RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND FOOD PROVIDED TO CHILDREN AGED FROM 6 TO 24 MONTHS IN QUANG NGAI PROVINCE, VIETNAM

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ABSTRACT

A cross-sectional descriptive study was conducted to determine the relationship between the nutritional status and food provided to children aged from 6 to 24 months in Quang Ngai province, Vietnam. The study factors included parental socio-demographics, maternal knowledge, food provision practices, and maternal and child health care. Stratified sampling was used to select 250 mothers who had children aged from 6 to 24 months. After the mothers consented to participate in this study, they were interviewed using a structured questionnaire. Their children were measured for weight and height. The statistics used were Chi-square test and Multiple logistic regression.

Nearly 31% of the children were underweight. The following factors influenced the likelihood of children being underweight: maternal education, father's education, family income, child birth weight, maternal knowledge regarding food provision and child growth monitoring, frequency of essential food provision, orange juice provision, separation of food, amount of food eaten, the number of prenatal checkups, medical checkups before delivery, duration of day sleep, washing mother's hands before preparing food, drinking Oral Rehydration Solution, and latrines. Children who were fed with protein and iodine salt inappropriately had a greater risk of being underweight. When adjusting for other factors, children who were fed with protein inappropriately had a 2.18 times greater risk of being underweight than those who were appropriately fed.

Appropriate food feeding programs focusing on protein and iodine salt provision and raising maternal awareness of maternal and child health care should be implemented, especially for high risk groups (mothers with low education, mothers of low birth weight children, households without latrines, low family income) to reduce the prevalence of underweight children.

KEY WORDS: NUTRITIONAL STATUS/FOOD PROVISION/CHILDREN AGED 6 TO 24 MONTHS/UNDERWEIGHT

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LIST OF ABBREVIATIONS

ADB	:	Asian Development Bank
AIHD	:	Asean Institute for Health Development
ANC	:	Antenatal Care
ARI	:	Acute Respiratory Infection
BMI	:	Body Mass Index
HAZ	:	Height for Age
MoH	:	Minister of Health
NCHS	:	National Center for Health Statistics
NIN	:	National Institute of Nutrition
ORS	:	Oral Rehydration Solution
UNESCAP	:	United Nations Economic and Social Commission for Asia and the Pacific.
UNICEF	:	United Nations International Children's Emergency Fund
VDC	:	Village Development committee
WAZ	:	Weight for Age
WHO	:	World Health Organization
WHZ	:	Weight for Height

CHAPTER I
INTRODUCTION

1.1 Rationale and Justification

The States of Asia News Network on Thursday, Feb 19, 2009, reported that more than 32.6 per cent of children under 5 years old in Vietnam were malnourished, stunted or underweight, making the country one of the world's 20 worst performers in child nutrition (1).

Children aged from 6 to 24 months have the highest prevalence of malnutrition of any age group in Vietnam. The prevalence of underweight (weight for age) children nearly triples in this critical period, while the prevalence of wasting (low weight-for-height) and stunting (low height-for-age) doubles for children aged from 12 to 24 months. A 1995 study showed the prevalence of anaemia among 2 to 24-month-old children made up 60 percent of malnutrition children in Vietnam. As a result, underweight children are a burden on the country for survival, health, and growth and for its economic and physical productivity. Traditional home prepared foods such as a porridge or gruel for children do not have enough nutrition to meet the nutritional needs of these vulnerable children (2).

Figure 1.1 Map of the epidemiology for 6-24 month old children vulnerable to malnutrition in Vietnam.

Source National institute of Nutrition and UNICEF 2003 (2).

Quang Ngai province is one of the provinces that had the highest prevalence of malnutrition in children aged from 6 to 24 months. According to statistics from the Quang Ngai health service, in July, 2009, the total number of children under 24 months was 37,313, including 35,474 children who had growth charts and 6,465 malnourished children (17.97 percent). 96.3 percent of normal children were monitored every three months. 1,295 pregnancies and 5,559 mothers of children aged less than 24 months were trained about antenatal care and child care practices (3).

Table 1.1 Malnutrition and Poverty Rates in Four Target Provinces (4).

Indicators	Vietnam	Quang-ngai	Quang-binh	Nghe-an	Ha-tinh
percent of poor households (2001).	13.21 % (1999).	20-29.9 %	≥30 %	20-29.9 %	20-29.9 %
percent of underweight children under age 5 (2002).	30.1 %	37.4 %	41.5 %	34.7 %	39.1 %

Source American Red Cross. Vietnam Education & Child, Nutrition Initiative

The rate of 37.4 percent for underweight children made Quang Ngai province one of the three highest underweight children provinces in Vietnam. Malnutrition in the first years of a child's life is a very important problem which affects the child's growth and development. In order to solve this problem and increase average Vietnamese stature, many organizations provide support and resources for child nutrition programs (4).

Children aged from 6 to 24 months are a particularly high-risk group for malnutrition. Some health projects for controlling micronutrient deficiencies (iron, vitamin A, iodine) have been making progress. Exclusive breastfeeding for the first six months of life is considered crucial to warding off malnutrition. Almost all Vietnamese mothers have at some time breastfed their children but no statistics show the duration of breastfeeding, or when it was started. Many plans and strategies have

been implemented to reduce malnutrition and improve food security. The NIN and MOH have implemented a new master plan for nutrition on Infant and Young Child Feeding. However, challenges still remain. The prevalence of malnutrition in children is still very high at 37.8 percent (5).

The relationship between the nutritional status of children in Quang Ngai province aged from 6 to 24 months and the food provided to them, Vietnam should be studied because children in this age group suffer the highest prevalence of malnutrition of any age group in Vietnam. Children aged 6 to 24 months are growing rapidly, but their stomachs are still relatively small. During this time, they need highly nutritious foods, which provide sufficient nutrients in a small volume of food – nutrient dense foods. Furthermore, Vietnam is one of the world's 20 worst performers in child nutrition and Quang Ngai is one of the top three provinces of the 64 provinces in Vietnam that has the highest prevalence of malnutrition in children 6 to 24 months (4).

This study will focus on the weight-for-age indicator for two reasons Firstly, the prevalence of underweight (weight-for-age) children nearly triples in this critical period in comparison with that of wasting and stunting. Secondly, monitoring Vietnamese child nutritional status can be based on the child growth charts distributed to all mothers and which monitor weight-for-age (4).

This study, therefore, aims to explore factors relating to the nutritional status (weight for age indicator) of children aged 6-24 months in Quang Ngai in order to encourage appropriate and effective interventions by the government and other organizations.

1.2 Research question

What is the relationship between nutritional status and food provided to children aged 6 to 24 months in Quang Ngai province, Vietnam?

1.3 Research Objectives

1.3.1 General objective

To determine the relationship between nutritional status of children aged from 6 to 24 months and the food provided to them in Quang Ngai province, Vietnam.

1.3.2 Specific objectives

1.3.2.1 To determine the relationship between nutritional status of children aged from 6 to 24 months and socio demographic factors in Quang Ngai province, Vietnam.

1.3.2.2 To determine the relationship between nutritional status of children aged from 6 to 24 months and maternal knowledge about food for children in Quang Ngai province, Vietnam.

1.3.2.3 To determine the relationship between nutritional status of children aged from 6 to 24 months and food provided to them in Quang Ngai province, Vietnam.

1.3.2.4 To determine the relationship between nutritional status of children aged from 6 to 24 months and maternal and child health care in Quang Ngai province, Vietnam.

1.4 Conceptual framework

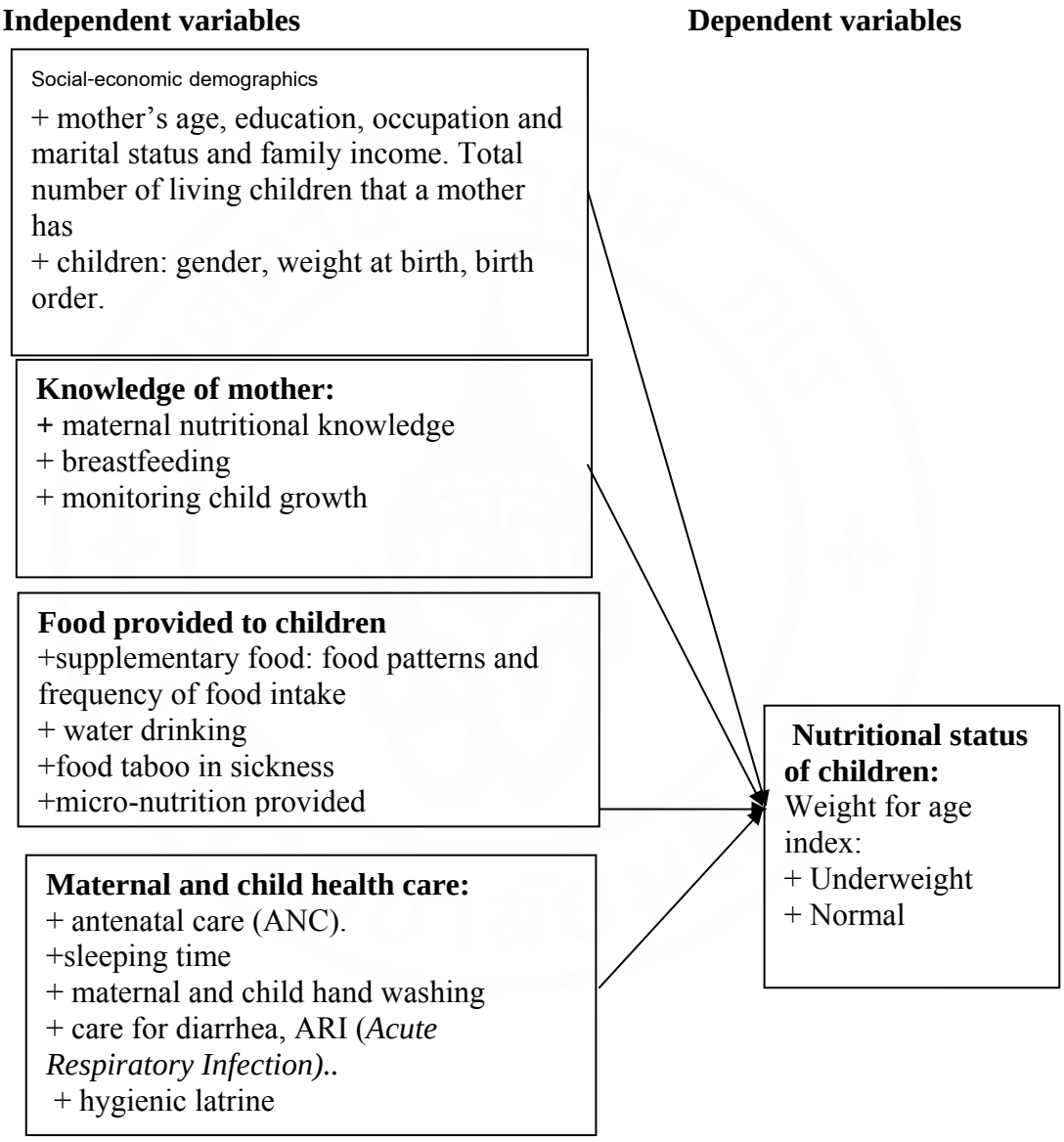


Figure 1.2 Conceptual framework.

1.5 Research hypotheses

1.5.1 There is a relationship between nutritional status in children aged from 6 to 24 months and socio demographic factors of parents

1.5.2 There is a relationship between nutritional status in children aged from 6 to 24 months and maternal knowledge about food provision

1.5.3 There is a relationship between nutritional status in children aged from 6 to 24 months and food provided to them.

1.5.4 There is a relationship between nutritional status in children aged from 6 to 24 months and maternal and child health care.

1.6 Operational definitions

1.6.1 Outcome variables:

Underweight child means the weight of a child for age less than minus 2 standard deviation (-2SD) from the median weight for age of the referent population.

Normal child means the weight of a child for age equal or greater than minus 2 standard deviation (-2SD) from the median weight for age of the referent population.

1.6.2 Socio-economic demographic factors

Age of the child in months is the number of months since the child's date of birth until the date of collecting data.

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

Marital status is classified into two groups

+ Group 1 married (living together).

+Group 2 Separated/ divorced/widow/ single mother.

Education is the educational level of the mother based on Vietnam's educational system. It is categorized as primary school, secondary school, high school, and higher education such as college, bachelor or master degree or higher.

Number of children refers to the number of living children under 5 years old that the mother was taking care of at the time of interview

Occupation is the main occupation of a mother and is divided into 6 categories housewife, farmer, laborer/factory worker, government officer, commerce/handicraft, and other.

Gender of child means male or female.

Weight at birth refers to the weight in grams of the child at birth.

1.6.3 Knowledge of mother refers to maternal knowledge about food supplementation, and maternal and child health care.

Breastfeeding refers to the duration of breastfeeding.

1.6.4 Foods provided to children

This term refers to breastfeeding and complementary feeding (9).

Complementary feeding Complementary feeding is defined as the process of starting other foods and liquids when breast milk alone is no longer sufficient, along with breast milk. The target age range for complementary feeding is generally taken to be 6 to 24 months of age, even though breastfeeding may continue beyond two years (10).

Food pattern refers to the kinds of food given to children daily.

Number of meals is defined as the number of meals provided for children daily based on WHO recommended guidelines for children at different ages (11).

Food taboo in sickness refers to cultural beliefs in different communities that mothers should avoid certain foods when a child falls sick (11).

1.6.5 Maternal health care

Antenatal care refers to the number of antenatal care visits during pregnancy.

Sleeping time of children refers to duration of time that children slept

Growth monitoring refers to mothers measuring and evaluating the weight of their children periodically based on the NIN guidelines that weight monitoring should occur every 3 months for normal children and every month for malnourished children

Disease of children refers to diseases or symptoms like diarrhea, fever, runny noses and coughs that occurred during the 2 weeks prior to the interview

1.7 Limitations of the study

This study was only concerned with the number of meals and kinds of food provided; it is not concerned with nutritional intakes or gradients of food. The study is only concerned with nutritional status in terms of weight-for-age and its related factors. Inferences of cause and effect are unwarranted in a cross-sectional study.

