breastfeeding or breastfeeding beyond 12 months seemed to have higher chances of being stunted (RR=1.77, 95 % CI=1.53-2.05 as per WHO standard) and (RR=1.78, 95 % CI=1.51-2.09 as per Thai reference). Time of introduction of food items like cereal (p-value <0.001), chicken (p-value <0.05), liver (p-value <0.001), yolk (p-value <0.001), fish (p-value <0.001), pork (p-value <0.001), leafy vegetables (p-value <0.001), other vegetables (p-value <0.001), banana (p-value <0.001), fruit juice (p-value <0.001), orange (p-value <0.001) and papaya (p-value <0.05) were significant in chi-square test according to both the references.

4.4 Final models of multiple logistic regression

All of the independent variables were further analyzed by Multiple Logistic Regression. The best suited model was obtained after eliminating the insignificant variables. The two references that were used – WHO international reference and Thai national reference, were almost similar in demonstrating the association between time of introduction of complementary food and stunting at 24 months though the prevalence of stunting was found higher according to WHO reference.

After adjusting for other variables in the final model, the significant risk factors for stunting were family income, study area, birth weight, gender, height of mother, prolonged breastfeeding, yolk and pork according to WHO reference. Whereas according to Thai reference, the significant risk factors for stunting were family income, birth weight, gender, height of mother, ANC, prolonged breastfeeding and whole eggs.

Table 4.5 Final models of multiple logistic regression

Variables	WHO Reference			Thai Growth Reference		
	Adjusted RR	95% CI	P-value	Adjusted RR	95% CI	P-value
Family income						
≥25 percentile	1			1		
<25 percentile	1.68	1.10-2.57	0.017	1.57	1-2.47	0.051
Study area						
Non hill tribe	1			1		
Hill tribe	3.57	1.07-1.95	0.039	2.15	0.62-7.52	0.23
Birth weight						
≥2500gm	1			1		
<2500gm	4.57	2.66-7.85	<0.001	4	2.29-6.98	<0.001
Gender						
Boy	1			1		
Girl	1.65	1.12-2.44	0.011	3.32	2.15-5.14	<0.001
Age of mother						
20-35 years	****	****	****	1		
<20 years	****	****	****	1.06	0.60-1.88	0.849
>35 years	****	****	****	1.35	0.71-2.56	0.361
Education of mother						
Secondary/ higher	1			1		
Informal/primary	1.25	0.82-1.91	0.302	1.19	0.75-1.87	0.46
Height of mother						
≥150 cm	1			1		
<150 cm	3.52	2.21-5.61	<0.001	2.79	1.72-4.55	<0.001
ANC						
≥ 4 times	1			1		
<4 times	0.57	0.29-1.14	0.112	0.46	0.21-0.98	0.046

Table 4.5 Final models of multiple logistic regression (cont.)

Variables	WHO Reference			Thai Growth Reference		
	Adjusted			Adjusted		
	RR	95% CI	P-value	RR	95% CI	P-value
Well baby clinic						
≥ 4 times	1			1		
<4 times	1.2	0.81-1.79	0.366	1	0.65-1.53	0.986
Prolonged breastfeeding						
≤12 months	1			1		
>12 months	2.7	1.77-4.10	<0.001	2.31	1.48-3.60	<0.001
Rice						
4-6m	1			1		
<4m	0.93	0.58-1.49	0.777	1.06	0.65-1.71	0.821
>6m	0.98	0.42-2.27	0.959	1.03	0.44-2.40	0.951
Cereal						
4-6m	1			1		
<4m	1.41	0.88-2.24	0.149	1.45	0.89-2.37	0.138
>6m	0.97	0.59-1.60	0.902	1.03	0.61-1.74	0.909
Chicken						
4-6m	1			****	****	****
<4m	0.5	0.04-5.92	0.581	****	****	****
>6m	0.66	0.37-1.16	0.149	****	****	****
Liver						
4-6m	1			1		
<4m	0.45	0.09-2.39	0.349	0.77	0.17-3.36	0.724
>6m	1.21	0.75-1.94	0.439	1.1	0.68-1.77	0.703
Yolk						
4-6m	1			1		
<4m	0.62	0.30-1.28	0.196	0.61	0.29-1.28	0.189
>6m	1.89	1.07-3.33	0.028	1.34	0.74-2.4	0.331

Table 4.5 Final models of multiple logistic regression (cont.)

Variables	WHO Reference			Thai Growth Reference		
	Adjusted			Adjusted		
	RR	95% CI	P-value	RR	95% CI	P-value
Whole eggs						
4-6m	1			1		
<4m	1.94	0.30-2.74	0.49	2.76	0.56-3.54	0.211
>6m	0.67	0.41-1.09	0.105	0.52	0.32-0.84	0.007
Fish						
4-6m	1			****	****	****
<4m	0	0-*	0.999	****	****	****
>6m	0.69	0.43-1.11	0.13	****	****	****
Pork						
4-6m	1			****	****	****
<4m	4.72	1.11-20.19	0.036	****	****	****
>6m	1.54	0.93-2.53	0.092	****	****	****
Leafy vegetables						
4-6m	1			1		
<4m	1.39	0.43-4.48	0.58	1.2	0.35-4.13	0.772
>6m	0.81	0.51-1.28	0.366	0.77	0.47-1.26	0.302
Other vegetables						
4-6m	****	****	****	1		
<4m	****	****	****	0.89	0.25-3.15	0.858
>6m	****	****	****	1.27	0.79-2.05	0.33
Banana						
4-6m	1			1		
<4m	1.28	0.79-2.07	0.325	1.31	0.79-2.17	0.292
>6m	1.09	0.81-1.46	0.577	2.16	0.91-5.13	0.081
Fruit juice						
4-6m	1			****	****	****
<4m	1.12	0.71-1.76	0.624	****	****	****
>6m	0.88	0.50-1.55	0.662	****	****	****

Table 4.5 Final models of multiple logistic regression (cont.)

Variables	WHO Reference			Thai Growth Reference		
	Adjusted			Adjusted		
	RR	95% CI	P-value	RR	95% CI	P-value
Orange						
4-6m	****	****	****	1		
<4m	****	****	****	0.64	0.31-1.33	0.231
>6m	****	****	****	1.12	0.70-1.77	0.638
Papaya						
4-6m	1			1		
<4m	0.74	0.27-1.98	0.547	1.7	0.68-4.24	0.253
>6m	0.97	0.63-1.50	0.895	1.07	0.67-1.73	0.766
Oil						
4-6m	1			****	****	****
<4m	0.5	0.03-9.44	0.644	****	****	****
>6m	0.85	0.49-1.47	0.558	****	****	****

**** Not included in the final model

CHAPTER V
DISCUSSION

This chapter focuses on the description about the prevalence of child stunting at 24 months, frequency distribution of time of introduction of complementary feeding and the association between time of introduction of complementary food and child stunting at 24 months as stated earlier in the objectives of the study. It is believed that this research provides better information on the affects of time of introduction of complementary food on child stunting, thereby helping to improve the infant feeding practices so that the overall growth and development of child can be ensured. The present study is one of the rare studies to associate time of introduction of complementary food with child stunting in Thailand.

5.1 Prevalence of child stunting at 24 months

The use of both international and the Thai criteria to ensure comparability of the findings both nationally and internationally is one of the strengths of this study. WHO reference seemed more sensitive in finding the stunted children as child stunting at 24 months was higher according to WHO reference in comparison to Thai reference. The possible reason for this may be the median height of Thai children being less than the WHO standard. But, for girls, same number of girls seemed to be stunted from both the references. This suggests that proper nutrition can enhance growth in Thai girl children.

5.2 Socio demographic, child and mother characteristics and health care

Families with comparatively low income were a risk to stunting. The finding is similar to some previous studies (52, 63, 65). This could be the effect of

family income on food availability.

Children living in hill area had about four times risk of stunting than children living in non-hill area according to WHO reference and that as per Thai reference was about two times. This result supports the findings of prior studies that have also described rural-urban differences in health (54, 67, 68). This shows people in hill area lack knowledge and are still practicing traditional feeding practices. Also, health services, education and other social support systems are not easily accessible to hill tribe. Various interventions addressing child malnutrition in hill area population should be intervened to bring improve their knowledge, develop positive attitude and for correct practices.

Low birth weight had nearly five times risk to child stunting from WHO reference and four times from Thai reference. Low birth weight was a significant predictor for stunting from both the references as agreed by some other studies (6, 65-67, 73-75). The possible reason may be the inability of infants with low birth weight to counteract the environmental and socio-economic circumstances, allowing persistence of infection and sub-optimal nutrition.

The findings showed girls have high risk of stunting than boys. There are some previous studies in support of this result (65, 76). But other studies showed boys in high risk of stunting in contravening the results of this study (33, 66, 73). The results in this study may be due to gender disparity, giving preference to boy child in terms of feeding and health-seeking behavior.

Mother's height was significantly linked to child stunting. A mother with height less than 150cm had about four times risk of having stunted child. The finding is in agreement with earlier studies (71, 78, 79). Maternal factors can alter prenatal characteristics of a child and due to the intergenerational effect; it can further act as a cause for stunting.

Using logistic regression, ANC visit less than four times was a significant risk factor to stunting in this study according to both the references. This was consistent with previous findings (67, 74, 76). When multiple logistic regression was performed, the factor was not found to be significant risk factor for stunting. This result could be because of small samples in the part of women visiting <4 times. A bigger sample size could reveal better result.

5.3 Feeding Practices

Infant feeding practices, in spite of being an important component of child rearing, have been one of the most neglected determinants of young child malnutrition, especially in Thai context

5.3.1 Frequency distribution of time of introduction of complementary feeding

The time of introducing complementary food for the first time to children has potential life-long impacts on health, thus is an important aspect of pediatric health supervision (119, 120).

The results showed that most of the children were fed several kinds of foods before they reach six months as it was hypothesized in the beginning of the research. This finding is consistent with the general consensus that despite of disadvantages of introducing complementary foods early, most infants in Thailand are introduced complementary foods before four months as in several other developing countries (102-104, 106, 107). Overall, children seemed to been introduced rice and banana before four months. From the earlier studies conducted in Thailand, introducing mashed rice or banana seemed old traditional practice as well (121). Some studies have even reported the evidences of introducing rice or banana as early as a few days after birth in Thailand (121, 122). This indicates the need of incorporating socio-cultural factors while designing the health and nutrition interventions which can stimulate local people to accept the appropriate child feeding guidelines.

5.3.2 Prolonged breastfeeding

The breast feeding duration was found in contradiction to WHO recommendations, more than 50% of the children being fed only up to one year, with median breast feeding duration just four months. The reason could be the ignorance of people. Most of the children from hill tribe area were found to be stunted. This group of people might not be able to access to proper health education compare to non hill-tribe leading to inappropriate complementary feeding practices and also breast feeding practices. After adjusting the confounding factors in the final model, prolonged breastfeeding was the most significant factor for stunting. Since most of the children

were found being introduced complementary foods early, this result could be due to reverse causality as some previous studies have found (97, 98). However, studies have shown the risk of malnutrition among the children getting prolonged breastfeeding (65, 96). Focusing just on prolonged breastfeeding does not ensure adequate early child growth (89). In this study, about 60% of the children were breastfed less than or just upto 12 months. Early introduction of complementary food might have led to termination of breast milk in the large group of children. Also, the quality of breast milk depends on the nutrition and health of mother. Besides, a complete model as suggested by UNICEF would help to depict the effect of breast feeding duration on stunting status of children.

5.3.3 Time of introduction of complementary foods

The results showed that out of 13 food items included in the final model, six food items, when introduced before four months, was risk to stunting and nine out of 13 food items, when introduced after six months showed protective effect towards stunting at 24 months according to WHO growth reference. As per Thai growth reference, six out of 10 food items, when introduced before four months resulted stunted status at 24 months. This hints that complementary foods, when introduced to the infants after six months, as per the existing WHO recommendation is helpful for the appropriate length-for-age development of children. Despite of having enough number of children in the study, the sample size on some particular food items were not enough due to missing values in the food items. Hence, due to small sample size, the effect of some individual food items on stunting were not statistically significant. But, it is believed that the further research with enough sample size will be able to demonstrate the result more clearly. Family income, study area, birth weight, gender, height of mother, and ANC were the confounders that were controlled for child stunting in the present study.

The final model for both WHO and Thai reference were significant ensuring capabilities of the included variables to explain the stunting effect at 24 months. Forward selection of the variables was used in multiple logistic regression analysis. According to WHO reference, introducing pork before four months was 4.72 times risk for stunting. Pork being animal source food, has high chance of bacterial

contamination and zoonotic infection which ultimately has negative impact on nutritional status of children (123). Besides, early introduction of animal source food may lead to reduced capacity of infants with respect to breast milk intake. Infant's gastric capacity is comparatively very small and these animal source food last long in the infant's stomach making the child feel full for long hours. Hence, the child gets deprived of nutritious breast milk. Studies in South and Central America (124), Peru (125), Kenya (126), New Guinea (127) have shown the positive association between animal source foods like meat, fish with linear growth of children only after six months of age.

According to Thai reference, introducing whole eggs before four months had the highest odds of stunting at 24 months while introducing whole eggs after six months was protective to stunting. Feeding whole egg to young infants may result allergy (128) which may cause illness in them. But when introduced at appropriate age, it is seen beneficial as in this study. A study in China on complementary feeding showed negative correlation of food items like animal products, vegetables and fruits with prevalence of stunting among 9-24 months children (129).

Among other food items included in the final model, introducing cereal, leafy vegetables, banana, fruit juice (as per WHO reference) and papaya (as per Thai reference) before four months were significant predictors of stunting. And, introducing oil, papaya, fruit juice, leafy vegetables, fish, whole egg, chicken, cereal and rice after six months showed protective effect to stunting according to WHO reference though not significant. The insufficient sample size might have led to the association to not be statistically significant. Traditional feeding of plant-based diets like cereals cannot replace nutrients of breast milk (130). This enforces the need of introduction of complementary food at appropriate time in order to prevent child stunting. Besides, earlier studies have found that infants who are exclusively breastfed for six months achieve better length-for-age than those who are introduced complementary foods before six months. Breast milk not only fulfills the nutrient requirement of infant, but also protects against infections, which may cause stunting (131, 132). Feeding practices, in particular, time of introduction of complementary food, play a vital role in explaining the stunting effect among young children. Improper preparation of food and subsequent food contamination, further worsen the scenario leading to infections (14).

Early introduction of complementary food is not beneficial to children (133). Early introduction of complementary food displaces breast milk in one hand, whereas in the other hand, increases the risk of diseases (123). Many studies have shown that due to the increased risk of various infections like diarrhea (134-136), respiratory infections (26, 137, 138) caused by poor quality of food supplied, early introduction of food does not benefit growth and can cause long-term growth faltering (139, 140). Earlier studies have reported the affect of early feeding of solid foods, especially before four months of age, on growth and prevalence of obesity (141, 142).

5.4 Methodological Concern

The PCTC was a cohort study with rare outcome, i.e., child stunting. Due to limitation of software and the outcome of the study being rare, adjusted OR was used to estimate adjusted relative risk in the final model (table 4.5). However, the level of crude relative risk was not much different from crude OR, as shown in Annex F.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The present study was conducted to determine the prevalence of child stunting at 24 months by using Thai and New WHO growth standard to examine the association between time of introduction of complementary food and stunting at 24 months using the information of infants from a cohort study. The study included total of 4,245 children. After excluding 60 twin infants and 18 with abnormalities, 4,167 children remained for data analysis. For the 2001 Thai reference, results showed 13.95% stunting prevalence whereas 2006 WHO reference showed 16.48% at the age of 24 months. Out of total 15 food items, seven food items were introduced to 50% of the children by six months. Rice and banana were the common food items introduced to majority of children before four months.

Regarding to the factors associated with outcome, besides sociodemographic characteristics, variables included in the study were prolonged breastfeeding and time of introduction of complementary food.

Chi square test was used to determine the association of each independent variable and outcome variable. Crude relative risk was used to present the strength of association with 95% confidence interval. Multiple logistic regression was performed to explore the suitable model containing the variables which could explain the stunting effect at 24 months.

After adjusting for confounding factors, this study showed that prolonged breast feeding was significantly associated (RR=2.7, 95% CI=1.77-4.10) and (RR=2.31, 95% CI=1.48-3.60) with child stunting from both the WHO and Thai references respectively. By using WHO reference, this study found that children who were introduced pork before four months (RR=4.72, 95% CI=1.11-20.19) had the highest risk to stunting at 24 months. And, by using Thai reference, it was found that

children who were introduced whole eggs before four months (RR=2.76, 95% CI=0.56-13.54) had the highest risk to stunting at 24 months.

6.2 Recommendations

The present study, following the WHO standards for complementary food introduction after 6 months, addressed the research gaps on association of time of introduction of individual food items with child stunting. The age of introducing complementary food to infants is of public health importance as there is risk of infections from contaminated foods at one hand and at other, replacement of nutritious breast milk by inappropriate food items which ultimately affects child growth. The framework of this study could not incorporate whole model as given in UNICEF conceptual framework which might have affected the association between independent variables and dependent variable in this study.

Individual level

- The close association of infections and inappropriate diet with growth faltering stresses the need of ensuring compliance to infant feeding guidelines.
- Each and every new mother should be encouraged to use MCH Handbook provided freely by the government.

Policy level

- Implementation of massive educational and awareness programmes on complementary feeding practices focusing especially to the hill tribe minorities.
- Integrating hazard-analysis-critical-control-point approach, taking into account the socio-cultural factors, into national infant feedings can lessen the infection episodes due to contaminated and inappropriate solid foods.
- Government should promote the use of MCH handbook to educate mothers regarding infant feeding practices.

For further research

In future, qualitative research and longitudinal studies should be carried, incorporating aspects like dietary diversity and meal frequency, in feeding practices. Also, adequate sample size should be maintained to have clear view of the association between feeding practices and child stunting.

- Research on complementary feeding practices, especially focusing on the optimum time for the introduction of individual complementary foods with regard to child stunting should be conducted.
- Developing an infant and child feeding index (ICFI) could be helpful in measuring caretakers' feeding behavior and infants' diet quality.

Regarding use of reference

The prevalence of stunting was lower using Thai reference compare to WHO reference. WHO reference seemed more sensitive in detecting the stunted cases. Also, from the results, it is known that different references show different risk factors, so appropriate reference should be used.