1.8 Usefulness of the study

This study highlighted the nutritional status of children aged from 6 to 24 months in Quang Ngai province, Vietnam, and the causes of the high prevalence of malnourished children. In order to solve this problem, appropriate interventions and participation of different organizations in the society were required. By identifying the causes, the government and other organizations were better able develop more effective strategies to solve and prevent child malnutrition.

CHAPTER II
LITERATURE REVIEW

2.1 Nutritional status of children situation, consequences and determinants

2.1.1 Nutritional status

Nutritional status means the condition of the body in those respects influenced by the diet; the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity (6).

The four variables used to undertake anthropometric assessment are age, sex, length and weight. Each of these variables provides one piece of information about a person. When they are used together they can provide important information about a person's nutritional status. Three indices are commonly used in assessing the nutritional status of children: weight-for-age; length/height-for-age, and weight-for-length/height (7).

Weight-for-age Low weight-for-age identifies the condition of being underweight, for a specific age. The advantage of this index is that it reflects both past (chronic) and or present (acute) under nutrition (although it is unable to distinguish between the two) (7).

Height-for-age Low height-for-age identifies past under nutrition or chronic malnutrition. It cannot measure short term changes in malnutrition. For children below 2 years of age, the term is length-for-age; above 2 years of age, the index is referred to as height-for-age. Deficits in length-for-age or height-for-age are referred to as stunting (7).

Weight-for-height Low weight-for-height helps to identify children suffering from current or acute under nutrition or wasting and is useful when exact ages are difficult to determine. Weight-for-length (in children under 2 years of age) or weight-for-height (in children over 2 years of age) is appropriate for examining short-term effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness.

The three indices are used to identify the three nutritional conditions are underweight, stunting, and wasting, respectively (7). Basing on the thresholds of WHO child growth standards about weight for age, length for age and weight for length, child nutritional status will be classified into following categories

Table 2.1 Nutrition categories of weight for age

Z scores of weight for age	**Nutritional status**
≥ +3 SD	heavy
+2 SD − <+3 SD	Overweight
-2 SD − <+2 SD	Average weight
-3 SD − <-2 SD	Under weight
<-3 SD	light

Source WHO- Child guideline standard (8).

Table 2.2 Nutrition categories of length for age

Z scores of length for age	**Nutritional status**
≥ +3 SD	tall
+2 SD − <+3 SD	Slightly tall
-2 SD − <+2 SD	Average height
-3 SD − <-2 SD	Slightly short
<-3 SD	short

Source WHO- Child guideline standard (8).

Table 2.3 Nutrition categories of weight for length

Z scores of weight for length	Nutritional status
≥ +3 SD	obese
+2 SD −< +3 SD	fat
+1 SD −< +2 SD	Slightly fat
-1 SD −<+1 SD	proportionate
-2 SD −< -1 SD	Slightly slim
-3 SD − <-2 SD	slim
<-3 SD	skinny

Source WHO- Child guideline standard (8).

2.1.2 Child nutritional status globally

The UNICEF report published on 2 May 2006 showed that more than one quarter of all children under the age of five in developing countries were underweight, many to a life-threatening degree. Poor nutrition remains a global epidemic contributing to more than half of all child deaths, about 5.6 million per year. In terms of both the percentage of children and sheer numbers, the highest burden is in Asia. In fact, 73 percent of the 146 million children who are underweight live in just 10 countries (India, Bangladesh, Pakistan, China, Nigeria, Ethiopia, Indonesia, DRC, Philippines, and Vietnam) (12, 13).

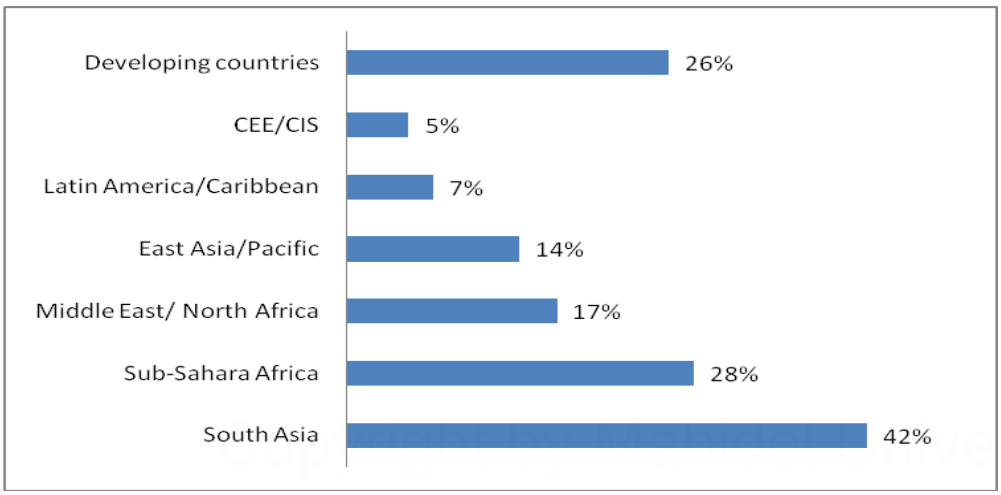


Figure 2.1 The prevalence of child underweight in the world.

Source USAID 2006 (12).

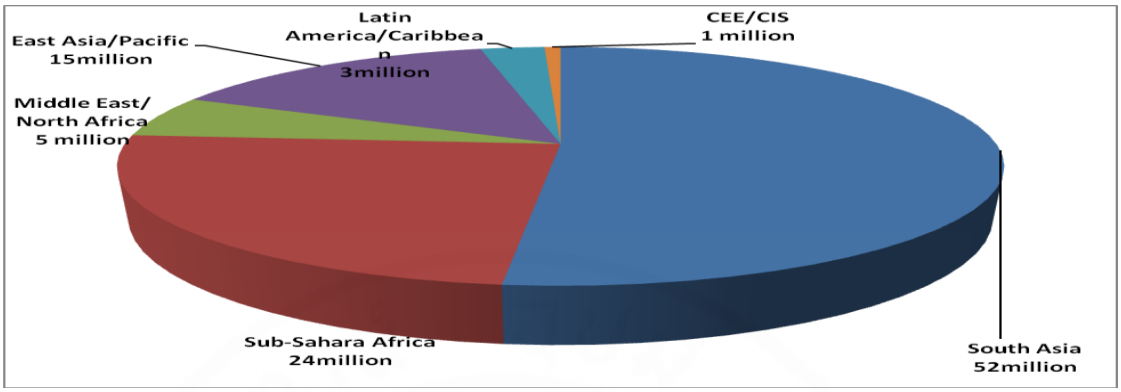


Figure 2.2 The prevalence of child underweight in low income countries

Source USAID 2006 (12, 13).

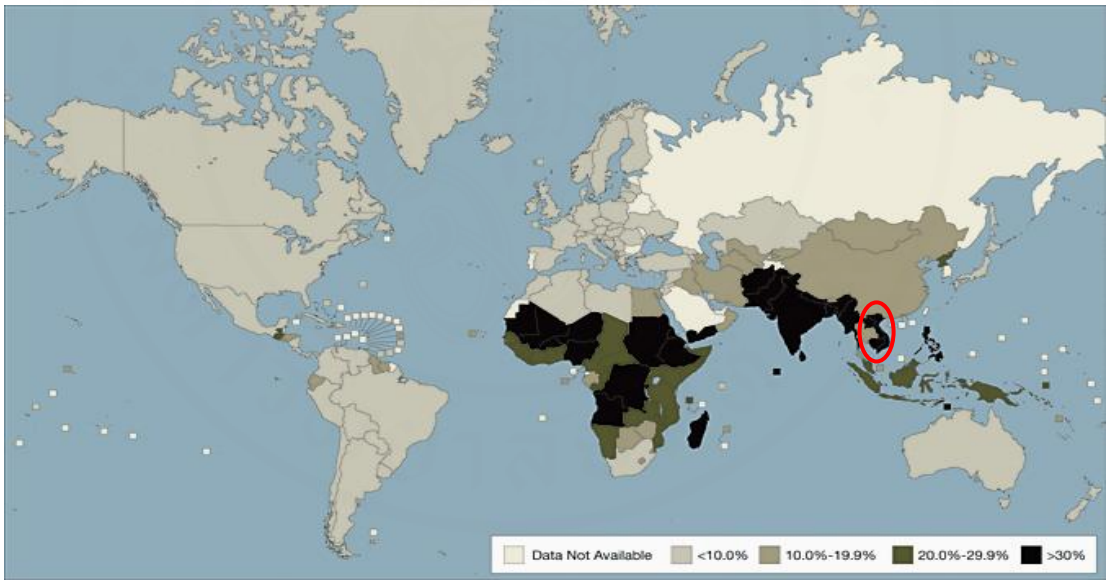


Figure 2.3 Estimates of Global Prevalence of Childhood Underweight in 1990 and 2015

Source *JAMA.* 2004; 2912600-2606 (14).

Without nutrition, our bodies could not stay warm, build or repair tissue, or maintain a heartbeat. Eating the right foods can help us avoid certain diseases or recover faster when illness occurs. These and other important functions are fueled by chemical substances in our food called nutrients. Nutrients are classified as carbohydrates, proteins, fats, vitamins, minerals, and water. Once digested, carbohydrates, proteins, and fats provide the body with the energy it needs to maintain

its many functions. The damaging effects of malnutrition can pass from one generation to the next, and good nutrition, therefore, plays an important role in the growth and development of children. Giving a child a solid nutritional start has an impact for life on her or his physical, mental and social development and well-being (15). Malnutrition weakens the immune system, making a child susceptible to disease, increasing severity of illness, and impeding recovery. A sick child, in turn, can quickly become malnourished. Age-appropriate breastfeeding and nourishing complementary foods, along with adequate health care, can break this vicious cycle (16).

Food provided to children

According to WHO guidelines about meal frequency and energy density for children 6-24 months, a healthy child should be provided with meals 4 to 5 times per day, with additional nutritious snacks (such as pieces of fruit or bread or chapatti with nut paste) offered 1 or 2 times per day, as desired. The appropriate number of feedings depends on the energy density of the local foods and the usual amounts consumed at each feeding. If energy density or amount of food per meal is low, more frequent meals may be required (17).

Table 2.4 Energy requirements, minimum meal frequency and minimum dietary energy density for non-breastfed children 6-24 months of age

Age	6-8 months	9-11 months	12-23 months
Average energy requirement (kcal/d)	615	686	894
Energy requirement + 2 SD (+ 25%)	769	858	1118
Functional gastric capacity (g/meal), based on 30 g/kg body weight	249	285	345
Number of meals required if energy density is			
0.6 kcal/g	5.1	5.0	5.4
0.8 kcal/g	3.9	3.8	4.1
1.0 kcal/g	3.1	3.0	3.2
Minimum energy density (kcal/g) required if meal frequency is			
3	1.03	1.00	1.08
4	0.77	0.75	0.81
5	0.62	0.60	0.65

Source Dewey et al., 2004 (17).

2.1.3 Child nutritional status in Vietnam

The Figure 2.4 shows that the prevalence of underweight children of developing countries in south East Asia was much higher than that in south Asia. South Asian countries have been making progress in decreasing the prevalence of malnutrition in children. However, challenges still remain, and the malnutrition rate for children under 5 years old is still high. Vietnam is in the 'top' 20 countries for child malnutrition. A report shows that about 33 percent of children in Vietnam are malnourished, stunted or underweight, making the country one of the world's 20 worst performers in child nutrition (1). Child malnutrition prevalence is most common in Tay Nguyen (Central Highlands) the north-western area, and the northern part of the central area, according to the Ministry of Health's National Institute of Nutrition.

A national conference on nutrition in February, 2009, in Hanoi showed that nutrition improvement activities in the previous year had reduced the rate of malnutrition in children by one percentage point, although the program had been hindered by the economic downturn and the outbreak of epidemics. One of the solutions discussed at the conference was increasing the prevalence of breastfeeding in babies' first six months by 5 percent, and the number of mothers having proper knowledge of nutrition by 10 per cent. A suggested target was to reduce underweight children by 1.1 per cent and stunting by 1.3 per cent. The ministry planned to keep strengthening public communication and education, and the care of pregnant women. Nutrition recovery activities and supplementary nutrition for pregnant women would also be included. Other plans included providing vitamin A for children from six months old to five years old and worming for children aged from 2 to 5 years old living in targeted communes.

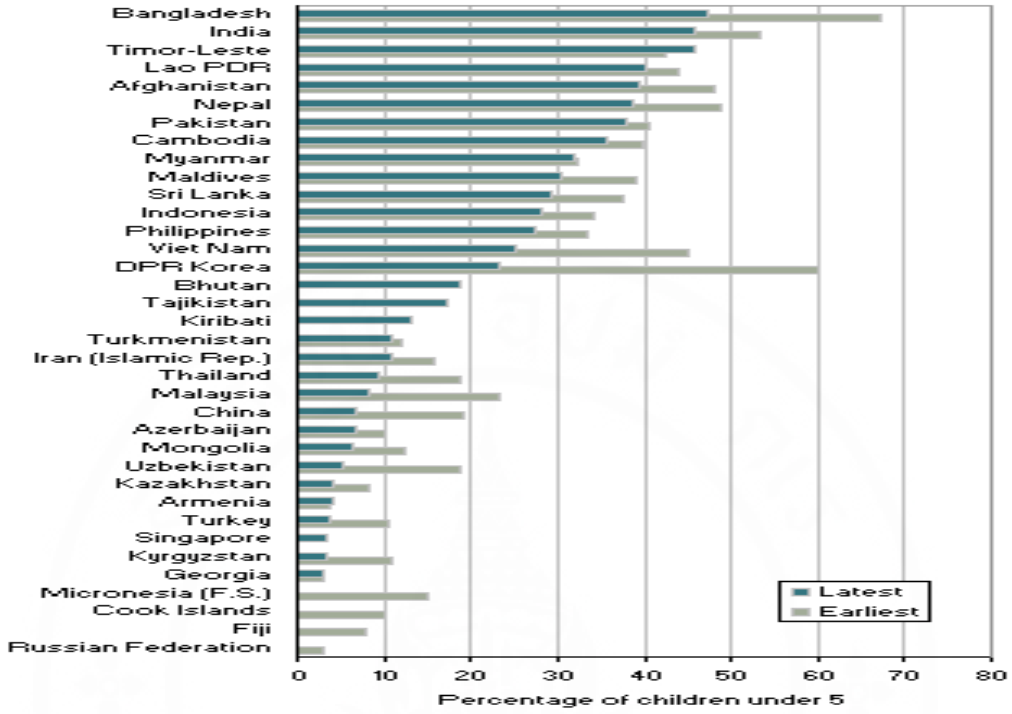


Figure 2.4 Underweight children in Asia and Pacific 2006 and 1990.