REFERENCES

1. Waterlow JC. Note on the assessment and classification of protein-energy malnutrition in children. Lancet. 1973;2:87-9.
2. WHO. Guiding principles for feeding non-breastfed children 6-24 months of age. Geneva: WHO; 2005.
3. Badham J, Sweet L. Stunting: An Overview. Sight and Life. 2010(3):40-7.
4. WHO. Complementary feeding:Report of the global consultation. Geneva:WHO; 2002.
5. Brown KH. The importance of dietary quality versus quantity for weanlings in less developed countries: a framework for discussion. Food Nutr Bull. 1991;13(2):86-94.
6. Zhang J, Shi L, Wang J, Wang Y. An infant and child feeding index is associated with child nutritional status in rural China. Early Hum Dev. 2009;85(4):247-52.
7. Caulfield LE, de Onis M, Blössner M, Black RE. Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles. Am J Clin Nutr. 2004 Jul 1;80(1):193-8.
8. El Taguri A, Besmar F, Abdel Monem A, Betilmal I, Ricour C, Rolland-Cachera M. Stunting is a major risk factor for overweight: results from national surveys in 5 Arab countries. East Mediterr Health J. 2009;15(3):549-62.
9. Eriksson JG, Forsen T, Tuomilehto J, Osmond C,Barker DJ. Early growth and coronary heart disease in later life: longitudinal study. BMJ. 2001;322:949-53.
10. Tomkins AM, Dunn DT, Hayes RJ. Nutritional status and risk for morbidity among young Gambian children allowing for social and environmental factors. Trans Roy Soc Trop Med Hyg. 1989;83:282-87.

11. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. The Lancet. 2008;371(9608):243-60.
12. Waterlow JC. Introduction. Causes and mechanisms of linear growth retardation (stunting). Eur J Clin Nutr. 1994;1(48 Suppl.):S1-S4.
13. Branca F, Ferrari M. Impact of Micronutrient Deficiencies on Growth: The Stunting Syndrome. Ann Nutr Metab. 2002;46(Suppl. 1):8-17.
14. Mamabolo RL, Alberts M, Mbenyane GX, Steyn NP, Nthangeni NG, Delemarre-van De Waal HA, et al. Feeding practices and growth of infants from birth to 12 months in the central region of the Limpopo Province of South Africa. Nutrition. 2004;20(3):327-33.
15. Ntab B, Simondon KB, Milet J, Cisse B, Sokhna C, Boulanger D, et al. A young child feeding index is not associated with either height-for-age or height velocity in rural Senegalese children. J Nutr. 2005 Mar;135(3):457-64.
16. Baig-Ansari N, Rahbar MH, Bhutta ZA, Badruddin SH. Child's gender and household food insecurity are associated with stunting among young Pakistani children residing in urban squatter settlements. Food Nutr Bull. 2006;27(2):114-27.
17. Lawal B.O, Samuel F.O. Determinants of nutritional status of children in farming households in Oyo state, Nigeria. African Journal of Food, Agriculture, Nutrition & Development. 2010;10(10):4235-53.
18. Moursi MM, Treche S, Martin-Prevel Y, Maire B, Delpeuch F. Association of a summary index of child feeding with diet quality and growth of 6-23 months children in urban Madagascar. Eur J Clin Nutr. 2008;63(6):718-24.
19. Alvarado BE, Tabares RE, Delisle H, Zunzunegui MV. [Maternal beliefs, feeding practices and nutritional status in Afro-Colombian infants]. Arch Latinoam Nutr. 2005 Mar;55(1):55-63.
20. Sawadogo PS, Martin-Prevel Y, Savy M, Kameli Y, Traissac P, Traore AS, et al. An infant band child feeding index is associated with the nutritional status of 6-to 23-month-old children in rural Burkina Faso. J Nutr. 2006 Mar;136(3):656-63.

21. Rah JH, Akhter N, Semba RD, de Pee S, Bloem MW, Campbell AA, et al. Low dietary diversity is a predictor of child stunting in rural Bangladesh. Eur J Clin Nutr. 2010 Dec;64(12):1393-8.
22. WHO. 10 facts on nutrition. 2010. [Online] Available from: http://www.who.int/features/factfiles/nutrition/facts/en/index9.html [Accessed 2011 Oct 5].
23. WHO. Complementary Feeding: Family foods for breasfed children. Geneva: Department of Nutrition for Health and Development, WHO; 2000.
24. UNICEF. Infant and young child feeding. 2008. [Online] Available from: http://www.unicef.org/nutrition/index_24826.html [Accessed 2011 Oct 10]
25. Saleemi MA, Ashraf RN, Mellander L, Zaman S. Determinants of stunting at 6, 12, 24 and 60 months and postnatal linear growth in Pakistani children. Acta Pædiatr. 2001;90(11):1304-8.
26. Kalanda BF, Verhoeff FH, Brabin BJ. Breast and complementary feeding practices in relation to morbidity and growth in Malawian infants. Eur J Clin Nutr. 2005;60(3):401-7.
27. UNICEF. Tracking progress on child and maternal nutrition: A survival and development priority, 2009. [Online] Available from: http://www.unicef.org/publications/files/Tracking_Progress_on_Child_and_Maternal_Nutrition_EN_110309.pdf. [Accessed 2012 Feb 24]
28. Frongillo EA, de Onis M, Hanson KMP. Socioeconomic and Demographic Factors Are Associated with Worldwide Patterns of Stunting and Wasting of Children. J. Nutr. 1997 Dec 1;127(12):2302-9.
29. Shrimpton R, Victora CG, de Onis M, Lima RC, Blössner M, Clugston G. Worldwide Timing of Growth Faltering: Implications for Nutritional Interventions. Pediatrics. 2001 May 1;107(5):e75.
30. WHO. Use and interpretation of anthropometric indicators of nutritional status. Bull World Health Organ. 1986;64:929-41.
31. WHO. Physical Status: The Use and Interpretation of Anthropometry:Report of a WHO Expert Committee. Geneva: WHO;1995. Technical Report Series No 854.

32. Mongkolchati A., et al. Prevalence and Incidence of Child Stunting from Birth to Two Years of Life in Thai Children: Based on the Prospective Cohort Study of Thai Children (PCTC). J Med Assoc Thai. 2010;93 (12):1368-78.
33. Wamani H, Astrom A, Peterson S, Tumwine J, Tylleskar T. Boys are more stunted than girls in Sub-Saharan Africa: a meta-analysis of 16 demographic and health surveys. BMC Pediatr. 2007;7(1):17.
34. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. What works? Interventions for maternal and child undernutrition and survival. Lancet. 2008;371(9610):417-40.
35. Brennan L, McDonald J, Shlomowitz R. Infant feeding practices and chronic child malnutrition in the Indian states of Karnataka and Uttar Pradesh. Econ Hum Biol. 2004;2(1):139-58.
36. Kramer MS, Chalmers, B., Hodnett, E. D., Sevkovskaya, Z., Dzikovich, I., Shapiro, S, et al. Promotion of breastfeeding intervention trial (PROBIT): A randomized trial in the Republic of Belarus. JAMA. 2001;285:413-20.
37. Butte NF, Lopez-Alarcon, M.G., & Garza, C. Nutrient adequacy of exclusive breastfeeding for the term infant during the first six months of life.WHO. 2002.
38. Agostoni C, Decsi T, Fewtrell M, Goulet O, Kolacek S, Koletzko B, et al. Complementary Feeding: A Commentary by the ESPGHAN Committee on Nutrition. J Pediatr Gastroenterol Nutr. 2008;46(1):99-110 10.1097/01.mpg.0000304464.60788.bd.
39. Victora C, Vaughan J, Martines J, Barcelos L. Is prolonged breast-feeding associated with malnutrition? Am J Clin Nutr. 1984 Feb 1;39(2):307-14.
40. Cogill. Anthropometric Indicators Measurement Guide.Washington D.C:Academy for Educational Development. 2003.
41. Victoria CG, de Onis M, Hallal PC, et al. Worldwide timing of growth faltering: revisiting implications for interventions. Pedeatrics. 2010;125:473-80.
42. WHO Multicentre Growth Reference StudyGroup: WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. Geneva, World Health Organization; 2006.

43. WHO. Physical Status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee, WHO Technical Report Series No. 854. Geneva: World Health Organization; 1995.

44. Ulijaszek SJ. Secular trends in growth: the narrowing of ethnic differences in stature. Nutrition Bulletin. 2001;26(1):43-51.

45. de Onis M, Garza C, Onyango AW, Borghi E. Comparison of the WHO Child Growth Standards and the CDC 2000 Growth Charts. J Nutr. 2007 Jan 1;137(1):144-8.

46. van't Hof MA, Haschke F. The Euro Growth study: why, who and how. J Pediatr Gastroenterol Nutr. 2000;31:S3-S13.

47. Wright CM, Booth IW, Buckler JMH, Cameron N, Cole TJ, Healy MJR,Hulse JA, Preece MA, Reilly JJ, WIlliams AF. Growth Reference Charts for use in the United Kingdom. Arch Dis Child. 2002;86:11-4.

48. United Nations Administrative Committee on Coordination/Sub-Committee on Nutrition. Fourth Report on the World Nutrition Situation: Nutrition Through the Life Cycle.Geneva:ACC/SCN. 2000.

49. Ministry of Public Health. Thailand Health Profile Report 2005-2007. Nonthaburi: The Ministry;2008.

50. Demographic Indicator, Thailand. 2010. [Online] Available from: http://www.childinfo.org/files/nutrition/DI%20Profile%20-%20Thailand.pdf [Accessed 2011 Dec 20]

51. WHO. Nutrition Landscape Information System,Country Profile. [Online] Available from: http://apps.who.int/nutrition/landscape/report.aspx?iso=THA&rid=161&template=nutrition&goButton=Go [Accessed 2011 Dec 20]

52. Tada Y KB, Pancharuniti N, Chamroonsawasdi K. Nutritional status of the preschool children of the Klong Toey slum, Bangkok. Southeast Asian J Trop Med Public Health. 2002;33(3):628-37.

53. Tienboon P, Wangpakapattanawong P. Nutritional status, body composition and health conditions of the Karen hill tribe children aged 1-6 years in Northern Thailand. Asia Pac J Clin Nutr. 2007;16(2):279-85.

54. Panpanich R, Vitsupakorn K, Chareonporn S. Nutritional problems in children aged 1-24 months: comparison of hill-tribe and Thai children. J Med Assoc Thai. 2000;83(11):1375-9.

55. Panpanich R, Vitsupakorn K, Brabin B. Breastfeeding and its relation to child nutrition in rural Chiang Mai, Thailand. J Med Assoc Thai. 2003;86(5):415-9.

56. WHO. Indicators for assessing infant and young child feeding practices: Part 3. Geneva: WHO;2007.

57. PAHO/WHO. Guiding principles for complementary feeding of the breastfed child. Washington DC: Pan American Health Organization/World Health Organization; 2002.

58. WHO. Complementary feeding. 2011. [Online] Available from: http://www.who.int/nutrition/topics/complementary_feeding/en/index.html [Accessed 2011 Oct 22].

59. UNICEF. Strategy for Improved Nutrition of Children and Women in Developing Countries. New York: Oxford University Press; 1990.

60. Shrimpton R, Kachondham Y. Analysing the Causes of Child Stunting in DPRK. Bangkok: Thai Health Promotion Foundation; 2003.

61. Benson T, Shekar M. Trends and Issues in Child Undernutrition. In: Jamison DT, Feachem RG, Makgoba MW, et al. Disease and Mortality in Sub-Saharan Africa. 2nd ed. Washington (DC): World Bank; 2006.

62. Adapted from ACC/SCN Fourth Report on the World Nutrition Situation. Geneva: ACC/SCN in collaboration with the International Food Policy Research Institute; 2000.

63. Delpeuch F, Traissac P, Martin-Prével Y, Massamba JP, Maire B. Economic crisis and malnutrition : socioeconomic determinants of anthropometric status of preschool children and their mothers in an African urban area. Public Health Nutr. 2000:39-47.

64. Aerts D, Drachler MdL, Giugliani ERJ. Determinants of growth retardation in Southern Brazil. Cadernos de Saúde Pública. 2004;20:1182-90.

65. Sakisaka K, Wakai S, Kuroiwa C, Flores LC, Kai I, Mercedes Arago´n M, et al. Nutritional status and associated factors in children aged 0–23 months in Granada, Nicaragua. Public Health. 2006;120(5):400-11.

66. Medhin G, Hanlon C, Dewey M, Alem A, Tesfaye F, Worku B, et al. Prevalence and predictors of undernutrition among infants aged six and twelve months in Butajira, Ethiopia: The P-MaMiE Birth Cohort. BMC Public Health. 2010;10:1-15.

67. El Taguri A, Betilmal I, Mahmud SM, Monem Ahmed A, Goulet O, Galan P, et al. Risk factors for stunting among under-fives in Libya. Public Health Nutr. 2009 Aug;12(8):1141-9.

68. Forste R. Infant feeding practices and child health in Bolivia. J Bio Soc Sci. 1998 Jan;30(1):107-25.

69. Kwena AM, Telouw DJ, Devlas SJ, Phillips-Howard PA, Hawley WA, et al. Prevalence of severity of malnutrition in pre-school children in a rural area of Western Kenya. Am J Trop Med Hyg. 2003;68(4):94-9.

70. Singh G.C.P, Nair M, Grubesic RB, Connell FA. Factors associated with underweight and stunting among children in rural Terai of eastern Nepal. Asia Pac J Public Health. 2009;21(2):144-52.

71. Espo M, Kulmala T, Maleta K, Cullinan T, Salin ML, Ashorn P. Determinants of linear growth and predictors of severe stunting during infancy in rural Malawi. Acta Pædiatrica. 2002;91(12):1364-70.

72. Mamiro PS, Kolsteren P, Roberfroid D, Tatala S, Opsomer AS, Van Camp JH. Feeding practices and factors contributing to wasting, stunting, and iron-deficiency anaemia among 3-23-month old children in Kilosa District, Rural Tanzania. J Health Popul Nutr. 2005;23(3):222-30.

73. Willey BA, Cameron N, Norris SA, Pettifor JM, Griffiths PL. Socio-economic predictors of stunting in preschool children: a population-based study from Johannesburg and Soweto. S Afr Med J. 2009;99:450-6.

74. Ricci J, Becker S. Risk factors for wasting and stunting among children in Metro Cebu, Philippines. Am J Clin Nutr. 1996 Jun 1;63(6):966-75.

75. Vitolo MR, Gama CM, Bortolili GA, Campagnolo PB. Some risk factors associated with overweight, stunting and wasting among children under 5 years old. Journal de Pediatria. 2008;84(3):251-57.

76. Kumar D, Goel NK, Mittal PC, Misra P. Influence of infant-feeding practices on nutritional status of under-five children. Indian J Pediatr. 2006;73(5):417-21.

77. Harnandes DS, Peterson KE, Dixit S, Para S, Barquera S, et al. Association of maternal short status with the stunting in Mexican children: Common gen vs Comon environment. Eur J Clin Nutr. 1999;53(12):938-45.

78. L.K. Zottarelli TSSaSR. Influence of parental and socioeconomic factors on stunting in children under 5 years in Egypt. East Mediterr Health J. 2007;13(6):1330-42.

79. Martorell R, Young MF. Patterns of Stunting and Wasting: Potential Explanatory Factors. Advances in Nutrition: An International Review Journal. 2012 Mar 1;3(2):227-33.

80. Park K. Textbook of Preventive and Social Medicine. 20th ed. Jabalpur (India): M/S Banarsidas: Bhanot Publishers; 2009. p450.

81. Alim F, Jahan F. Impact of Prenatal checkups of Mothers and Immunization of children on the Health Status of Children (0-3 years)- A Study in Rural Areas of Aligarh District,Uttar Pradesh. Online J Health Allied Scs. 2010;9(3):10.

82. WHO. Thailand: health profile. [Online] Available from: http://www.who.int/gho/countries/tha.pdf [Accessed 2011 Dec 20].

83. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. Lancet.370(9595):1358-69.

84. Howard D. Aspects of Maternal Morbidity: The Experience of Less Developed Countries. Advances in Maternal and Child Health. 1987;7:1-35.

85. Renaudin P. Evaluation of the nutritional status of children less than 5 years of age in Moundou, Chad. 1997;57(1):49-54.

86. Cunha AL. Relationship between acute respiratory infection and malnutrition in children under 5 years of age. Arch Pediatr 2000;89(5):608-9.

87. WHO. Infant and young child feeding. Model chapter for textbooks for medical students and allied health professionals. Geneva: WHO; 2009.

88. Umeta M, West CE, Verhoef H, Haidar J, Hautvast J.G.A.J. Factors Associated with Stunting in Infants Aged 5–11 Months in the Dodota-Sire District, Rural Ethiopia. J Nutr. 2003 Apr 1;133(4):1064-9.

89. Onyango A, Koski KG, Tucker KL. Food diversity versus breastfeeding choice in determining anthropometric status in rural Kenyan toddlers. Int J Epidemiol. 1998 Jun 1;27(3):484-9.

90. Saadeh R J, Labbok MH, Cooney K A, Koniz-Booher P (eds). Breast-feeding. The technical basis and recommendations for action. Geneva: World Health Organization; 1993. WHO/NUT/MCH/93.1.

91. Department of Health, Ministry of Public Health.Annual report 2005. Bangkok, Thailand: Ministry of Public Health; 2005.

92. WHO. The optimal duration of exclusive breastfeeding:report of an expert consultation.Geneva:WorldHealth Organization;2001 (WHO/NHD/0109,WHO/FCH/CAH 0124).

93. Feachem RG, Koblinsky MA. Interventions lor the control of diarrhoeal diseases among young children: promotion of breast-feeding. Bull World Health Organ. 1984;62:271-91.

94. Asha Bai PV, Leela M, Subramaniam VR. Adequacy of breast milk for optimal growth of infants. Trop Geogr Med. 1980;32:158-61.

95. Grummer-Strawn LM . Does prolonged breastfeeding impair child growth? A critical review. Pediatrics. 1993;91:766-71.

96. Victora CG, Huttly SRA, Barms FC, Martines JC, Vaughan JP. Prolonged Breastfeeding and Malnutrition: Confounding and Effect Modification in a Brazilian Cohort Study. Epidemiol. 1991;2(3):175-81.

97. Marquis GS, Habicht JP, Lanata CF, Black RE, Rasmussen KM. Association of breastfeeding and stunting in Peruvian toddlers: an example of reverse causality. Int J Epidemiol. 1997 Apr 1;26(2):349-56.

98. Fawzi WW, Herrera MG, Nestel P, et al. A longitudinal study of prolonged breastfeeding in relation to child undernutrition. Int J Epidemiol 1998;27(2):255-60.

99. Brakohiapa LA, Bille A, Quansah E, Kishi K, Yartey J, Harrison E, et al. Does prolonged breastfeeding adversely affect a child's nutritional status? Lancet. 1988;332(8608):416-8.

100. Briend A, Bari A. Breastfeeding improves survival, but not nutritional status, of 12-35 months old children in rural Bangladesh. Eur J Clin Nutr. 1989;43(9):603-8.

101. WHO. Infant and young children nutrition; global strategy for infant and young child feeding. WHA55.25. Geneva: Fifty-fifth World Health Assembly; 2002.