Source United Nations Millennium Development Indicators on 1 August 2008 (13).

The percentage of children aged 0-5 years with their weight below minus 2 standard deviations from the median weight for age of the international reference population as researched by the WHO.

2.1.4 Consequence of malnutrition

Underweight children often lack energy. They do not want to play. They sleep more. They may be quiet and "good", or miserable, but they are less interested in the environmental things happening around them. They do not explore or discover things. So they cannot learn and develop as quickly as well nourished children. A underweight child is difficult in school (18).

Dr. Sylvester Igbedioh, a UNICEF Zone 'A' Field Officer, observed that children who are undernourished have lowered resistance to infection and are more likely to die from such common childhood ailments as diarrheal diseases and respiratory infections (19).

Malnutrition is an essential direct and indirect risk factor for *mortality* among young children in developing countries. Malnutrition is the most important risk factor for disease, as malnourished children have *longer and harsher illnesses*. Malnutrition affects long-term growth and an individual's *physical capacity in adulthood*. Malnutrition has important effects on *brain development* and cognition. The period of early childhood is crucial for brain development as well as physical growth (18).

2.1.5 Determinants of nutritional status

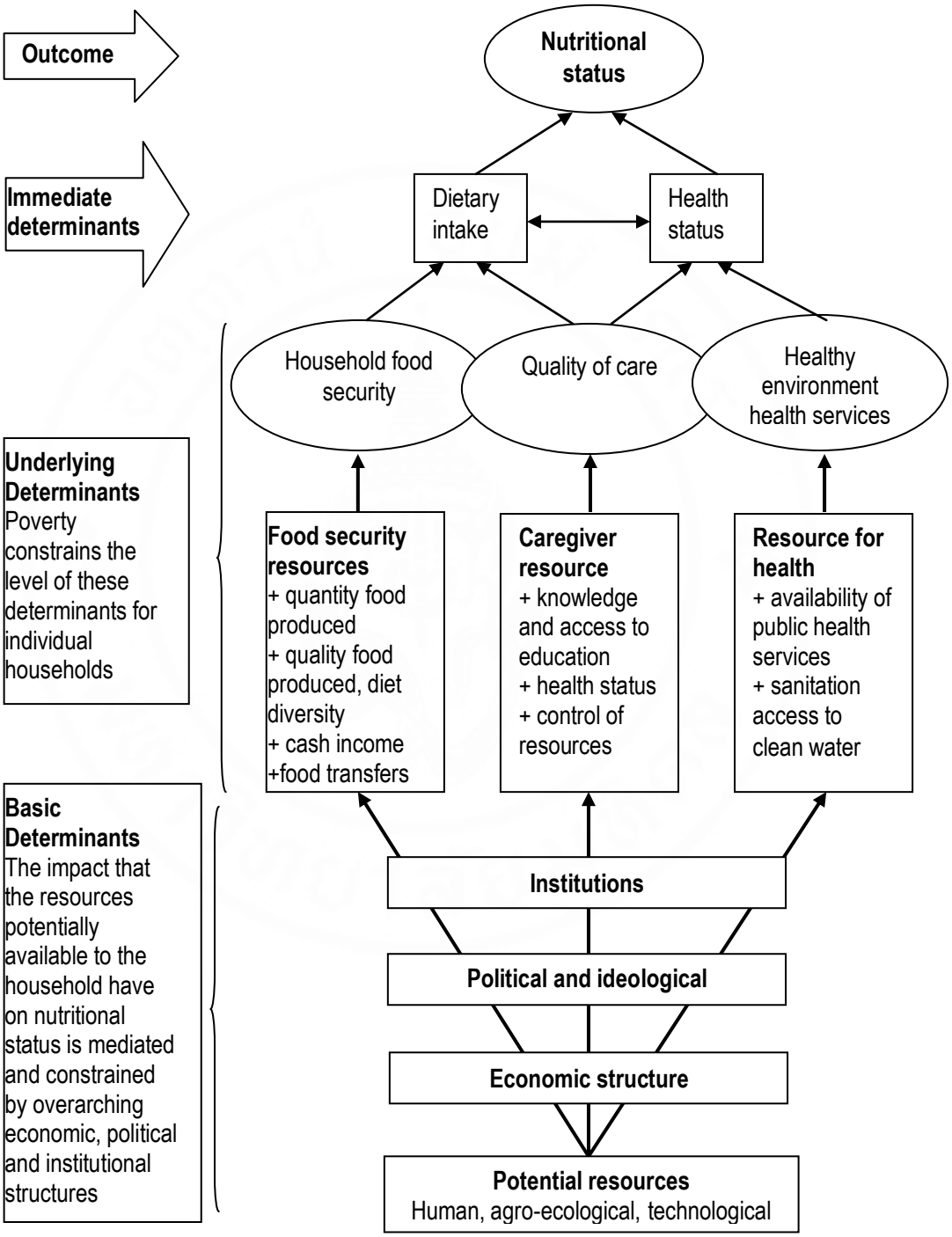


Figure 2.5 The UNICEF Conceptual Framework of the Determinants of Nutritional Status

Source Jonsson 1993; Smith and Haddad 2000; and UNICEF 1990 (20).

Figure 2.5 illustrates how malnutrition in children is directly attributable to two intermediate determinants individual dietary intake and health status. These, in turn, depend on three underlying determinants, namely household food security, the quality of care, and health services and a healthy environment. These underlying determinants are complementary and inter-dependent, and all need to be supported by resources. Thus, food security requires the availability of food in sufficient quantity and of sufficient quality; the quality of care depends on caregiver resources such as knowledge and education, appropriate care skills, health, and management ability; and health status depends on access to health services and a healthy environment (20).

The availability and distribution of resources operates at an individual and family level. However, they are also affected by additional basic determinants which may reflect how wider society is structured and organised economically, politically, socially and ideologically. Nutrition security, therefore, is achieved for a household when there is secure access to food coupled with a sanitary environment, adequate health services and knowledgeable care (21).

2.2 Theoretical model

The conceptual framework for this study is based on the UNICEF Conceptual Framework of the Determinants of Nutritional Status developed by Jonson 1993; Smith and Haddad 2000 and UNICEF 1990

The outcomes of study child nutritional status is measured by three indices (weight for age, height for age and weight for height).

Immediate factors food provided and sickness,

Underlying factors Antenatal care, care of sick children, and breastfeeding.

2.3 Literature

2.3.1 Socio demographic factors

Mothers' age

The study of Vitolo MR**.** showed that maternal age is associated with nutritional status of children. Mothers'age <20 years were related to the nutritional status of children (22).

Maternal educational levels

Maternal education influences child nutritional status because it affects maternal *health knowledge*, including knowledge about child nutrition (14). A study reported in Bangkok, in June 2003, showed that the prevalence of malnourished children taken care of by mothers with high educational levels was lower than that of malnourished children cared for by mothers with lower educational levels (23). A negative relationship between nutritional status of children and maternal educational level is expected because mothers who have high educational levels can take care of their children better than mothers with lower educational levels.

Number of children per household is the second risk factor of malnourished children (23, 24).

Child birth weight

The prevalence of malnourished children whose birth weights are ≥ 2.5kg is lower than that of children whose birth weights are < 2.5kg (24, 25). It is expected that there is a negative relationship between the nutritional status of children and birth weight.

Birth order

An increase in family size means an increase the number of dependent members to share the available expenditure and resources for living, and a decrease in the quality of their living and food intake. A positive relationship between the nutritional status of children and birth order is expected.

Age of children

Age of children relates to child malnutrition (23). It is likely that older children are more likely to suffer from malnutrition than younger children (25).

Gender of children

Whether a child is a boy or girl also relates to child malnutrition. Boys are likely favoured by parents over girls according to some cultural traditions. Therefore, malnourished boys tend to be fewer than malnourished girls. A positive relationship between boy child and the nutritional status of boys is expected (26).

Family income

A high income will increase the share of expenditure on food and access to nutritious food. This will make a child's meal better in terms of quality and quantity. Therefore, a negative relationship between the nutritional status of children and total household income is expected.

2.3.2 Knowledge of mothers

Nutritional awareness of mothers

After 6 months, babies need other foods to complement breast milk marking a new phase in their social, emotional, and behavioural development and their relationship with their parents. Feeding provides opportunities for development of communication skills, motor skills and hand-to-eye coordination. The consistency and texture of the foods given, how they are fed, and the amounts offered need to change as children grow and learn how to move food around in their mouths, to chew, to hold foods and a spoon and, in time, to feed themselves. This child-sensitive feeding is referred to as 'responsive feeding' and involves carers helping and encouraging children to eat (without force feeding), feeding slowly and patiently, experimenting with different foods and minimizing distractions so that feeding becomes a time for learning and love. Complementary feeding and continued breastfeeding is part of a caring transition from exclusive breastfeeding through to family foods (27).

The role of maternal nutritional knowledge in child health has been further examined as mothers' ability to rightly judge whether their children's growth status is normal or not as a proxy of maternal nutritional knowledge. Maternal diagnostic ability of child growth performance reflects a care giver's nutritional knowledge. A correct diagnosis is also a prerequisite for corrective action and is thus positively associated with a child's nutritional status (28).

Maternal nutritional knowledge and a mother's ability to judge correctly her child's growth status is also an important aspect of maternal nutritional knowledge. Maternal diagnostic ability regarding a child's growth performance not only reflects a care giver's nutritional knowledge in the abstract but a correct diagnosis is also a prerequisite for corrective action and is positively associated with a child's nutritional status (29).

Mothers with better knowledge of nutrition may practice and prepare food and meals more effectively and efficiently to improve their children's nutritional condition. Therefore, a negative relationship between the nutritional status of children and maternal knowledge of nutrition is expected.

Breastfeeding is the process of feeding newborn milk directly from the breast. Milk from human females provides all the nutrients that a baby needs, as well as substances that promote growth and help fight infection. Colostrums contain a greater concentration of antibodies than the milk that follows it; however, breast milk also contains these agents which have been shown to protect infants against life threatening intestinal disorders. Antibodies inactivate dangerous bacteria in infants' digestive tracts where they would otherwise cause great harm, while promoting the growth of "digestive friendly" bacteria (30). According to an article in Lancet, prolonging breastfeeding can reduce total food intake and thus predispose to malnutrition (31).

From 6 months of age, infants need additional foods together with breastfeeding. Complementary feeding aims to give other foods and drinks to

'complement', as in 'make complete', the nutrients provided by human milk. 'Complementary feeding' supersedes the term 'weaning' which implies weaning off breast milk rather than adding to it. How much complementary food is required is estimated by calculating the gap between the nutrients which can be provided by breast milk and children's nutritional requirements. In 2001, energy requirements were revised downwards by around 20 percent in the 6-24 month age group. This means that breastfeeding is able to meet a higher proportion of children's energy needs than had previously been thought. Furthermore, technical documents tend to assume that as soon as children begin taking other foods, they take less breast milk, although there is other evidence that this need not be the case. How to complement continued breastfeeding is a challenge and providing too much food can reduce a child's desire to breastfeed so that foods displace human milk intake rather than complement it (32).

Better breastfeeding skills increase children's nutritional status. Therefore, it is expected that the better the mothers' breastfeeding skills, the higher the amount of energy their children receive.

2.3.3 Food provided to children

2.3.3.1 Supplementary food provision

From 6 to 24 months, children are growing rapidly, but their stomachs still have not enough space for their food. Therefore, their food should be high in nutrients or quality but small in quantity. They should consume nutrient dense foods. 'Family foods' should be considered because in most households, infants are fed from the same pool of foods that are eaten by the rest of the family. This is not meant to imply that older babies can move directly from exclusive breastfeeding to eating exactly the same meals as the rest of the family. Older babies and young children need to be given the 'best bits' of the family's food like beans, vegetables, fish and meat, modified (mashed, chopped, softened etc) to make it suitable for their eating abilities. At about 12 months of age, most children are physically able to eat foods of similar consistency to the rest of the family. In some circumstances, mothers may prefer to prepare separate nutritious foods specifically for their older babies.

Commercially made baby foods, which are properly fortified with suitable amounts of added vitamins and minerals, can be helpful if the family can afford them (33).

The foods given should 'complement' – make complete – the nutrients provided by breast milk. Optimal complementary feeding needs to be; Timely – started at the right time, so it does not lessen the benefits of breastfeeding; Nutritionally Adequate – provides the energy and nutrients needed by breastfed babies over 6 months of age; Safe – hygienically prepared and fed; Responsively fed – given in a way which is sensitive to what the child needs to achieve effective feeding (28). It is expected that providing appropriate complementary food in this way will increase a child's nutrition intake.

2.3.3.2 Food pattern

Kinds of food is divided into 8 groups 1- Carbohydrate foods (rice, maize, potato, wheat, plantain with some of the foods); 2- Protein (meat, poultry, fish or egg); 3- milk; 4-Vegetables, colour vegetables contain more nutrients than pale; 5-fruit; 6- fat or oil; 7- salt or salt with iodine; and 8-low energy food like snacks, candies and other. This is based on WHO guidelines (34, 35, 36 & 9).

2.3.3.3 Food taboo in sickness

A food taboo is a prohibition against consuming certain foods. Some nutritionists prefer to speak of "food avoidance" instead of food taboo (37). In sickness, children should not be forced to eat but some kinds of food should be changed and offered to stimulate their appetite so that they will be more likely to eat. However, most mothers breastfeed more during sickness, when the children eat less food. Therefore, taking care of sick children also relates to nutritional status of children (38).

2.3.3.4 Micro-nutrition provided

Some breastfeeding mothers may also need vitamin mineral supplements or fortified products, both for their own health and to ensure normal

concentrations of certain nutrients (particularly vitamins). in their breast milk. Such products may also be beneficial for pre-pregnant and pregnant women (10).

The key nutrients which older babies (over 6 months) need in greater amounts than can be provided by breast milk and typical complementary feeding, are iron and zinc. In some communities, vitamin A, some of the vitamin B group, vitamin C, folic acid and calcium should also be added (28). Therefore, a positive relationship between the nutritional status of children and supplementary vitamins and minerals, for children is expected.