102. Knodel J, Kamnuansilpa P, Chamratrithirong A. Infant Feeding Practices, Postpartum Amenorrhea, and Contraceptive Use in Thailand. Stud Fam Plann. 1985;16(6):302-11.

103. Chusilp K, Somnasang P, Kirdpon W, Wongkham S, Sribonlue P, Mahaverawat U, et al. Observations on the development of stunting in children of the Khon Kaen region of Thailand. Eur J Clin Nutr. 1992 Jul;46(7):475-87.

104. Jackson DA, Imong SA, Wongsawasdii L, et al. Weaning practices and breast-feeding duration in Nothern Thailand. Brit J Nutr. 1992;67:149-64.

105. Pichaipat V, Thanomsingh P, Pudhapongsiriporn S, Buranasin P, Phanidanunt M, Monkalasiri R. An Intervention Model for Breastfeeding in Maharat Nakhon Ratchasima Hospital. Southeast Asian J Trop Med Public Health. 1992;23(3):439-43.

106. Faber M, Benadé AS. Perceptions of infant cereals and dietary intakes of children aged 4–24 months in a rural South African community. Int J Food Sci Nutr. 2001;52(4):359-65.

107. Saha KK, Frongillo EA, Alam DS, Arifeen SE, Persson LA, Rasmussen KM. Appropriate infant feeding practices result in better growth of infants and young children in rural Bangladesh. Am J Clin Nutr. 2008 Jun;87(6):1852-9.

108. Faber M, Benadé AS. Perceptions of infant cereals and dietary intakes of children aged 4–24 months in a rural South African community. Int J Food Sci Nutr. 2001;52(4):359-65.

109. Jean D. Skinner BRC, Kelly S, Houck, Frances Coletta, Richard Cotter, Dana Ott, Max McLeod. Longitudinal study of nutrient and food intakes of infants aged 2 to 24 months. J Am Diet Assoc. 1997;97:496-504.

110. Bolling K, Grant C, Hamlyn B, et al. Infant Feeding Survey 2005. PL London:PN The Information Centre, National Health Service. 2007.

111. Giovannini M, Riva E, Banderali G, Scaglioni S, Veehof SHE, Sala M, et al. Feeding practices of infants through the first year of life in Italy. Acta Pædiatrica. 2004;93(4):492-7.

112. Cribb VL, Warren JM, Emmett PM. Contribution of inappropriate complementary foods to the salt intake of 8-month-old infants. Eur J Clin Nutr. 2012 Jan;66(1):104-10.

113. Grummer-Strawn L, Scanlon K, Fein S. Infant feeding and feeding transition during the first year of life. Pediatrics. 2008;122:S36 - S42.

114. Grote V, Schiess SA, Closa-Monasterolo R, Escribano J, Giovannini M, Scaglioni S, et al. The introduction of solid food and growth in the first 2 y of life in formula-fed children: analysis of data from a European cohort study. Am J Clin Nutr. 2011 Dec 1;94(6 Suppl):1785S-93S.

115. Fox MK, Condon E, Briefel RR, Reidy KC, Deming DM. Food consumption patterns of young preschoolers: are they starting off on the right path? J Am Diet Assoc. 2010 Dec;110(12 Suppl):S52-9.

116. WHO. WHO Anthro, version 3.2.2: Software for assessing the growth and development of the world's children. Geneva: WHO; 2011.

117. WHO multicentre growth reference study group. WHO Child Growth Standards based on length/height, weight and age. Acta Pædiatrica. 2006;Suppl 450:76-85.

118. McNutt L-A, Chuntao Wu, Xue X, Hafner JP. Estimating the Relative Risk in Cohort Studies and Clinical Trials of Common Outcomes. Am J Epidemiol. 2003 May 15;157(10):940-3.

119. World Health Organization. Infant and child nutrition: Global strategy for infant and young child feeding. 2002.

120. Kramer M, Kakuma, R. The optimal duration of exclusive breastfeeding: a systematic review. Cochrane Database of Systematic Reviews 2002, Issue 1. Art. No.:CD003517. DOI: 10.1002/14651858.CD003517.

121. Vong-ek P. Patterns of maternal beliefs affecting duration of breast feeding in the central and the northeast of Thailand. Mahidol University at Salaya: Institute of Population and Social Research, Publication No. 152. 1990.

122. Tontisirin K, Winichagoon P, Chavasi V, Yamborisut U. In: Winichagoon P, Kachondham Y, Attig G, Tontisirin K, eds. Integrating food and nutrition into development: Thailand's experiences and future visions. Salaya, Thailand: Institute of Nutrition, Mahidol University, and Bangkok: UNICEF East Asia & Pacific Regional Office. 1992(133-45).

123. Neumann C, Harris DM, Rogers LM. Contribution of animal source foods in improving diet quality and function in children in the developing world. Nutrition Research. 2002;22(1–2):193-220.

124. Black ER ed. Zinc for child health. Am J Clin Nutr. 1998;68:409S-516S.

125. Marquis GS, Habicht JP, Lanata CF, Black RE, Rasmussen KM. Breast milk or animal-product foods improve linear growth of Peruvian toddlers consuming marginal diets. Am J Clin Nutr. 1997;66:1102-9.

126. Neumann CG, Harrison G. Onset and evolution of stunting in infants and children. Examples from the Human Nutrition Collaborative Research Support Program, Kenya and Egypt studies. Eur J Clin Nutr. 1994;48:S90-102.

127. Smith T, Earland J, Bhatia K, Heywood P, Singleton N. Linear growth of children in Papua New Guinea in relation to dietary, environmental and genetic factors. Ecol Food Nutr. 1993;31:1-25.

128. Caubet J-C, Wang J. Current Understanding of Egg Allergy. Pediatr Clin North Am. 2011;58(2):427-43.

129. Chang S-Y, He W, Chen C-M. Complementary Feeding and Growth of Infant and Young Child in China. Biomed Environ Sci. 2008;21(3):264-8.

130. Krebs NF. Meat as an early complementary food for infants: implications for macro- and micronutrient intakes. Nestle Nutr Workshop Ser Pediatr Program. 2007;60:221-9; discussion 9-33.

131. Hop LT, Gross R, Giay T, Sastroamidjojo S, Schultink W, Lang NT. Premature complementary feeding is associated with poorer growth of Vietnamese children. J Nutr. 2000;130(11):2683-90.

132. Villalpando S, Lóez-Alarcón M. Growth faltering is prevented by breast-feeding in underprivileged infants from Mexico City. J Nutr. 2000;130(3):546-52.

133. Cohen RJ, Brown KH, Dewey KG, Canahuati J, Landa Rivera L. Effects of age of introduction of complementary foods on infant breast milk intake, total energy intake, and growth: a randomised intervention study in Honduras. The Lancet. 1994;344(8918):288-93.

134. Wright CM, Parkinson KN, Drewett RF. Why are babies weaned early? Data from a prospective population based cohort study. Arch Dis Child. 2004 Sep 1;89(9):813-6.

135. Mondal SK, sen Gupta PG, Gupta DN, Ghosh S, Sikder SN, Rajendran K, et al. Occurrence of diarrhoeal diseases in relation to infant feeding practices in a rural community in West Bengal, India. Acta Pædiatr. 1996;85(10):1159-62.

136. Ziyane IS. The relationship between infant feeding practices and diarrhoeal infections. J Adv Nurs. 1999;29(3):721-6.

137. Anga G, Vince JD, Kaupa M. Early Introduction of Solids and Pneumonia in Young Infants in Papua New Guinea: A Case Control Study. J Trop Pediatr. 2008 Jun 1;54(3):192-5.

138. Armentia A, Bañuelos C, Arranz ML, Del Villar V, Martín-Santos JM, Gil FJM, et al. Early introduction of cereals into children's diets as a risk-factor for grass pollen asthma. Clinical & Experimental Allergy. 2001;31(8):1250-5.

139. Motarjemi Y, Kaferstein F, Moy G and Quevedo F. Contaminated weaning food: a major risk factor for diarrhoea and associated malnutrition. Bull World Health Organ. 1993;71(1):79-92.

140. Shamim S, Naz F, Waseem Jamalvi S, Sanower Ali S. Effects of weaning period on nutritional status of children. J Coll Physicians Surg Pak 2006;16(8):529-31.

141. Sass P. Does early introduction of solid food (before 4 months of age) lead to an increased risk of adult obesity? Evidence-Based Practice. 2006;9(7):9.

142. Huh SY, Rifas-Shiman SL, Taveras EM, Oken E, Gillman MW. Timing of Solid Food Introduction and Risk of Obesity in Preschool-Aged Children. Pediatrics. 2011 Mar 1;127(3):e544-e51.

APPENDICES

APPENDIX A

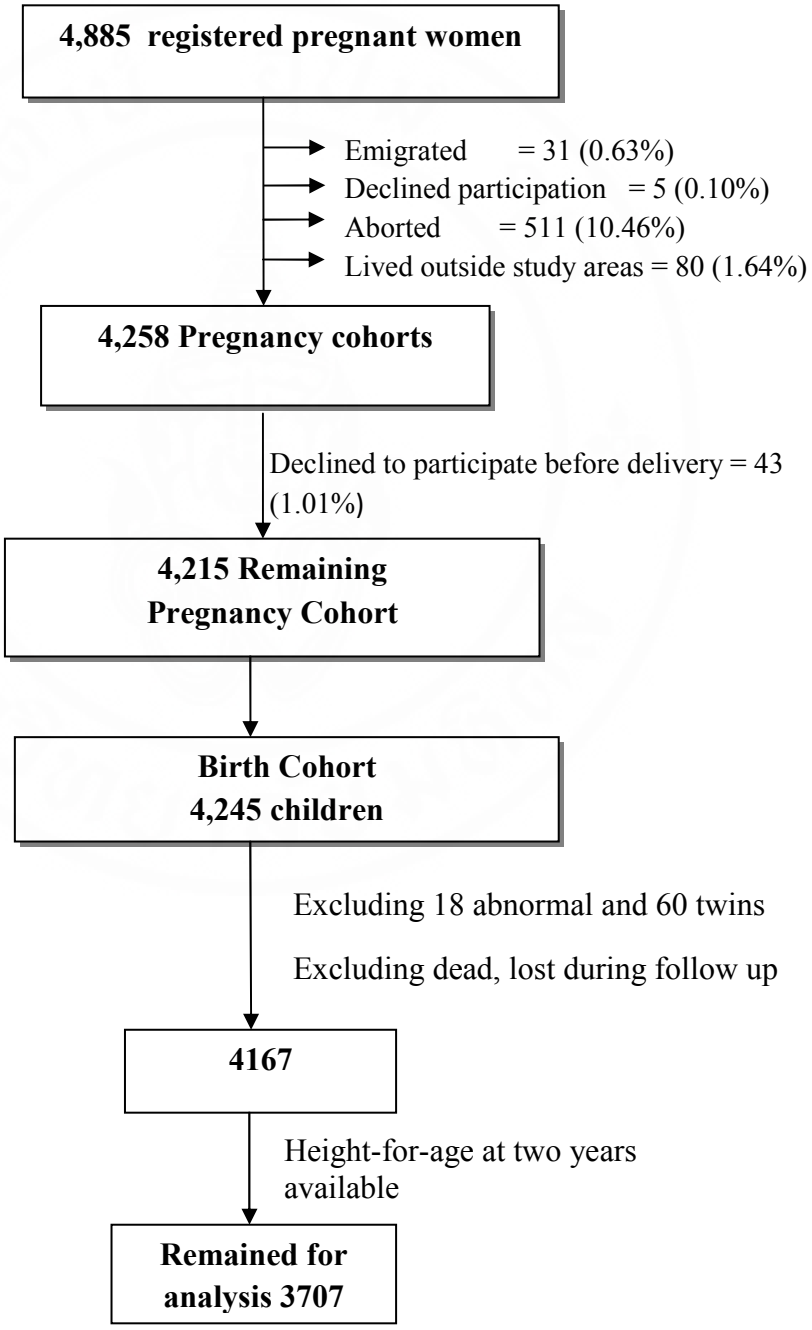

Figure 3.2 Design overview

APPENDIX B

Data Collection Instruments

Main outcome

Item	Form Number	Age	Variables Retrieved
1.	C08	6 months	Feeding Pattern at Age of 6 Months : Feeding, Development, Sleeping, Excretion, and Health Care
2.	D11	12 months	Physical Examination For Child at Age of 1 Year ± 1 Week
3.	D16	18 months	Physical Examination Age 18 Months ± 2 Weeks
4.	**N10,** ข **10**	**24 months**	แบบบันทึกการตรวจร่างกายและพัฒนาการเด็กอายุ **2** ปี **±** **2** สัปดาห์

Determinant

Item	Form Number	Age	Variables Retrieved
1.	G03	At Birth	VILLAGE DATA (PART 1) Survey by Researcher
2.	**K02**	At Birth	Socioeconomics of the Family **Idchd, K21IG, K21L, K21E1**
3.	**B02**		**B20C**
4.	**B05**	**At Birth**	**Pregnancy Outcome (upon delivery) B50, B53B**
5.	**C02**	**1 month**	**Child Rearing at 21 Days of Age C26**
6.	C03B	3 months	Behavior of Relationship Between Mother and Child While Breastfeeding at Age of 3 Months
7.	C04	3 months	Roles of Care giver for Child 3 Months of Age

Item	Form Number	Age	Variables Retrieved
8.	**C07**	**3 months**	**Feeding, Sleeping, and Development of Child Aged 3 months** **C71, C73**
9.	C07B	3 months	Child's Hospitalization as an Inpatient Within the First 3 Months of Age
10.	**C08**	**6 months**	**Feeding Pattern at Age of 6 Months : Feeding, Development, Sleeping, Excretion, and Health Care** **C81, C83**
11.	D03B	12 months	Hospitalization of Child At Age 6 Months to 1 Year
12.	**D05**	**12 months**	**Child Feeding, Development and Vaccination at Age of 1 Year ± 1 week** **D51A1, D51C1, D52, C83**
13.	D15	18 months	Questionnaire for Milk Feeding and Child Development at 18 months± 2 Weeks
14.	**E01**	**24 months**	แบบสัมภาษณ์การให้นม พัฒนาการ การเล่น สุขภาพฟัน การนอน การขับถ่าย การรับวัคซีน และการเลี้ยงดูเด็ก **at 2 years ± 2 weeks**
15.	**E03**	**24 months**	**Hospitalization of Child** **At Age 1 Year to 2 Years**
16.	**K06**	**-**	**Mother Practice during Pregnancy** **K61**

Note: The bold variables were retrieved for this study from PCTC

APPENDIX C

Food Calender

APPENDIX D

ที่ สธ 0321/ 2094

กระทรวงสาธารณสุข
ถนนติวานนท์ จังหวัดนนทบุรี 11000

๑๘ พฤษภาคม 2547

เรื่อง อนุมัติให้ดำเนินการวิจัยได้

เรียน ผู้อำนวยการสถาบันวิจัยระยะยาวในเด็กไทย

สิ่งที่ส่งมาด้วย 1. หนังสืออนุมัติ ฉบับภาษาไทย จำนวน 1 แผ่น
2. หนังสืออนุมัติ ฉบับภาษาอังกฤษ จำนวน 1 แผ่น
3. รายชื่อคณะกรรมการพิจารณาศึกษาวิจัยในคน กระทรวงสาธารณสุข จำนวน 1 ฉบับ

ตามที่ สถาบันวิจัยระยะยาวในเด็กไทย โดย นาง[illegible] ซึ่งเป็นหัวหน้าโครงการวิจัย "การวิจัยระยะยาวในเด็กไทยโครงร่างวิจัยระยะที่ 2 กรกฎาคม 2546 ถึง มิถุนายน 2553 (Ref. No. 40/2546 ได้เสนอโครงการดังกล่าวให้คณะกรรมการพิจารณาการศึกษาวิจัยในคน กระทรวงสาธารณสุข พิจารณาอนุมัติ นั้น

ในการนี้ กระทรวงสาธารณสุข โดยคณะกรรมการพิจารณาการศึกษาวิจัยในคน กระทรวงสาธารณสุข อนุมัติให้ดำเนินการตามโครงการดังกล่าวได้ อนึ่งคณะกรรมการ ฯ ขอแจ้งเกี่ยวกับหน้าที่และความรับผิดชอบของผู้วิจัยภายหลังได้รับการอนุมัติ คือ จะต้องแจ้งหรือรายงานสถานะ (status) ให้คณะกรรมการฯ ทราบทุกปี และเมื่อเกิดเหตุการณ์ต่อไปนี้ทุกครั้ง ได้แก่

1. เมื่อโครงการวิจัยหยุดลง ซึ่งอาจจะเป็นการดำเนินการวิจัยเสร็จสิ้นสมบูรณ์ หรืออาจจะไม่สามารถดำเนินการวิจัยต่อไปได้ พร้อมทั้งแจ้งสาเหตุของการยุติโครงการวิจัยให้ทราบด้วย
2. เมื่อมีการเปลี่ยนแปลงในโครงการวิจัยต้องระบุให้ชัดเจนว่า มีการเปลี่ยนแปลงอะไร อย่างไร พร้อมเหตุผลที่ต้องเปลี่ยนแปลง
3. เมื่อมีการเปลี่ยนแปลงหัวหน้าโครงการวิจัย หรือเพิ่มเติมคณะผู้วิจัย ต้องส่งประวัติของคนที่เปลี่ยนแปลงพร้อมเหตุผลให้คณะกรรมการ ฯ ทราบด้วย
4. เมื่อมีอาการไม่พึงประสงค์เกิดขึ้นในโครงการวิจัย ขอให้ผู้วิจัยวิเคราะห์สถานการณ์การเกิดอาการไม่พึงประสงค์ที่ relate, possible/likely, probably related, fatal กับโครงการวิจัยที่ท่านรับผิดชอบอย่างไร รวมทั้งขอทราบมาตรการในการดูแลป้องกันอาสาสมัครในประเทศไทยด้วย

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

Scan ไว้ให้
[illegible]

กรมการแพทย์
สำนักพัฒนาวิชาการแพทย์
โทรศัพท์/ โทรสาร 591-8251

/

เอกสารเลขที่ 34 /2547

คณะกรรมการพิจารณาการศึกษาวิจัยในคน
กระทรวงสาธารณสุข

โครงการวิจัย: การวิจัยระยะยาวในเด็กไทยโครงร่างวิจัยระยะที่ 2 กรกฎาคม 2546 ถึง มิถุนายน 2553 (Ref. No. 40/2546)

ผู้ดำเนินการวิจัยหลัก: นางสาวจันทร์เพ็ญ ฐาระภาวรรณ และคณะ

หน่วยงานรับผิดชอบ : สถาบันวิจัยระยะยาวในเด็กไทย

คณะกรรมการพิจารณาการศึกษาวิจัยในคน กระทรวงสาธารณสุข อนุมัติในแง่จริยธรรมให้ดำเนินการศึกษาวิจัยเรื่องข้างต้นได้

.....ประธานคณะกรรมการ
(นายเสรี โสตถิจินดา)

.....กรรมการและเลขานุการ
(นายปกรณ์ ศิริยง)

รับรองวันที่ 26 พฤษภาคม 2547 ถึงวันที่ 30 มิถุนายน 2553

Document No. 94 /2004

The Ethical Review Committee for Research in Human Subjects
Ministry of Public Health, Thailand

Title of Project : The Prospective Cohort Study of Thai Children (PCTC) Protocol for Phase II July 2003 to June 2010 (Ref.No.40/2546)

Principle Investigator : Ms Chanpen Choprapawan and staff

Place of Proposed Study : The Prospective Cohort Study of Thai Children.