2.3.4 Maternal and child health care

Antenatal care

In households where mothers make more antenatal visits, children are less likely to be wasted; these results suggest the significance of health facilities/services in reducing the incidence of underweight and wasting (39). Therefore, it is expected that there is a positive relationship between the number of antenatal visits and nutritional status of children.

Sleeping time of children

Sleep duration of less than 12 hours per day during infancy appears to be a risk factor for overweight and obesity in children. A growing body of evidence suggests that sleep deprivation has adverse effects on weight. In a study of sleep of children, sleep duration of less than 12 hours in a 24-hour period in the first 2 years of life was associated with higher adiposity and greater odds of being overweight at 3 years of age. Strategies to improve sleep duration of young children may be an important component of behavioural interventions that promote childhood overweight prevention (40).

Hand washing

Maternal and child hand washing play an important role in reducing child diseases that may cause child malnutrition (41). A Bangkok report has shown that only 14 percent of children of mothers who washed their hands with soap after child

defecation were malnourished compared with 18 percent of children of the mother who did not (23). Maternal hand washing with soap has a strong and significant association with the nutritional status of children (25). Therefore, it is expected that there is a negative relationship between child malnutrition and the frequency of hand washing.

Diarrhea and ARI

Regarding diarrhea, a study about the effects of diarrhea showed that 19 percent of malnutrition was caused by diarrhea (42). A negative relationship between nutritional status and diarrhea is expected.

With regard to ARI, a study about the effects of ARI showed that 24 percent of malnutrition was caused by ARI. A survey in the northeast of Brazil was used to examine the association between ARI, and malnutrition in children less than 5 years of age. Current and past malnutrition was associated with acute lower respiratory infection (ALRI) even after adjusting for potential confounders (odds ratio 2.03; 95% CI 1.20-2.43) Decreasing malnutrition along with timely and proper treatment of ARI may improve children's health in developing countries. A negative relationship between nutritional status and ARI is expected (42).

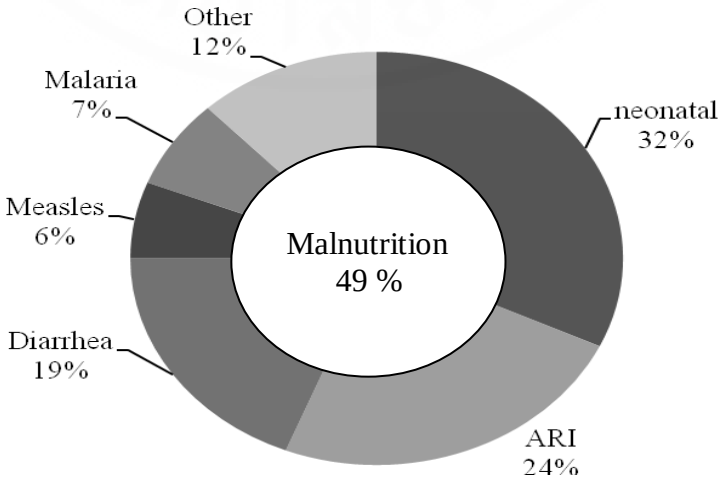


Figure 2.6 Diarrhea and ARI caused to child malnutrition with 19 percent and 24 percent respectively

Source Rae Galloway. Global Health Mini-University, October 27, 2006 (43).

Hygienic latrines

A workshop, in Bangkok, in June 2003, showed that the prevalence of malnourished children living in households with sanitary latrines was 10 percent as opposed to 20 percent where they lived in houses with unsanitary latrines. The nutritional status of children is better in houses with sanitary latrines than in house without sanitary latrines (23). Households with sanitary latrines have a strong and significant association with the nutritional status of children. Therefore, it is expected that there is a positive relationship between nutritional status and households with sanitary latrines.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Study design

A cross sectional study was conducted to determine the relationship between nutritional status and food provided to children aged from 6 to 24 months in Quang Ngai province, Vietnam.

3.2 Study areas and study population

Quang Ngai is a province of the south central coastal region of Vietnam with a population of nearly 1,271,370 people, including 1,064,879 people living in the delta region and 20, 6491 people living in the mountainous region and island. According to the Quang Ngai health service, in July 2009, the total number of children under 24 months was 37, 313, including 35, 474 children who had growth charts and 6, 465 malnourished children, (17. 97 %) (3).

Quang Ngai is divided into 14 districts belonging to 2 different geographic regions: the delta region and the mountainous-island region. The 14 districts are divided into 180 sub-districts and each district has one health station. The average distance from a health station to the remote communities is approximately 15 kilometers. All health stations can be accessed by a motorbike and are located in the community centers. Each sub-district has a network of village health volunteers.

Children aged from 6 to 24 months who were living in Quang Ngai province, were measured for weight and height by the research team.

3.3 Sample size

The sample size was computed according to the following formula:

$$n = \frac{z^2_{\frac{\alpha}{2}} NP(1-P)}{z^2_{\frac{\alpha}{2}} P(1-P) + (N-1)E^2} = \frac{1.96^2(37{,}313)0.1797(1-0.1797)}{1.96^2(0.1797)(1-0.1797) + (37{,}313-1)(0.05)^2} = 226$$

Where: at

$Z_{\alpha/2}$ = Standard normal score set at 95 percent confidence interval

P = 0.1797 (3).

N= 37,313 children (3).

E = degree of accuracy desired, setting at 0.05 (5 %).

To compensate for the possibility of incomplete data or withdrawal of participants, the sample size was increased by 10 percent. Therefore, the sample size in this study was at least 249

3.4 Sampling technique

There are some differences between the delta region and mountainous-island region in terms of geography, culture, and accessing health services. Therefore, a stratified random sampling technique was used to select 250 respondents from 14 districts (consisting of 180 communities).

The sample was selected by 3 steps:

Step 1 Based on the above differences, 14 districts were divided into 2 regions: 7 districts of the delta region including a city (total 114 communities) and 7 districts of the mountainous-island region (total 66 communities).

Step 2 One district from each region was conveniently selected as follows:

+ The Son Tinh was one of the delta districts in Quang Ngai province. It was selected from the delta districts because it was similar to 5 other districts in terms of

geography, culture, and accessing health services. Son Tinh is located in a large delta region with a main river crossing and a culture of water rice.

Son Tinh district consisted of 21 communities with one health care center for each community including maternal and child health care services and a net work of village health volunteers for each community. This is the same as other districts. Its social-demographic characteristics were typical of the other districts in the province. Moreover, Son Tinh district was nearer to the researcher's house than other 6 delta districts which made data collection convenient.

The Son Ha district was one of the mountainous districts in Quang Ngai province. It was selected from the mountainous districts because it was similar to the 6 other mountainous districts in terms of geography, culture, and accessing health services. Like other mountainous districts, its terrain is difficult for transport in the raining season because of the many forests, streams, rivers and muddy roads. However, the culture of its people has been diversified by minority ethnic groups.

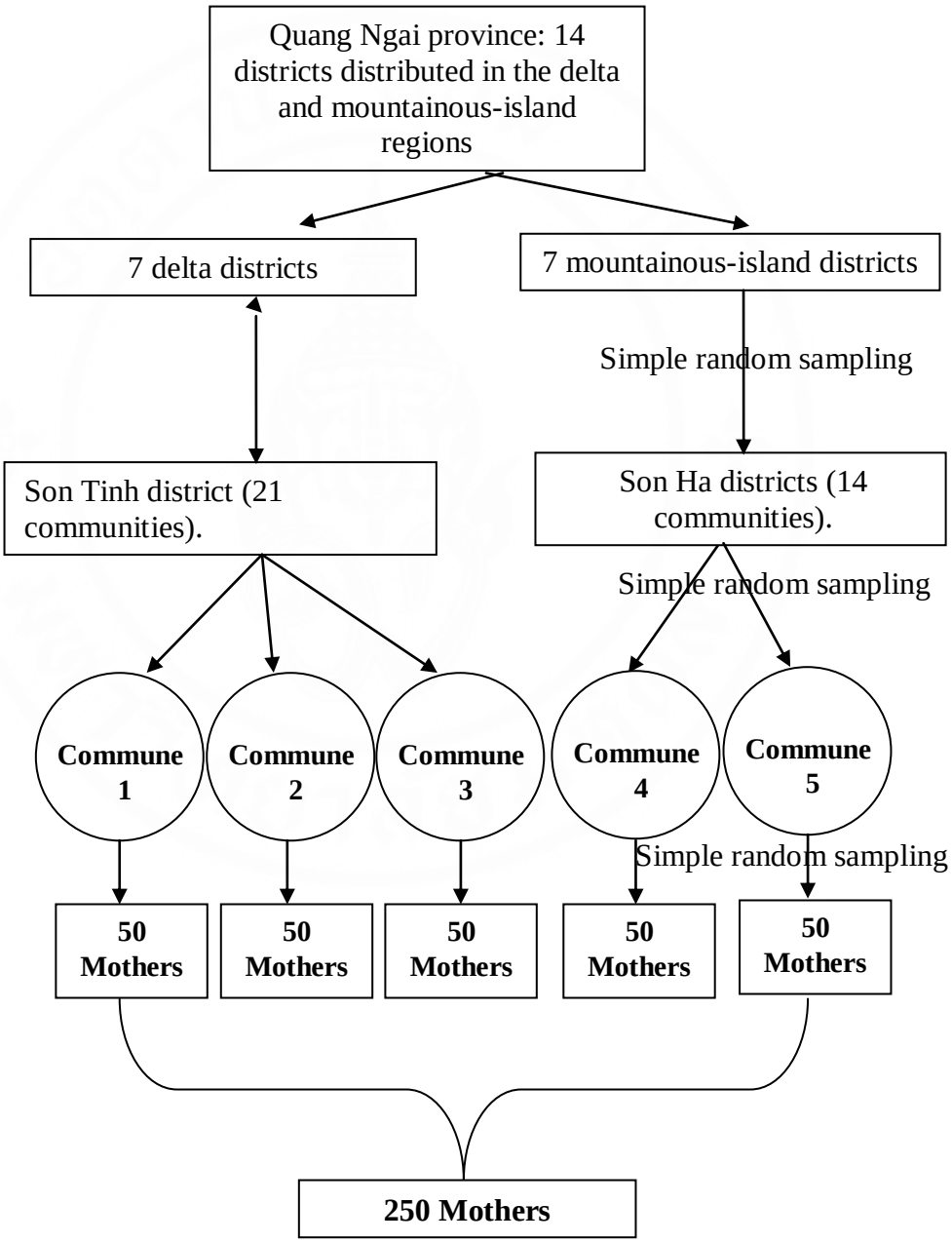
Son Ha district consisted of 14 communities with one health care center for each community, including maternal and child health care services and a net work of village health volunteers for each community. Its social-demographic characteristics were typical of the other mountainous districts in the province.

The island district is Ly Son consisting of 3 communities and a total population of 20.000. Therefore, it was not selected as representative of the mountainous-island districts. Moreover, Son Ha district was nearer to the researcher's house than the other 6 moutainous-island districts which made data collection convenient.

Step 3 The ratio between the 21communities of Son Tinh and the 14 communities of Son Ha is 3:2. Therefore, 3 communities were randomly selected from Son Tinh district and 2 communities were randomly selected from Son Ha district.

Step 4 From the 5 communities, 50 mothers with children aged 6 to 24 months were randomly selected from each community. In total, 250 mothers were selected from the 5 communities.

Stratified Sampling



3.5 Research instrument for data collection

A structured questionnaire was translated into Vietnamese, copied and used to collect data.

Part 1 Questions about socio-economic demographic factors: mother's age, marital status, education and occupation of mothers and fathers, children's age in months, gender, and weight at birth.

The criteria to evaluate are good and not good condition of socio-economic to feed the children;

Mother's age(44):

20-35 year olds	(normal group)	: 1 point
<20 or >35 years	(risk group)	: 0 points

Mother's education:

Secondary or higher	(normal group)	: 1 point
Primary school	(risk group)	: 0 points

Mother's occupation:

Employment	(normal group)	: 1 point
Unemployment	(risk group)	: 0 points

Father's education:

Secondary or higher	(normal group)	: 1 point
Primary school	(risk group)	: 0 points

Father's occupation:

Employment	(normal group)	: 1 point
Unemployment	(risk group)	: 0 points

Marital status:

Living together	(normal group)	: 1 point
Separated	(risk group)	: 0 points

Number of children:

≤ 2 children	(normal group)	: 1 point
> 2 children	(risk group)	: 0 points

Income:

Sufficient or better	(normal group)	: 1 point
Low income	(risk group)	: 0 points

Total possible scores ranged from 0 to 8 and were divided into 2 categories using the 25^{th} percentile as the cut-off point.

High score (Group 0) ≥ 25^{th} percentile

Low score (Group 1) < 25^{th} percentile

Part 2 Questions about knowledge of mothers, such as maternal nutrients, breastfeeding, using growth charts to monitor, time to introduce solid food, food provided to children. A correct answer was given 1 point and an incorrect answer was given 0 points. According to Benjamin S Bloom criteria (45), knowledge was categorized into three levels.

High knowledge means that percentage of correct answers > 80 percent of possible total maximum score. The high knowledge scores were higher than 12.8.

Moderate knowledge was set up as the percentage of correct answers of total maximum scores between 9.6 (60 %). and 12.8 (80 %).

Low knowledge means that percentage of correct answers < 60 percent of possible total maximum score. The low knowledge scores were lower than 9.6.

Part 3 the questions focus about food provided for the children: meals, kinds of supplementary food: food patterns, frequency and amount of food intake. The criteria to evaluate are appropriate and inappropriate.