We also confirm that we are an ethics committee constituted in agreement and in accordance with the ICH-GCP.

Approved by The Ethical Review Committee for Research in Human Subjects Ministry of Public Health, Thailand.

Seree Tuchinda
..... Chairman
(Mr. Seree Tuchinda)

Pakorn Sisiyong
..... Secretary
(Mr. Pakorn Sisiyong)

Date of Approval 26 May 2004 Date of expire 30 June 2009

Document No. 34 /2547

The Ethical Review Committee for Research in Human Subjects
Ministry of Public Health, Thailand
29 August 2001 - Present

Member Title and Name	Occupation (Position)	Qualification (If applicable)	Male/Female (M/F)	Tick
Chairman Mr. Seree Tuchinda	Director-General, Department of Medical Services	M.D.	M	-
Vice Chairman Mr. Vichai Chokevivat	Director-General, Department of development of Thai traditional and alternative medicine	M.D., M.P.H.	M	-
Member Mr. Luecha Wanaratana	Senior Public Health officer (Nutrition), Office of the Permanent Secretary	M.D.	M	-
Mr. Tanongsan Sutatam	Deputy director general, Department of Medical Services	M.D.	M	-
Mrs. Nanta Auamkul	Senior Medical Officer, Department of Health	M.D. M.Sc., MCH	F	✓
Mr. Supachai Rerkhngarm	Senior Expert in Preventive Medicine, Department of Communication Disease Control	M.D.	M	✓
Mr. Kasem Tantiphlachiva	Senior Psychiatrist Somdet Chaopraya Hospital, Department of Mental Health	M.D., B.Sc., FRCP sychT.	M	✓
Mrs. Mayura Kusump	Senior Principal Medical Scientist, Department of Medical Sciences	M.D.	F	✓
Ms. Yuppadee Javroongrit	Senior Pharmacist, The Food and Drug Administration	B.Sc.in.Pharm. M.S. , Ph.D.	F	✓
Mr. Pinit Kunlavanit	Secretary General, The Thai Medical Council	M.D., M.Sc.	M	✓
Director of Legal Affairs Division	Director of Legal Affairs Division, Office of the Permanent Secretary	Bachelor LL.b	F	✓

Document No. 34 /2547

Member Title and Name	Occupation (Position)	Qualification (If applicable)	Male/Female (M/F)	Tick
Director of Medical Registration Division	Director of Medical Registration Division, Office of the Permanent Secretary	M.D.	M	-
Mr. Wiwat Rojanapithayakorn	Senior Advisor, International Health Policy Program ,Bangkok	B.Sc., M.D., M.P.H.	M	-
Mrs. Oratai Rauyajin	Associate Professor, Faculty of Social Science and Humanities, Mahidol University	MA., M.P.H., Dr.PH	F	-
Secretary Mr. Pakorn Siriyong	Senior Medical Doctor Department of Medical Services	M.D., M.P.H.	M	✓
Assistant Secretary Mr.Korakot Chutasmit	Physician , Department of Medical Services	M.D.	M	✓
Mr. Suchart Chongprasert	Senior Pharmacist, The Food and Drug Administration	B.Sc in Pharm. Ph.D.	M	✓
Mrs. Rachneebool Udomchairat	Senior Health Technical Officer, Department of Medical Services	B.Sc. in Public Health nursing., M.A.	F	✓
Mrs. Porntiva Chaloemvipaht	Senior Health Technical Officer, Department of Medical Services	B.Sc. in Nurse & Midwife., M.P.H.	F	✓
Ms. Narukorn Thamkasem	Health Technical Officer, Department of Medical Services	B.Sc. in Nurse & Midwife.,M.A.	F	✓

Date of Meeting : 23 April, 2003

Date of Approval : 26 May ....,2004

For Protocol : The Prospective Cohort Study of Thai Children (PCTC) Protocol for Phase II July 2003 to June 2010 (Ref.No.40/2546)

Signed : Pakorn Siriyong .....(Secretary of Ethics Committee)

APPENDIX E

สำหรับพื้นที่อำเภอ.....

ใบยินยอมเข้าร่วมโครงการด้วยความสมัครใจ

การวิจัยเรื่อง **การศึกษาติดตามเด็กไทยตั้งแต่ก่อนคลอดไปในระยะยาว กับ ปัจจัยที่มีอิทธิพลทั้งด้านครอบครัว ชุมชน และสิ่งแวดล้อม**

วันให้คำยินยอม วันที่ .....เดือน.....พ.ศ. 254.....

ก่อนที่จะลงนามในใบยินยอมเข้าร่วมโครงการวิจัยนี้ ข้าพเจ้าได้รับคำอธิบายจากผู้วิจัยถึงวัตถุประสงค์ของการวิจัย วิธีการวิจัย อันตรายที่อาจเกิดขึ้นจากการวิจัย รวมทั้งประโยชน์ที่จะเกิดขึ้นจากการวิจัยอย่างละเอียด และมีความเข้าใจดีแล้ว ผู้วิจัยรับรองว่าจะตอบคำถามต่างๆ ที่ข้าพเจ้าสงสัยด้วยความเต็มใจ ไม่ปิดบัง ซ่อนเร้นจนข้าพเจ้าพอใจ

ข้าพเจ้ามีสิทธิที่จะบอกเลิกการเข้าร่วมโครงการนี้เมื่อใดก็ได้ และเข้าร่วมโครงการนี้โดยสมัครใจและการบอกเลิกการเข้าร่วมการวิจัยนี้ จะไม่มีผลต่อบริการต่างๆ ที่ข้าพเจ้าจะได้รับต่อไป

ผู้วิจัยรับรองว่าจะเก็บข้อมูลเฉพาะเกี่ยวกับตัวข้าพเจ้าและครอบครัวไว้เป็นความลับและจะเปิดเผยได้เฉพาะในรูปที่เป็นสรุปผลการวิจัย หรือการเปิดเผยข้อมูลต่อผู้มีหน้าที่เกี่ยวข้องกับการสนับสนุนและกำกับดูแลการวิจัยเท่านั้น

ผู้วิจัยรับรองว่าหากเกิดอันตรายใดๆ จากการวิจัยดังกล่าว ข้าพเจ้าจะได้รับการรักษาพยาบาลโดยไม่คิดมูลค่า และจะได้รับการชดเชยรายได้ที่สูญเสียไประหว่างการรักษาพยาบาลดังกล่าว ตลอดจนเงินทดแทนความพิการที่อาจเกิดขึ้น และรายละเอียดที่เกี่ยวกับการรักษาพยาบาลหรือเงินชดเชยดังกล่าว ข้าพเจ้าสามารถติดต่อได้ที่ผู้อำนวยการโรงพยาบาลอำเภอ.....จังหวัด.....

หรือ ผู้อำนวยการโครงการฯ พ.ญ. จันทร์เพ็ญ ชูประภาวรรณ สถาบันวิจัยระบบสาธารณสุข ที่อยู่ สถาบันวิจัยระบบสาธารณสุข กระทรวงสาธารณสุข อาคารกรมสุขภาพจิตชั้น 5 ถนนติวานนท์ อำเภอเมือง จังหวัดนนทบุรี หมายเลขโทรศัพท์ (02) 951-1284-95 ต่อ 145 และ 148 หรือหมายเลขโทรศัพท์เคลื่อนที่ (01) 868-3634 หรือ วิทยุติดตามตัว (1188) 7114420

ข้าพเจ้าได้อ่านข้อความข้างต้นแล้ว มีความเข้าใจดีทุกประการ จึงลงนามในใบยินยอมนี้ด้วยความเต็มใจ

ลงนาม.....ผู้ยินยอม

ลงนาม.....พยาน

ลงนาม.....พยาน

ข้าพเจ้าไม่สามารถอ่านหนังสือได้ แต่ผู้วิจัยได้อ่านข้อความในใบยินยอมนี้ให้ข้าพเจ้าฟังจนเข้าใจดีแล้ว ข้าพเจ้าจึงลงนามในใบยินยอมนี้ด้วยความเต็มใจ

ลงนาม.....ผู้ยินยอม

ลงนาม.....พยาน

ลงนาม.....พยาน

ในกรณีของบุตร/หลานข้าพเจ้า ซึ่งยังไม่บรรลุนิติภาวะ ผู้ปกครองหรือผู้อุปการะที่ชอบด้วยกฎหมาย จึงลงนามยินยอมด้วยความเต็มใจ

ลงนาม.....ผู้ปกครองที่ชอบด้วยกฎหมาย

ลงนาม.....พยาน

ลงนาม.....พยาน

ผู้อำนวยการโครงการวิจัยฯ ในฐานะผู้รับผิดชอบโครงการ ได้ทำความเข้าใจกับผู้ยินยอมแล้ว ผู้ยินยอมเข้าใจดีทุกประการ จึงลงนามในฐานะคู่สัญญา