The first time for feeding children by supplementary food:

Appropriate time is at 6 month of age (17, 35) : 1 point

Inappropriate time is before or after 6 month of age : 0 points

Kinds of food were classified into 8 groups, such as carbohydrates, protein, milk, vegetables, fruit, fat, salt and low nutrition foods. Many questions were set up for each group. Each question had the following possible answers: eat usually food = 4 points, sometimes = 3 points, rarely = 2 points, and never = 1 point. The frequencies of eating per week were usually (≥ 5 days per week), sometime (3-4 days per week), rarely (1 - 2 days per week), and never eat. The categories of each kind of food were as follows

Criteria for carbohydrates, protein, milk, vegetables, and fat or oil groups

Appropriate means ate ≥ 5 days/ week : 4 points

Inappropriate means ate < 5 days/week : 1 – 3 points

Criteria for fruit and salt groups

Appropriate means ate ≥ 4 days/ week : 3 or 4 points

Inappropriate means ate < 4 days/ week : 1 or 2 points

Criteria for low nutrition groups (17)

Appropriate means ate < 3 days/ week : 3 or 4 points

Inappropriate means ate ≥ 3 days/week : 1 or 2 points

According to WHO guidelines about complementary food for children aged from 6 to 24 months, children should eat all kinds of food every day except that low nutritional food should only be eaten on 1 or 2 days per week. Therefore, any kind of food was eaten by the children appropriately was given 2 points and inappropriately 1 point (17, 35).

Total possible scores ranged from 8 to 16 and were divided into 2 categories based on the median score:

Appropriate ≥ median (median=14, output from Minitab in chapter IV)
Inappropriate < median.

Supplementary milk to the child:

Yes:	powdered milk	: appropriate
No:	no supplementary milk	: inappropriate

Using oil in daily meal

Yes	: appropriate
No	: inappropriate

Orange juice:

Yes	: appropriate
No	: inappropriate

Main meals per day:

Appropriate is ≥ 3 main meals and 1 sub meal per day	: appropriate
Inappropriate < three main meals or no sub-meal per day	: inappropriate

Sub-meals per day:

Appropriate is ≥ 1 sub meal per day	: appropriate
Inappropriate < 1 or no sub-meal per day	: inappropriate

Separated food:

Separated : appropriate

Not separated : inappropriate

Amount of food:

Good eating, appetizing: Finishing all food or near all food: appropriate

Poor eating: Finishing less than 1/2 of amount of food : inappropriate

Drinking water:

Yes : appropriate

No : inappropriate

Part 4 Questions about maternal and child health care: antenatal care, sleeping time, and care for diarrhoea of children.

Antenatal care was divided into two categories, WHO recommend that antenatal care should consist of at least four visits with a doctor, nurse, or midwife during pregnancy. (46): Times of medical visits > 3 times : appropriate

Times of medical visits ≤ 3 times : inappropriate

Sleep at night time for 6 to 24 month children should be about 11hours (± 1 hour): appropriate. Otherwise is inappropriate

Sleep day time of the children 6-24 months is about

120-195 minutes : appropriate.

<120 or > 195 : inappropriate (47).

Hand washing:

Always + soap : appropriate

Never, sometimes washing or washing without soap : inappropriate

The questions about getting diarrhoea, using ORS, drinking ORS, and latrine

Yes : appropriate

No : inappropriate

Get fever or cough

No : appropriate

Yes : inappropriate

Pre-test of the questionnaire

The questionnaires were tested on 30 respondents randomly selected in the Nghia Dien community, a rural community of the province as a pre-test in December, 2009. The Kruder-Richardson method (KR20) was used to analyze the reliability of knowledge. The result showed that KR20 was equal to 0.728.

3.6 Data collection procedure

The data collection was conducted in January, 2010 after receiving approval from the ethic committee of Mahidol University (COA.No.MU-IRB 2009/320.1512)

1. Mothers with 6 to 24 month children in 5 randomly selected communities voluntarily participated in interviews to complete the questionnaires, weights and measures.
2. A course of training was provided for the research assistants who were 8 doctors and two nurses keeping the roles as directors of community health centers to familiarize them with the instrument administration procedure.
3. The mothers with children who voluntarily participated were invited to the community health centers.
4. A written information sheet was delivered to each mother. If they want to participate in the study, they signed the consent forms.

5. The purposes and processes of the interview and measurement were explained. Small gifts were prepared for them.
6. Community health staff measured the weight and height of the children under monitoring.
7. The assistants used the structured questionnaire to interview the respondents directly. It took about 6-8 minutes to complete the questionnaire.
8. The respondents were assured that their information would only used for study purposes and kept confidential.
9. The respondents were informed that they had the right to participate or withdraw from this study at anytime, and that their decision would not affect health services they would receive from the center in the future.
10. When the questionnaires were completed, the researcher and assistants thanked everyone for their cooperation and gave each respondent a gift.

3.7 Data analysis:

After the primary data was collected, it was coded, edited, entered and analysed using Epi-data software and then analyzed by WHO-Anthro and Minitab software. Statistical methods used were:

Chi-square test for determining the relationship between each independent variable and the dependent variable

Crude Odds ratio was used to show the strength of association with 95 percent confident interval.

The dependent variable was composed of two groups. Therefore, Multiple logistic regression was used to determine the relationship between all independent variables and the dependent variable.

CHAPTER IV
RESEARCH RESULTS

This cross sectional study was conducted to determine the relationship between nutritional status and food provided to children aged from 6 to 24 months in Quang Ngai province, Vietnam. Two hundred fifty mothers with their children were included in the study. The results of the study are presented on this chapter.

Part 4.1 The prevalence of nutritional status of children aged 6 to 24 months

Part 4.2 The relationship between the nutritional status of children and socio demographics factors.

Part 4.3 The relationship between the nutritional status of children and maternal knowledge.

Part 4.4 The relationship between the nutritional status of children and food provided.

Part 4.5 The relationship between the nutritional status of children and maternal and child health care.

Part 4.6 Predicting factors affecting the nutritional status of children.

4.1 The prevalence of nutritional status of children aged 6 to 24 months

WHO-Anthro software was used to process the data (age in days, weight and height) and generate z-scores for each child. The software was developed for the application of the WHO Child Growth Standards in monitoring growth and development in individuals and populations. These z-scores were categorized based on WHO standards (8). The nutritional status in Table 4.1 was determined by assessing weight for age and calculating nutritional status according to WHO standards. The Table shows the prevalence of overweight (0.80%), average weight (68.40%), underweight (22.40%), and light (8.40%). No child was heavy. These

categories were then divided into two groups **normal nutritional status (**average + overweight) and **underweight (**underweight + light) for further analysis.

For the height for age index, Table 4.1 shows that 49.60% of children were of average height. Nearly half (48.40%) were slightly short or short. However, only 2 percent were slightly tall and tall children. The nutritional status was determined by calculating weight for length and divided into 7 categories according to WHO standards. Table 4.1 also shows that 50 percent of the studied children were proportionate or normal nutritional status. Only 8 children (3.2%) were obese and 23 children (5.2%) were skinny

Table 4.1 Percentage distribution of nutritional status of studied children in Quang Ngai province

Nutritional status	Frequencies (n = 250)	Percent (%)
Nutritional status (weight for age index)		
Overweight	2	0.80
Average weight	171	68.40
Under weight	56	22.40
Light	21	8.40
Nutritional status (length for age index)		
Tall	3	1.20
Slightly tall	2	0.80
Average height	124	49.60
Slightly short	52	20.80
Short	69	27.60

Table 4.1 Percentage distribution of nutritional status of studied children in Quang Ngai province (cont.)

Nutritional status	Frequencies (n = 250)	Percent (%)
Nutritional status (weight for length index)		
Obese	8	3.20
Fat	10	4.00
Slightly fat	37	14.80
proportionate	128	50.00
Slightly slim	43	17.20
Slim	14	5.60
skinny	23	5.20

4.2 The relationship between the nutritional status (weight for age) of children and socio demographics of parents

4.2.1 Frequency and percentage of the respondents by socio-demographics factors

The socio demographic factors consisted of age, marital status, parental education and occupations, number of children, children's birth weights, order and gender. The results are shown in Table 4.2.

Table 4.2 shows that the majority (84%) of the studied mothers were 20 to 35 years old and the remaining 16 percent were under 20 or over 35 years old.

Regarding maternal education, 71.60 percent of the mothers had secondary or higher education and the remaining 28.40 percent had only primary education. Most (88.00%) of the mothers were employed and only 12 percent were unemployed. The majority (73.20%) of the father had had secondary or higher education and the remaining 26.80 percent had only had primary education. Most (87.60%) of the fathers were employed and a minority (12.40%) of the fathers were unemployed.

Almost all (96.40%) of the studied mothers were living together with their husbands and the remaining 3.60 percent were separated. Most (80.80%) of the studied mothers had 1 or 2 children and the remaining 19.20 percent had more than 2 children. Regarding family income, 46.00 percent of the families in this study had sufficient or better income and 54.00 percent of the families in study had financial difficulty. Regarding the studied children, nearly all (96.00%) of the studied children had a child birth weight greater than 2500 grams and the remaining 4.00 percent had a child birth weight less than 2500 grams. A majority (72.40%) of the studied children were the first or the second children in their families and 27.60 percent were the third or subsequent. More than a half of studied children (57.60%) were girls and the remaining 42.40 percent were the boys.

Table 4.2 Frequency and percentage of the respondents by socio demographics factors of parents

Characteristics	**Frequency (n= 250)**	**Percent (%)**
Age of mother (years)		
20 – 35	210	84.00
<20 or >35	40	16.00
Median=28 QD= 3.5 Min=16 and Max = 45		
Mothers 'educational levels		
≥ secondary	179	71.60
Primary education	71	28.40
Occupation of mothers		
Employed	220	88.00
Unemployed	30	12.00
Fathers 'educational levels		
≥ secondary	183	73.20
Primary education	67	26.80

Table 4.2 Frequency and percentage of the respondents by socio-demographics factors of parents (cont.)

Characteristics	Frequency (n= 250)	Percent (%)
Occupation of fathers		
Employed	219	87.60
Unemployed	31	12.40
Marital status		
Married	241	96.40
Separated	9	3.60
Total number of children		
≤ 2 children	202	80.80
≥ 3 children	48	19.20
Family income		
Sufficient or better income	115	46.00
Low income	135	54.00
Child birth weight		
≥2500 grams	240	96.00
<2500 grams	10	4.00
Median = 3000 QD = 200 Min =1700 and Max =3900		
Birth order		
Before the third child	206	72.40
The third or subsequent	44	27.60
Child gender		
Male	106	42.40
Female	144	57.60

4.2.2 The relationship between the nutritional status of children aged from 6 to 24 months and socio demographics of parents

Regarding socio demographics, Table 4.3 shows that maternal education, paternal education, and family income were factors which each related significantly to the nutritional status of children with P-value <0.001. Moreover, the child birth weight factor was found statistically significant with OR = 5.67 and P-value = 0.009. Other factors were not found significantly related.

Regarding maternal education, of the mothers with secondary education or higher, 79.33 percent had normal children and 20.67 percent had underweight children. On the other hand, 43.66 percent of mothers with only primary education had normal children and 56.54 percent of them had underweight children. The result showed that the children of the mothers with primary education or below had a 4.95 times greater risk of being underweight than the children of the mothers with at least secondary education (P-value < 0.001). Maternal educational levels related significantly to the nutritional status of children.

Regarding paternal education, of the fathers with secondary education or higher, 78.69 percent of them had normal children and 21.31 percent of them had underweight children. On the other hand, the fathers whose educational levels were primary 43.28 percent had children with normal nutritional status and 56.72 percent with underweight children. The result showed that the children of the fathers with primary education or below had a 4.48 times greater risk of being underweight than the children of the fathers with at least secondary education. Paternal educational levels related significantly to the nutritional status of children (P-value < 0.001).

Table 4.3 The relationship between the nutritional status of children and socio demographics of parents

Socio-demographics	Nutritional status Weight for age index		Crude OR	95%CI	P-Value
	Normal (%)	Underweight (%)			
Age of mother					
20 – 35	71.43	28.57	1		
<20 or >35	57.50	42.50	1.85	0.92-7.30	0.087
Mothers 'educational levels					
≥ secondary	79.33	20.67	1		
Primary education	43.66	56.34	4.95	2.74-8.95	<0.001*
Occupation of mothers					
Employed	70.00	30.00	1		
Unemployed	63.33	36.67	1.35	0.61-3.00	0.464
Fathers 'educational levels					
≥ secondary	78.69	21.31	1		
Primary education	43.28	56.72	4.84	2.66-8.81	<0.001*
Occupation of fathers					
Employed	69.86	30.14	1		
Unemployed	64.52	35.48	1.28	0.58-2.81	0.551
Marital status					
Married	70.12	29.88	1		
Separated	44.44	55.56	2.93	0.77-1.24	0.117
Total number of children					
≤ 2 children	69.80	30.20	1		
≥ 3 children	66.67	33.33	1.16	0.59-2.26	0.674
Family income					
Sufficient or better	81.74	18.26	1		
low	58.52	41.48	3.17	1.77-5.69	<0.001*

Table 4.3 The relationship between the nutritional status of children and socio demographics of parents (cont.)

Socio-demographics	Nutritional status Weight for age index		Crude OR	95%CI	P-Value
	Normal (%)	Underweight (%)			
Child birth weight					
≥2500 grams	70.83	29.17	1		
<2500 grams	30.00	70.00	5.67	1.42-2.54	0.009*
Birth order					
Before the third child	69.90	30.10	1		
The third, subsequent	65.91	34.09	1.20	0.60-2.40	0.605
Child gender					
Male	69.44	30.56	1		
Female	68.87	31.13	1.03	0.60-1.77	0.922

Significance at P-value< 0.01

In respect of family income, of the families having sufficient or better income, 81.74 percent had normal children and 18.26 percent had underweight children. On the other hand, of the families living with financial difficulty, 58.52 percent had normal children and 41.48 percent had underweight children. The result showed that the children of the families with financial difficulty had a 3.17 times greater risk of being underweight than the children of the families with sufficient or better income. Family income related significantly to the nutritional status of children (P-value < 0.001). Regarding child birth weight, of the studied children whose birth weights were greater than 2500 grams, 70.83 percent were normal and 29.17 percent were underweight. On the other hand, of the children whose birth weights were less than 2500 grams, 30 percent were normal and 70 percent were underweight. The result showed that the low birth weight children had a 5.67 times greater risk of being underweight than normal birth weight children. Child birth weight related significantly to the nutritional status of children (P-value = 0.009).

4.2.3 The relationship between the nutritional status (weight for age) of children and overall socio demographics

4.2.3.1 Percentage of overall socio demographics

In order to examine the overall index of socio demographics status about strength, prediction in logistic regression, and its effects to other factors, an index was created from variables in the part of socio demographics. Table 4.4 shows the overall frequency and percentage distribution of socio demographics of parents. Socio demographics levels were divided into two groups using the Quartile 1 as a cut off point. 83.60 percent of mothers had high scores and the remaining 16.40 percent had low scores.

Table 4.4 Frequency and percentage of parental social demographic

Socio demographics	Frequency (n=250)	Percent (%)
High	209	83.60
Low	41	16.40
Median = 7, QD = 1.5 Q1 = 5, Q3 = 8 Min = 2 Max = 8		

4.2.3.2 The relationship between the nutritional status of children and overall socio demographics

Table 4.5 shows that 75.46 percent of the children of the mothers with high scores were normal and 24.54 percent were underweight. However, of the mothers who had low scores, 57.47 percent had normal children and 42.53 percent had underweight children. The result showed that the children of the mothers with low socio demographics levels had a 3.24 times greater risk of being underweight than the children of the mothers with high status. Socio demographics of parents related significantly to the nutritional status of children (P-value=0.001).

Table 4.5 The relationship between the nutritional status of children and social demographic of parents

Socio demographics	Nutritional status		Crude OR	95%CI	P-Value
	Normal (%)	Underweight			
High	75.46	24.54	1		
Low	57.47	42.53	3.24	1.63-6.44	0.001*

4.3 The relationship between maternal knowledge and the nutritional status of children aged from 6 to 24 months.

4.3.1 The percentage of maternal knowledge.

Table 4.6 The Percentage distribution of the mothers by knowledge levels

Knowledge levels	Frequency (n=250).	Percent (%)
Good	78	31.20
Fair	85	34.00
Low	87	34.80
Q1 = 8, Q3 = 13 Min = 3 Max = 16 QD = 2.5		

Table 4.6 shows the knowledge of the mothers. It was found that 65.20 percent of the studied mothers had good or fair knowledge levels, and 34.80 percent had low knowledge levels. Only a minority of the studied mothers answered incorrectly to the questions about time of complementary food, monitoring healthy child, and taboo food while a majority of studied mothers answered correctly to the remaining of knowledge questions. Particularly, only 23.20 percent of studied mothers answered correctly to the appropriate time of the first feeding complementary food while almost all of studied mothers (96.80%) answered correctly to the question about vitamin C. The percentages of maternal knowledge in items of maternal knowledge were presented in the Table 4.15 in appendix B.

4.3.2 The relationship between maternal knowledge and the nutritional status of children.

Table 4.7 shows that of the mothers with good or fair knowledge levels, 75.46 percent had normal children and 24.54 percent had underweight children. On the other hand, 57.47 percent of the mothers with low knowledge levels had normal children and 42.53 percent had underweight children. The result showed that the children of the mothers with low knowledge had a 2.28 times greater risk of being underweight than the children of the mothers with Fair to good knowledge. Maternal knowledge levels related significantly to the nutritional status of children (P-value=0.004).

Table 4.7 The relationship between the nutritional status of children and maternal knowledge

Knowledge levels	Nutritional status weight for age index		Crude OR	95%CI	P-Value
	Normal (%)	Underweight			
Fair to good	75.46	24.54	1		
low	57.47	42.53	2.28	1.31-3.96	0.004*

Significance at P-value< 0.01

The study also revealed that knowledge of food provision about feeding the child appetizingly, vitamin A, monitoring malnourished children, direction of growth chart and goals of using growth chart were the factors which related significantly to the nutritional status of children. Other factors had no significant relationship with the nutritional status of children (Table 4.16 in the Appendix B).

4.4 The relationship between the nutritional status of children and food provided to them

4.4.1 The percentage distribution of food provision

Table 4.8 presents supplementary food times. 23.60 percent of the studied children were fed supplementary food at appropriate times and 76.40 percent were fed supplementary food at inappropriate times.

Regarding supplementary milk, a minority (16.40%) of the studied children were fed with supplementary milk besides breast milk while 83.60 percent were not. A majority (88%) of the studied mothers added oil to the children's daily meals while 12 percent did not. In order to examine vitamin C supply from natural resources, orange juice is presented in this Table as a variable. Slightly over half (55.60%) of the studied children were fed with orange juice while 44.40 percent were not.

Regarding number of main meals and sub-meals per day, 82 percent of the studied children had main meals ≥ 3 times/day and 18 percent of them had less than 3 meals/ day. However, all of the studied children had sub-meals at least once per day.

A minority 73.60 percent of the studied children had separated food while 26.40 percent had not separated food. 53.60 percent of the studied children finished all their food or nearly all their food on the day before the interview day while 46.40 percent did not. Regarding drinking water, almost all (88.80%) of the studied children drank boiled water and the remaining 11.20 percent did not.

In respect of frequencies of 8 kinds of food, in order to examine the overall index of frequencies of 8 kinds of food, an index was created for the eight kinds of food which were carbohydrates, protein, milk, vegetables, fruit, fat, iodine salt, and poor value food. This index is presented in Table 4.8 in which 51.60 percent had high scores and 48.40 percent had low scores. This was represented in Table 4.8. This factor was described in its eight essential kinds of food as following

Of eight essential kinds of food, over a half (52%) of the studied children were appropriately fed with protein like meat, fish or eggs, and 48 percent were not. All of the studied children were usually fed with carbohydrates such as rice or noodles. A majority (70.80%) of the studied children were appropriately fed with milk, and the remaining 29.20 percent were inappropriately fed with milk. Regarding vegetables, 52.80 percent of the studied children were appropriately fed with vegetables and 47.20 percent were inappropriately fed with vegetables. Similarly for fruit, 84.40 percent of the studied children were appropriately fed with fruit and 15.60 percent were inappropriately fed with fruit. A minority (30.80%) of the studied children were appropriately fed with fat or oil, and the remaining 69.20 percent were inappropriately fed with fat or oil. Most children (81.20%) were appropriately fed with iodine salt and 18.80 percent were inappropriately fed. Regarding feeding poor value foods, 76.40 percent of the children were appropriately fed and 23.60 percent were inappropriately fed (Table 4.17 appendix B)

Table 4.8 The percentage distribution of food provision

Food provision	Frequency (n= 250).	Percent (%)
Time for supplementary food		
Appropriate (180 - <210 days)	59	23.60
Inappropriate (<180 or ≥ 210)	191	76.40
Supplementary milk		
yes	41	16.40
No	209	83.60
Oil added in daily meals		
Appropriate (yes)	220	88.00
Inappropriate (no)	30	12.00
Orange juice		
Appropriate (yes)	139	55.60
Inappropriate (no)	111	44.40

Table 4.8 The percentage distribution of food provision (cont.)

Food provision	Frequency (n= 250).	Percent (%)
Number of main meals per day		
Appropriate (≥ 3 times)	205	82
Inappropriate (<3 times)	45	18
Number of sub meals per day		
Appropriate (≥1 times)	250	100
Separation of food for children		
Appropriate (separated)	184	73.80
Inappropriate (not separated)	66	26.40
Amount of food eaten		
Appropriate	134	53.60
Inappropriate	116	46.40
Drinking water		
Appropriate (yes)	222	88.80
Inappropriate (no)	28	11.20
Overall frequency of essential food provision		
Appropriate	129	51.60
Inappropriate	121	48.40

4.4.2 The relationship between the nutritional status of children and food provided to them

Regarding supplementary milk, of the children fed with supplementary milk, 85.37 percent were normal and 14.63 percent were underweight. On the other hand, of the children not fed with supplementary milk, 66.03 percent were normal and 33.97 percent were underweight. The result showed that the children with no supplementary milk had a 3 times greater risk of being underweight than the children fed with supplementary milk. Supplementary milk provision related significantly to the nutritional status of the children (P-value = 0.009).

In respect of food provision, Table 4.9 shows that overall frequency of essential food provision, supplementary milk, orange juice, separation of food, and amount of food were the factors related significantly to the nutritional status of children. Regarding overall frequency of essential food provision, of the children fed food appropriately, 82.95%were normal and 17.05 percent were underweight. On the other hand, of the children fed food inappropriately, 54.55 percent were normal and 45.45 percent were underweight. The result showed that the children fed food inappropriately had a 4.05 times greater risk of being underweight than the children fed food appropriately. Overall frequency essential food provision related significantly to the nutritional status of children (P-value<0.001). In order to examine vitamin C supply from natural resources data about the provision of orange juice is presented in Table 4.9. Of the children fed with orange juice, 77.70 percent were normal and 22.30 percent were underweight. On the other hand, of the children not fed with orange juice, 58.56 percent were normal and 41.44 percent were underweight. The result showed that the children not fed with orange juice had a 2.47 times greater risk of being underweight than the children fed with orange juice. Orange juice provision related significantly to the nutritional status of the children (P-value=0.001). Particularly, of overall frequencies of essential food provision, protein, milk, vegetable, and fat or oil significantly related to the nutritional status of children. (Table 4.18 Appendix B)

In respect of separation of food, of the children having separated food, 76.63 percent were normal and 23.37 percent were underweight. On the other hand, of the children not having separated food, 48.48 percent were normal and 51.52 percent were underweight. The result showed that the children not having separated food had a 3.48 times greater risk of being underweight than the children fed with separated food. Separation of food related significantly to the nutritional status of the children (P-value < 0.001). Regarding amount of food, of the children who finished all food or nearly all their food, 74.63 percent were normal and 25.37 percent were underweight. On the other hand, of the children who did not finish their food, 62.93 percent were normal and 37.07 percent were underweight. The result showed that the children who did not finish their food had a 1.73 times greater risk of being underweight than the

children who finished all food or nearly all their food. Amount of food eaten related significantly to the nutritional status of the children (P-value = 0.046). Other factors such as time for supplementary food, adding oil in daily meals, number of main meals or sub-meal per day, and drinking water were not found to have a significant relationship with the nutritional status of children.

Table 4.9 The relationship between the nutritional status of children and detailed food Provision

Food provision	Nutritional status		Crude OR	95%CI	P-Value
	Normal	Underweight			
Time for supplementary food					
Appropriate	76.27	23.73	1		
Inappropriate	67.02	32.98	1.58	0.81-3.10	0.171
overall frequency of essential food provision					
Appropriate	82.95	17.05	1		
Inappropriate	54.55	45.45	4.05	2.27-7.25	<0.001
Supplementary milk					
yes	85.37	14.63	1		
no	66.03	33.97	3.00	1.21-7.47	0.009**
Oil added in daily meals					
Appropriate (yes)	69.55	30.45	1		
Inappropriate (no)	66.67	33.33	1.14	0.51-2.57	0.750
Orange juice					
Appropriate (yes)	77.70	22.30	1		
Inappropriate (no)	58.56	41.44	2.47	1.42-4.27	0.001**
Number of main meals per day					
Appropriate	68.78	31.22	1		
Inappropriate	71.11	28.89	0.90	0.44-1.82	0.758
Number of sub meals per day					
Appropriate (≥1)	69.20	30.80	1		

***** Significance at P-value< 0.01***

Table 4.9 The relationship between the nutritional status of children and detailed food provision (cont.)

Food provision	Nutritional status weight for age index		Crude OR	95%CI	P-Value
	Normal	Underweight			
Separation of food for children					
Separated	76.63	23.37	1		
Not separated	48.48	51.52	3.48	1.93-6.29	<0.001**
Amount of food eaten					
Appropriate	74.63	25.37	1		
Inappropriate	62.93	37.07	1.73	1.01-2.98	0.046*
Drinking water					
Appropriate (yes)	68.92	31.08	1		
Inappropriate (no)	71.43	28.57	0.89	0.37-2.11	0.785

**** Significance at P-value< 0.05***

4.5 The relationship between the nutritional status of children and health care

4.5.1 The percentage of maternal and child health care distribution

Table 4.10 shows that almost all (95.20%) of the studied mothers were medically checked before delivery, although 4.80 percent were not. Furthermore, 41.08 percent of the studied mothers were medically checked before delivery ≥ 4 times while 58.92 percent were medically checked < 4 times. Almost all (94.40%) of the studied children had a day time sleep habit and 5.60 percent did not. However, only 16.10 percent of the studied children slept for an appropriate period of time during the day while the majority (84.90%) did not. Nearly a half (48%) of the studied children slept for an appropriate period of time during the night but 52 percent did not. A minority (15.60%) of the studied mothers washed their hands appropriately after taking care of the child after defecation while a majority (84.40%) did not. Similarly, a

minority (14.80%) of the mothers washed their hands appropriately before preparing food while a majority (85.20%) did not.

A majority (82%) of the children had not had diarrhea in the previous week while 18 percent had. However, only 61.60 percent of the mothers used ORS for their children when they got diarrhea but 38.40 percent did not. In addition, only 64.40 percent of the children drank ORS when they got diarrhea but 35.60 percent of them did not. Most (82.80%) of the children had not had fever or coughs in the previous week but 17.20 percent had. Slightly over a half (52%) of the children were living in houses with latrines but 48 percent of them were not.

Table 4.10 The frequency and percentage distribution of health care activities

health care activities	Frequency (n= 250).	Percent (%)
Medical checkup before delivery		
Appropriate (yes)	238	95.20
Inappropriate (no)	12	4.80
Number of medical checkups (n=241).		
Appropriate (≥ 4 times)	99	41.08
Inappropriate (< 4 times)	142	58.92
Daytime sleep habits		
Appropriate (yes)	236	94.40
Inappropriate (no)	14	5.60
Duration of day sleep (n=236)		
Appropriate [120-195 min]	38	16.10
Inappropriate (< 120, > 195)	198	83.90
Duration of night sleep		
Appropriate (10-12hrs)	120	48.00
Inappropriate (< 10, > 12)	130	52.00
Washing mother's hands after taking care of a child after defecation		
Appropriate	39	15.60
Inappropriate	211	84.40

Table 4.10 Frequency and percentage of health care activities (cont.)

health care activities	Frequency (n= 250).	Percent (%)
Washing mother's hands before preparing food		
Appropriate	37	14.80
Inappropriate	213	85.20
Diarrhea		
Appropriate (no)	205	82.00
Inappropriate (yes)	45	18.00
Using ORS		
Appropriate (yes)	179	61.60
Inappropriate (no)	71	38.40
Drinking ORS		
Appropriate (yes)	161	64.40
Inappropriate (no)	89	35.60
Fever or coughs		
Appropriate (no)	207	82.80
Inappropriate (yes)	43	17.20
Latrines		
Appropriate (yes)	130	52.00
Inappropriate (no)	120	48.00

4.5.2 The relationship between the nutritional status of children and health care

In respect of maternal and child health care, Table 4.11 shows that prenatal checkups, duration of day sleep, washing mother's hands before preparing food, drinking ORS and latrines were the factors which related significantly to the nutritional status of children. In respect of prenatal checkups, of the mothers having check ups, 71.43 percent had normal children and 28.57 percent had underweight children. On the other hand, of the mothers not medically checked, 25 percent had normal children and 75 percent had underweight children. The result showed that the children of the mothers not medically checked had a 7.5 times greater risk of being

underweight than the children of the mothers medically checked. Prenatal checkups related significantly to the nutritional status of the children (P-value=0.001).