ลงนาม.....ผู้อำนวยการ

ลงนาม.....พยาน

ลงนาม.....พยาน

APPENDIX F

Table 4.6 Association of socio-demographic, child and mother characteristics and health care with child stunting at 24 months using crude OR

Variables		WHO Reference			Thai Growth Reference		
	Total	S (%)	Crude OR	95% CI	S (%)	Crude OR	95% CI
Socio-Demographic Characteristics Family income* **							
≥25 percentile	2668	325(54.90)	1		275(54.89)	1	
<25 percentile	939	267(45.10)	2.86***	2.38-3.44	226(45.11)	2.76***	2.27-3.35
Study area* **							
Non hill tribe	3593	545(89.20)	1		461(89.17)	1	
Hill tribe	114	66(10.80)	7.69***	5.24-11.28	56(10.83)	6.56***	4.49-9.59
Child Characteristics Birth weight* **							
≥2500gm	3305	485(82.20)	1		410(82.16)	1	
<2500gm	280	105(17.80)	3.49***	2.69-4.53	89(17.84)	3.29***	2.51-4.32
Gender* **							
Boy	1873	257(42.1)	1		163(31.53)	1	
Girl	1834	354(57.9)	1.5***	1.26-1.79	354(68.47)	2.51***	2.06-3.06
Mother Characteristics Age of mother* **							
20-35 years	2874	439(72.09)	1		360(69.77)	1	
<20 years	445	85(13.96)	1.31*	1.01-1.69	79(15.31)	1.51***	1.15-1.97
>35 years	363	85(13.96)	1.7***	1.30-2.21	77(14.92)	1.88***	1.43-2.47
Education of mother* **							
Secondary/ higher	1666	164(26.93)	1		141(27.33)	1	
Informal/primary	2004	445(73.07)	2.61***	2.16-3.17	375(72.67)	2.49***	2.03-3.06

Table 4.6 Association of socio-demographic, child and mother characteristics and health care with child stunting at 24 months using crude OR (cont.)

Variables	WHO Reference				Thai Growth Reference		
			Crude			Crude	
	Total	S (%)	OR	95% CI	S (%)	OR	95% CI
Occupation of mother* **							
Housewife/student	650	99(16.26)	1		88(17.05)	1	
Agriculture/construc -tion labor/ fishermen	1988	428(70.28)	1.53***	1.20-1.94	357(69.19)	1.40**	1.09-1.80
Shopkeeper/ professionals/clerk	1049	82(13.46)	0.47***	0.35-0.64	71(13.76)	0.46***	0.33-0.64
Height of mother* **							
≥150 cm	3137	406(67.55)	1		338(66.27)	1	
<150 cm	518	195(32.45)	4.06***	3.30-4.99	172(33.73)	4.12***	3.32-5.10
Health Care ANC**							
≥ 4 times	3211	508(83.14)	1		426(82.40)	1	
<4 times	496	103(16.86)	1.39**	1.10-1.77	91(17.60)	1.47**	1.14-1.88
Well baby clinic**							
≥ 4 times	2470	440(72.85)	1		374(73.19)	1	
<4 times	1176	164(27.15)	0.75**	0.62-0.91	137(26.81)	0.74**	0.60-0.91
Illness at 24 months							
No	3233	530(87.31)	1		450(87.55)	1	
Yes	409	77(12.69)	1.18	0.91-1.54	64(12.45)	1.15	0.86-1.53

*, P <0.05; **, P <0.01; ***, P <0.001

Note: S stands for stunted children

Table 4.7 Association of time of introduction of complementary feeding with child stunting at 24 months using crude OR

Variables	WHO Reference				Thai Growth Reference		
	Total	S (%)	Crude OR	95% CI	S (%)	Crude OR	95% CI
Feeding Practices							
Prolonged breastfeeding* **							
≤12 months	1631	121(32.79)	1		102(32.69)	1	
>12 months	1140	248(67.21)	3.47***	2.75-4.38	210(67.31)	3.38***	2.64-4.35
Rice							
4-6m	1889	307(54.63)	1		260(54.74)	1	
<4m	1342	213(37.90)	0.97	0.80-1.18	179(37.68)	0.96	0.79-1.18
>6m	194	42(7.47)	1.42	0.99-2.05	36(7.58)	1.43	0.97-2.10
Cereal* **							
4-6m	1276	174(31.64)	1		148(31.76)	1	
<4m	1013	207(37.64)	1.63***	1.30-2.03	176(37.77)	1.6***	1.27-2.03
>6m	967	169(30.73)	1.34*	1.07-1.69	142(30.47)	1.31*	1.02-1.68
Chicken*							
4-6m	685	123(23.16)	1		102(22.82)	1	
<4m	43	13(2.45)	1.98*	1-3.91	11(2.46)	1.96	0.96-4.02
>6m	2468	395(74.39)	0.87	0.70-1.09	334(74.72)	0.89	0.70-1.14
Liver* **							
4-6m	1423	194(36.26)	1		163(36.14)	1	
<4m	127	11(2.06)	0.6	0.32-1.14	10(2.22)	0.66	0.34-1.29
>6m	1667	330(61.68)	1.56***	1.29-1.90	278(61.64)	1.55***	1.26-1.90
Yolk* **							
4-6m	2278	344(65.15)	1		291(64.81)	1	
<4m	499	63(11.93)	0.81	0.61-1.08	54(12.03)	0.83	0.61-1.13
>6m	528	121(22.92)	1.67***	1.32-2.11	104(23.16)	1.67***	1.31-2.14
Whole eggs							
4-6m	706	131(25.24)	1		112(25.45)	1	
<4m	56	10(1.93)	0.95	0.47-1.94	8(1.82)	0.88	0.41-1.92
>6m	2389	378(72.83)	0.83	0.66-1.03	320(72.73)	0.82	0.65-1.04
Fish* **							
4-6m	1401	184(34.52)	1		150(33.33)	1	
<4m	53	6(1.13)	0.84	0.36-2	5(1.11)	0.87	0.34-2.22
>6m	1742	343(64.35)	1.62***	1.33-1.97	295(65.56)	1.70***	1.38-2.10
Pork* **							
4-6m	1082	132(24.81)	1		105(23.39)	1	
<4m	73	7(1.32)	0.76	0.34-1.70	5(1.11)	0.68	0.27-1.73
>6m	2110	393(73.87)	1.65***	1.33-2.04	339(75.50)	1.78***	1.41-2.25

Table 4.7 Association of time of introduction of complementary feeding with child stunting at 24 months using crudeOR (cont.)

Variables	WHO Reference				Thai Growth Reference		
			Crude			Crude	
	Total	S (%)	OR	95% CI	S (%)	OR	95% CI
Leafy vegetables* **							
4-6m	1627	205(38.25)	1		174(38.33)	1	
<4m	163	16(2.99)	0.76	0.44-1.29	15(3.30)	0.85	0.49-1.47
>6m	1451	315(58.77)	1.92***	1.59-2.33	265(58.37)	1.87***	1.52-2.29
Other vegetables* **							
4-6m	1424	167(30.53)	1		136(29.44)	1	
<4m	165	14(2.56)	0.7	0.39-1.24	11(2.38)	0.68	0.36-1.28
>6m	1663	366(66.91)	1.29***	1.20-1.37	315(68.18)	2.21***	1.78-2.74
Banana* **							
4-6m	1327	236(41.04)	1		192(39.83)	1	
<4m	2023	281(48.87)	0.75**	0.62-0.90	242(50.21)	0.8*	0.66-0.98
>6m	173	58(10.09)	1.33***	1.18-1.49	48(9.96)	2.27***	1.57-3.27
Fruit juice* **							
4-6m	1297	187(34.31)	1		166(36.01)	1	
<4m	1479	202(37.06)	0.94	0.76-1.16	166(36.01)	0.86	0.68-1.08
>6m	591	156(28.62)	2.13***	1.67-2.71	129(27.98)	1.90***	1.48-2.45
Orange* **							
4-6m	788	108(21.56)	1		93(22.20)	1	
<4m	374	44(8.78)	0.84	0.58-1.22	38(9.07)	0.85	0.57-1.26
>6m	1921	349(69.66)	1.4**	1.11-1.77	288(68.74)	1.32*	1.03-1.69
Papaya*							
4-6m	936	129(24.39)	1		112(25.11)	1	
<4m	130	19(3.59)	1.07	0.64-1.80	16(3.59)	1.03	0.59-1.81
>6m	2081	381(72.02)	1.40**	1.13-1.74	318(71.30)	1.33*	1.05-1.67
Oil							
4-6m	597	113(21.08)	1		90(19.87)	1	
<4m	30	3(0.56)	0.48	0.14-1.60	2(0.44)	0.4	0.09-1.72
>6m	2612	420(78.36)	0.82	0.65-1.03	361(79.69)	0.9	0.70-1.16

*, P <0.05; **, P <0.01; ***, P <0.001

Note: S stands for stunted children

BIOGRAPHY

NAME	Miss Shrijana Joshi
DATE OF BIRTH	4th December, 1987
PLACE OF BIRTH	Lalitpur district, Nepal
INSTITUTION ATTENDED	Purbanchal University, 2006-2009 Bachelors in Public Health ASEAN Institute for Health Development, Mahidol University, Master of Primary Health Care Management (2011-2012)
HOME ADDRESS	Lalitpur-11, Nepal Tel 01-5532592
E-MAIL ADDRESS	shrijana_12@hotmail.com shrijana.joshi9@gmail.com