With regard to the number of prenatal checkups, Table 4.11 shows that of the mothers medically checked ≥ 4 times, 84.85 percent had normal children and 15.15 percent had underweight children. On the other hand, of the mothers medically checked < 4 times, 61.97 percent had normal children and 38.03 percent had underweight children. The result shows that the children of the mothers medically checked < 4 times had a 3.44 times greater risk of being underweight than the children of the mothers medically checked ≥ 4 times. Number of medical checkups related significantly to the nutritional status of the children (P-value < 0.001). With regard to the duration of day sleep, of the children with an appropriate duration of day sleep, 86.84 percent were normal and 13.16 percent were underweight. On the other hand, of the children with an inappropriate duration of day sleep, 67.17 percent were normal and 32.83 percent were underweight. The result showed that the children having an inappropriate duration of day sleep had a 3.23 times greater risk of being underweight than the children having appropriate duration of day sleep. Duration of daytime sleep related significantly to the nutritional status of the children (P-value = 0.01).

Regarding washing mother's hands before preparing food, of the mothers who washed their hands appropriately, 83.78 percent had normal children and 16.22 percent had underweight children. On the other hand, of the mothers who did not, 66.67 percent had normal children and 33.33 percent had underweight children. The result showed that the children of the mothers who washed their hands inappropriately before preparing food had a 2.58 times greater risk of being underweight than the children of the mothers who washed their hands appropriately. Washing hands before preparing food related significantly to the nutritional status of the children (P-value < 0.05).

In respect of drinking ORS, of the children drinking ORS, 74.53 percent were normal and 25.47 percent were underweight. On the other hand, of the children not drinking ORS., 59.55 percent were normal and 40.45 percent were underweight

The result showed that the children not drinking ORS had a 1.99 times greater risk of being underweight than the children drinking ORS. Drinking ORS related significantly to the nutritional status of the children (P-value = 0.015).

In respect of latrines, of the children living in houses with latrines, 77.69 percent were normal and 22.31 percent were underweight. On the other hand, of the children living in houses without latrines, 60 percent were normal and 40 percent were underweight. The result showed that the children living in houses without latrines had a 2.32 times greater risk of being underweight than the children living in houses with latrines. Latrines related significantly to the nutritional status of the children (P-value = 0.002). Thus, day time sleep habit, duration of night sleep, washing mother's hands after taking care of a child after defecation, diarrhea, using ORS, and fever or coughs were not found to have a significant relationship with the nutritional status of children.

Table 4.11 The relationship between the nutritional status of children and health care

Health care	Nutritional status		Crude OR	95%CI	P-Value
	Normal	Underweight			
Medical checkup before delivery					
Appropriate (yes)	71.43	28.57	1		
Inappropriate (no)	25.00	75.00	7.50	1.97-28.55	0.001**
Number of medical checkups					
Appropriate	84.85	15.15	1		
Inappropriate	61.97	38.03	3.44	1.80-6.55	<0.001
Daytime sleep habit					
Appropriate (yes)	70.34	29.66	1		
Inappropriate (no)	50.00	50.00	2.37	0.80-7.01	0.123
Duration of day sleep					
Appropriate	86.84	13.16	1		
Inappropriate	67.17	32.83	3.23	1.20-8.65	0.010*

Significance at P-value< 0.05

Table 4.11 The relationship between the nutritional status of children and health care (cont.)

Health care	Nutritional status weight for age index		Crude OR	95%CI	P-Value
	Normal	Underweight			
Duration of night sleep					
Appropriate	72.50	27.50	1		
Inappropriate	16.15	33.85	1.35	0.79-2.32	0.277
Washing mother's hands after taking care of a child after defecation					
Appropriate	74.36	25.64	1		
Inappropriate	68.25	31.75	1.35	0.62-2.93	0.449
Washing mother's hands before preparing food					
Appropriate	83.78	16.22	1		
Inappropriate	66.67	33.33	2.58	1.03-6.48	0.029*
Diarrhea					
No	71.22	28.78	1		
Yes	60.00	40.00	1.65	0.85-3.22	0.147
Using ORS					
Appropriate (yes)	72.07	27.93	1		
Inappropriate (no)	61.97	38.03	1.58	0.89-2.83	0.123
Drinking ORS					
Yes	74.53	25.47	1		
Inappropriate (no)	59.55	40.45	1.99	1.14-3.45	0.015*
Fever or coughs					
Appropriate (no)	70.05	29.95	1		
Inappropriate (yes)	65.12	34.88	1.25	0.63-2,51	0.528
Latrine					
Yes	77.69	22.31	1		
No	60.00	40.00	2.32	1.34-4.03	0.002*

Significance at P-value< 0.05

4.6 Factors predicting the nutritional status of children

4.6.1 Full model of Multiple Logistic Regression

In order to predict the factors that affect the nutritional status of children, multiple logistic regression was used. The significant factors from previous Tables were used to predict by multiple logistic regression. The outputs are presented in Table 4.12.

After using the Minitab software, the only factor that was related to the nutritional status of children was frequency of essential food provision (OR = 2.61, 95%CI = 1.24-5.52 and P-value = 0.012). . Other factors were no longer shown to be related to nutritional status.

Table 4.12 The full model of Multiple Logistic Regression

Predictors	Adjusted OR	95%CI for OR	P-value
Socio demographics of parents			
High scores	1		
Low scores	0.97	0.34-2.77	0.954
Child birth weight			
≥2500 grams	1		
<2500 grams	1.43	0.17-12.24	0.745
Knowledge levels			
Fair to good	1		
low	1.90	0.79-4.54	0.150
Overall frequency essential food provision			
Appropriate	1		
Inappropriate	2.61	1.24-5.52	0.012*
Amount of food			
Appropriate	1		
Inappropriate	1.05	0.51-2.14	0.898

Table 4.12 The full model of Multiple Logistic Regression (cont.)

Predictors	Adjusted OR	95%CI for OR	P-value
Separation of food for children			
Appropriate (separated)	1		
Inappropriate (not separated)	0.41	0.03-5.79	0.508
Medical checkup before delivery			
Yes	1		
No	0.69	0.23-2.01	0.492
Number of medical checkups			
Appropriate (≥ 4 times)	1		
Inappropriate (< 4 times)	2.12	0.93-4.83	0.074
duration of day sleep			
Appropriate [120-195 min]	1		
Inappropriate (< 120, > 195)	0.97	0.34-2.77	0.954
Washing mother's hands after taking care before preparing food			
Appropriate	1		
Inappropriate	1.33	0.45-3.90	0.607
Drinking ORS			
yes	1		
no	1.37	0.66-2.81	0.398
Latrines			
Yes	1		
no	0.75	0.31-1.79	0.514

Significance at P-value< 0.05

4.6.2 The second model of detail food provision of Multiple Logistic Regression.

In order to determine the eight factors inside the Overall frequency essential food provision, eight variables were continually adjusted together in the model of Multiple Logistic Regression (Table 4.13). When the model adjusted for the child birth weight, the most significant risk factors related to the nutritional status of

children were protein provision (OR = 2.21, 95% CI = 1.15-4.25) and iodine salt provision (OR = 2.24, 95% CI = 1.05-4.81). Other factors of food provision were no longer related to the nutritional status of children. Carbohydrate was not presented in this model because 100% studied children were fed with carbohydrate appropriately.

Table 4.13 The second model of food provision of Multiple Logistic Regression

Predictors	Adjusted OR	95%CI for OR	P-value
Child birth weight			
≥2500 grams	1		
<2500 grams	4.08	0.98-17.02	0.054
Protein			
Appropriate	1		
Inappropriate	2.21	1.15-4.25	0.018*
Milk			
Appropriate	1		
Inappropriate	1.04	0.50-2.16	0.924
Vegetables			
Appropriate	1		
Inappropriate	1.77	0.89-3.54	0.106
Fruit			
Appropriate	1		
Inappropriate	1.22	0.55-2.71	0.618
Fat or oil			
Appropriate	1		
Inappropriate	1.74	0.82-3.68	0.147
Iodine salt			
Appropriate	1		
Inappropriate	2.24	1.05-4.81	0.038*
Poor value food			
Appropriate	1		
Inappropriate	1.43	0.69-2.93	0.334

4.6.3 The final model of Multiple Logistic Regression.

In Table 4.14, each variable in Overall frequency essential food provision was further analyzed by Multiple Logistic Regression**.** After adjusting for other factors in the final model, the most significant risk factors related to underweight children were child birth weight (OR = 4.21, 95% CI = 1.02-17.42), protein provision (OR = 2.18, 95%CI = 1.77-4.06) and iodine salt provision (OR = 2.67, 95%CI = 1.26-5.66). Children who were provided protein inappropriately had a 2.18 times greater risk of being underweight than children who were provided protein appropriately. Moreover, children inappropriately provided iodine salt had a 2.67 times greater risk of being underweight than children appropriately provided iodine salt. Other factors were no longer related to the nutritional status of the children.

Table 4.14 Final model of Multiple Logistic Regression

Predictors	Adjusted OR	95% CI for OR	P-value
Child birth weight			
≥2500 grams	1		
<2500 grams	4.21	1.02-17.42	0.047*
Protein			
Appropriate	1		
Inappropriate	2.18	1.17-4.06	0.014*
Iodine salt			
Appropriate	1		
Inappropriate	2.67	1.26-5.66	0.011*

**Significance at P-value< 0.05*

CHAPTER V
DISCUSSION

5.1 The prevalence of underweight children in Quang Ngai province

In this study, the prevalence of underweight children aged 6 to 24 months in Quang Ngai province was classified by weight for age according to WHO guideline standards. The prevalence of underweight children found in this study was 30.80 percent. This figure was substantially greater than 18 percent, the official rate reported by the provincial health center on July 15, 2009 (3). However, the provincial health center rate was reported for children aged 0 to 24 months. This prevalence was also the same level reported for Vietnam by the American Red Cross Vietnam Education & Child, Nutrition Initiative (4).

5.2 Socio demographic factors

Regarding maternal education, it was found that maternal education related significantly to the nutritional status of children. The mothers with only primary education had a higher risk of having underweight children than the mothers with secondary or higher education. The study showed that the children of the mothers with primary education or below had a 4.95 times greater risk of being underweight than the children of the mothers with at least secondary education. This was consistent with the study reported in ADB/UNESCAP that 27 percent of the children whose mothers had secondary education were underweight while 43 percent of those whose mothers had only primary education were underweight (23). It is logical to assume that higher and better education enables mothers to have more knowledge about child care and that they are therefore better able to care for their children. Better education

may also lead to better jobs and, therefore, better income. This means that they can afford proper and better food for their children.

With regard to paternal education levels, a relationship between paternal education levels and the nutritional status of children was found. Fathers with only primary education had a higher risk of having underweight children than fathers with secondary or higher education. The study showed that the children of the fathers with primary education or below had a 4.48 times greater risk of being underweight than the children of the fathers with at least secondary education. This was similar to the study of Mosiur Rahman, Golam Mostofa and Sarker Obaida Nasrin which showed that children of fathers with higher levels of education, were less likely to be underweight than those with illiterate fathers (48). As with mothers, it may also be assumed that better paternal education also benefits child nutrition for the same reasons.

Regarding family income, the study generated sufficient evidence to indicate that family income related significantly to the nutritional status of children. The children living in families with low incomes had a 3.17 times higher risk of being underweight than the children in families with sufficient or better income. This was similar to the report of the WHO meeting in December 2001 develops Global Strategy for Infant and Young Child Feeding (49) and similar to the study of Ma. Adrienne S. Constantino, Ma. Regina A. Pedro, Ph.D. and Pentalpha C. Cabrera as well (50). Higher family incomes is perhaps associated with education so that high income families generally have more knowledge about child care and nutrition. Higher family incomes probably also means more money is available to purchase more and better quality food.

With respect to child birth weight, a relationship between child birth weight and the nutritional status of children was found. The children weighting less than 2500 grams at birth had a 5.67 times higher risk of being underweight than the children weighting more than 2500 grams. This was similar to the study of J Mason

and R Shrimpton that the prevalence of underweight children and low birth weight were correlated (51). It is open to speculation that low birth weight results from poor maternal health and nutrition. Children with low birth weight also often have weakened immune systems and are less able to resist disease.

Other factors which did not relate to nutritional status were gender of children and order of birth. Strangely, parental occupation was not shown to relate significantly to nutritional status.

5.3 Maternal knowledge

The study generated sufficient evidence to indicate that maternal knowledge levels related significantly to the nutritional status of children. The children of the mothers with low knowledge scores had a 2.28 times greater risk of being underweight than the children whose mothers had fair or good knowledge.

This was consistent with the study of James R. Blaylock which found that maternal knowledge of health and nutrition influenced children's nutrient intakes (52). This would seem to indicate the importance of maternal knowledge and the need for appropriate pre-birth education. If mothers lack knowledge about nutrition and health care, then they may not know how to feed their children properly or understand their children's nutritional needs.

5.4 Food provision

5.4.1 Overall frequency and kinds of food

Concerning overall frequency and kinds of food, a relationship between the overall frequency and kinds of food and the nutritional status of children was found. The children fed with frequency and kinds of food inappropriately had a 4.05 times higher risk of being underweight than the children fed with frequency and kinds of food appropriately. This was consistent with guiding principles of the WHO for feeding

children 6 to 24 months of age regarding frequency and appropriate kinds of food (17). This strongly suggests that WHO guidelines about regular feeding are appropriate and that frequency and regularity assists child development and growth.

5.4.2 Food provision

Regarding supplementary milk, there was a significant relationship between supplementary milk and the nutritional status of children. The children fed with supplementary milk inappropriately had a 3 times higher risk of being underweight than the children fed with supplementary milk appropriately. This was consistent with guiding principles of the WHO for feeding children 6 to 24 months of age with supplementary milk every day (17). Again, proper feeding with supplementary milk similarly assists child development and growth.

With regard to orange juice, a relationship between orange juice and the nutritional status of children was demonstrated. The children fed with orange juice had a 2.47 times higher risk of being underweight than the children not fed with orange juice. According to Linus Pauling Institute, Micronutrient Information Center, Vitamin C, ascorbic acid, is one of the most important vitamins found in citrus juices, particularly orange juice. Unlike most mammals and other animals, humans do not have the ability to make their own vitamin C. Therefore, children must obtain vitamin C through their diet. The human body requires Vitamin C for the synthesis of collagen, blood vessels, tendons, ligaments, bone and other and to strengthen the immune systems to prevent diseases. It is logical that children not fed with orange juice cannot prevent disease well, and are liable to get diseases. An unhealthy or sick child can result in underweight (53).

Regarding separation of food from family food, there was a significant relationship between separation of food and the nutritional status of children. The children were fed without separated food had a 3.48 times higher risk of being underweight than the children fed with separated food. This study was consistent with WHO guidelines that complementary food should be prepared appropriately (mashed, chopped, or softened) to suit the children's eating abilities (36). The nexus between

separation of food and nutritional growth may also suggest the benefits of feeding food which is more easily consumed and matches children's eating ability. This means they are encouraged to eat sufficient nutritional food.

One of salient significant factors was amount of food eaten by the children. The children who did not finish their food on the day before the interview day had a 1.73 times higher risk of being underweight than the children who finished their food. It is preferable that children should be fed kinds of food making them more appetizing and finishing their food. This may help the children take in more nutrients to grow and gain weight. This study was consistent with WHO guidelines that complementary food should be increased as children show more interest to suit their eating abilities (36).

5.5 Maternal and child health care

Regarding prenatal checkups, although only 4.80 percent mothers in this study were not checked medically, almost all of their children were underweight. This study produced sufficient evidence to indicate that prenatal checkups related significantly to the nutritional status of children (P-value = 0.001). The children whose mothers were not checked medically day had a 7.5 times higher risk of being underweight than the children whose mothers were checked medically. In this study, each of the two communities in the mountainous area with difficult terrain for travel had a health center that was far from populated areas and pregnant woman not only lacked health information but also had difficulty accessing the health centers. Therefore, a minority of them did not receive prenatal checkups and often gave birth at home with midwives. As a result, their babies had low birth weight, and the lack of prenatal care result in child underweight (54). This would seem to suggest that mothers who do not receive pre-natal checkups do not receive adequate information about their condition and how to prepare for birth. Moreover, they may proceed to delivery without diagnoses or treatment of relevant medical conditions.

With respect to number of prenatal checkups, this study had sufficient evidence to indicate that the children whose mothers had prenatal checkups < 4 times had a 3.44 times greater risk of being underweight than the children whose mothers were medically checked ≥ 4 times (P-value < 0.001). As result of difficult terrain and lack of health information, pregnant woman dwelling in mountainous areas far from the health centers were limited in travelling. Therefore, the number of prenatal checkups was lower than 4 times. This was consistent with the study of Jonsson, Smith and Haddad who found that one of determinants of child underweight can be inadequate prenatal care (20). Inadequate care for mothers can result in child underweight. Insufficient checkups means pregnant women have less contact with trained medical and health personnel. Consequently, they receive less advice about their condition and how to prepare for the coming birth. They may also have undiscovered but potentially harmful medical conditions or diseases which need to be treated, or indicate the need for proper birthing facilities.

Regarding duration of day sleep, this study had sufficient evidence to indicate that the children having inappropriate duration of day sleep had a 3.23 times greater risk of being underweight than the children having appropriate duration of day sleep (P-value = 0.01). Daytime sleep is a major requirement for good health, and for children to get enough of it, some daytime sleep is usually needed. Crucial physical and mental development occurs in early childhood, and naps provide much-needed downtime for growth and rejuvenation. (55). This study was consistent with the study in the Miriam Hospital that child sleep changes hormones associated with hunger and appetite, being hungrier, be more motivated to eat, and eat more food (56).

Regarding washing mother's hands before preparing food, a relationship between washing mother's hands before preparing food and the nutritional status of children was found in which the children of the mothers who washed their hands inappropriately before preparing food had a 2.58 times greater risk of being underweight than the children of the mothers who washed their hands appropriately (P-value = 0.029). This was consistent with the report of ADB/UNESCAP Concluding Workshop on Enhancing Social and Gender Statistics Bangkok, 24-27 June 2003 that

28 percent children whose mothers washed the hand before preparing food were underweight but 48 percent children whose mothers did not were underweight (23).

With respect to drinking ORS, this study had sufficient evidence to indicate that the children not drinking ORS had 1.99 times greater risk of being underweight than the children drinking ORS (P-value =0.015).

According to WHO and UNICEF, the use of ORS is responsible for saving the lives of millions of children worldwide. This inexpensive and readily available intervention reduces death and suffering from dehydration caused by diarrhoea. Since the WHO adopted ORS in 1978 as its primary tool to fight diarrhoea, the mortality rate for children suffering from acute diarrhoea has fallen from 5 million to 1.3 million deaths annually (57). Without drinking ORS, diarrhoea can be prolonged. Diarrhoea is considered chronic when it lasts longer than 14 days. Weight loss with diarrhoea should always be a concern and deserves thorough investigation (58).

Regarding latrines, 48 percent the children were living in houses without latrines and 60 percent of them were underweight. This study had sufficient evidence to indicate that the children living in houses without latrines had a 2.32 times greater risk of being underweight than the children living in houses with latrines (P-value = 0.002). This study was consistent with the report of ADB/UNESCAP Concluding Workshop on Enhancing Social and Gender Statistics Bangkok, 24-27 June 2003 (23) that 25 percent of children living in houses with latrines were underweight while 44 percent of children living in houses without latrines were underweight. It is likely that environmental sanitation relate to child underweight. Moreover, this study was also similar to the study of Kesitegile Gobotswang that children who had no latrine had a greater risk of being underweight than children from households with a latrine (59).

5.6 Factors predicting nutritional status of children

After analyzing all significant independent variables by multiple logistic regression to determine which factors could be significant for nutritional status of children when controlling other factors, it was found that overall frequency of food variable was revealed as a significant risk factor to the nutritional status of children (OR= 2.61, 95% CI = 1.24-5.52 and P-value = 0.012). Other factors were no longer associated with the nutritional status of children.

This study was consistent with the study of Randa Saadeh, WHO - Department of Nutrition for Health and Development. As a baby grows and becomes more active; an age is reached when breast milk alone is not sufficient to meet the child's nutritional needs. So they should be fed with food appropriately to fill the gap between the total nutritional needs of the child and the amounts provided by breast milk (60).

Furthermore, 8 variables in overall frequency and kinds of food variable were continually developed in the model of Multiple Logistic Regression. Of the eight variables of overall frequency and kinds of food, the most significant risk factors related to underweight children were protein provision and iodine salt provision. After adjusting with other factors in the final model of multiple logistic regression, low birth weight (OR= 4.21, 95% CI = 1.02-17.42 and P-value = 0.047)**,** protein provision (OR= 2.18, 95% CI = 1.17-4.09 and P-value = 0.014) and iodine salt provision (OR= 2.67, 95% CI = 1.26-5.66 and P-value = 0.011) were significant risk factors. Other factors were no longer associated with the nutritional status of children.

The effects of low birth weight in this study on the nutritional status of children were similar to the study of the Research and Special Studies Div that children who had low birth weight were at greater risk of being underweight than children with normal birth weight (61*).* The effects of protein provision in this study were similar to the study of Beatrice Olubukola Ogunba that most children who were fed with inappropriate protein provision were wasted, stunted and underweight (62).

The effects of iodine salt provision in this study were consistent with the study of Jorgen Schlundt Chizuru and NishidaLandscape, WHO that iodine deficiency can result in underweight, stunting and wasting (63). As explained above, low birth weight may indicate medical and health problems, and may also mean less resistance to disease and delay the proper physical development and growth of a child.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The objective of this study was to determine the relationship between the nutritional status of children aged from 6 to 24 months and the food provision in Quang Ngai province, Vietnam. In addition their socio-demographics, maternal knowledge about food, food provision, and maternal and child health care are examined. This study therefore attempted to identify the relationship between each of these factors and their nutritional status.

The subjects of the study were 250 mothers who had children aged from 6 to 24 months in Quang Ngai province, Vietnam. Data were collected in January, 2010. A written information sheet and informed consent form were given to the mothers. All children of the studied mothers were measured for weight and height. The mothers were interviewed after returning the information sheets and informed consents. A structured questionnaire was prepared in Vietnamese and consisted of four parts. Part one contained questions about socio demographic factors: mother's age, education, occupation, father's education, occupation, marital status, family income, child birth weight, gender. Part two contained questions about knowledge of mothers regarding the first feeding of supplementary food, and food provided for the children. Part three contained questions about maternal and child health care: ANC, growth monitoring of the children, history of illness, and latrines

The Chi-square test was used to determine any significant association between each independent variable and the dependent variable. Crude odd ratio was used to measure the strength of association with 95% confidence interval. Multiple

Logistic Regression using forward selection was performed to explore the relationship between each independent variable and the outcome variable. The independent factors found to have significantly influenced on nutritional status of children were as following:

The significant factors of socio-demographics consisted of maternal education (P-value < 0.001), father's education (P-value < 0.001), family income (P-value of children < 0.001), child birth weight (P-value = 0.009).

The significant factors of maternal knowledge in the Table 21 (appendix C) were knowledge of mothers about groups of essential food (P-value = 0.011), feeding the child appetizingly (P-value = 0.006), vitamin A (P-value = 0.020), monitoring malnourished children (P-value = 0.007), direction of growth chart (P-value = 0.011) and goals of using a growth chart (P-value < 0.001).

The significant factors of food provision included protein provision (P-value < 0.001), milk provision (P-value = 0.026), vegetable provision (P-value = 0.017), fat or oil provision (P-value =0.008), powdered milk provision (P-value = 0.009), orange juice provision (P-value = 0.001), separation of food (P-value < 0.001), amount of food eaten (P-value = 0.046).

The significant factors of health care comprised prenatal checkups (P-value = 0.001), number of medical checkups before delivery (P-value < 0.001), duration of day sleep (P-value = 0.01), washing mother's hand before preparing food (P-value = 0.029), drinking ORS (P-value = 0.015), and latrines (P-value = 0.002).

By Multiple Logistic Regression analysis using forward selection, three significant risk factors including birth weight (OR=4.21, 95% CI= 1.02-17.42 P-value = 0.047), protein provision (OR=2.18, 95% CI= 1.17-4.06 P-value = 0.014), and iodine salt provision (OR=2.67, 95% CI= 1.26-5.66 P-value = 0.011). It therefore suggested that child underweight control programs should focus on all these factors together.

6.2 Recommendations

The significant factors associated with underweight of children were birth weight, protein provision and iodine salt provision. Other factors had no significant association with underweight children. The following public health activities are recommended.

6.2.1 Recommendations for reduction of low birth weight

a) High risk groups of pregnant women who had symptoms of poor nutritional status and had poor weight gain (less than 6 kilos for six months of pregnancy) should be identified.

b) Direct communication (face to face) and indirect channels of communication (mass media) should be utilized to raise general awareness of maternal and child health care. Mothers need to be educated about such matters as breastfeeding, complementary feeding, feeding sick children, balancing and diversifying diet and food groups, preparing safe drinking water, creating a healthy home environment, and family planning.

c) Educate students about reproductive health care to prevent early pregnancies and underweight births.

d) Consolidate and develop nutritional health volunteer networks by recruiting and training.

e) Mobilize government opinion about the need to reduce the prevalence of low birth weight (e.g. through policies, increased budget allocations).

6.2.2 Recommendations for improvement of protein and iodine salt provision for children, especially underweight children

a) Educate and counsel caregivers and mothers regarding appropriate protein and iodine salt provision. Children should be fed all kinds of food and focus on

iodine salt and protein foods. Nutritional health volunteers should often visit households in order to help mothers or caregivers if they have difficulty or misunderstand the requirements of proper nutritional feeding for their children.

b) Health education programs should be implemented at immunization times and focus on prevention of low birth weight and underweight children.

c) Mothers should be encouraged to adopt exclusive breastfeeding and other family members should be educated to support mothers breastfeeding their children.

d) Local government agencies should strengthen and improve iodine salt distribution programs to rural people.

e) Promote home gardening to allow self supply of protein, such as meat and eggs, in order to improve daily meals. Moreover, children should be fed with vegetables and fruit in order to increase mineral and vitamin intakes.

f) Explore local barriers to feed children and then find solutions such as improving eating habits, and making food more appetizing.

g) Co-ordinate women's associations to practice and prepare nutritional meals as a model from which children and mothers can learn.

6.3 Recommendations for further studies

a) Further studies should concentrate on food patterns, mineral and vitamin content of children's daily meals, especially protein food and food enriched with iodine, iron, vitamin C, and vitamin A. The food provision should be ensured to meet the relevant WHO guidelines. A larger sample size should be selected to reflect the nutritional status consisting of weight for age index, weight for height index and height for age index.

b) Qualitative research should be conducted to ascertain the reasons for inappropriate feeding.

c) An experimental study should be conducted in order to determine protein content, iodine content and other vitamin-mineral content in daily meals that relate to the nutritional status of children.

d) Explore in detail maternal health practices (such as washing hands) related to underweight of children.

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APPENDICES

APPENDIX A
QUESTIONNAIRES

RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND FOOD PROVIDED TO CHILDREN AGED FROM 6 TO 24 MONTHS IN QUANG NGAI PROVINCE. VIETNAM

Background information:

Address (community)……..

Interviewer……..

Phone: …….

Date of interview: *day…..month….year2010*

Weight of the child at birth: ……gms……

Weight of the child now: ……gms……

Height of the child now: ……cms……

Birth date: *day…..month….year2010*

Order of the child: ……..

Gender: ☐ 1. Male ☐ 2. Female

Part 1 Socio-Demographic Factors

1. Mother's age…….years old

2. Highest education level of mother

☐ 1. Primary school ☐ 3. High school

☐ 2. Secondary school ☐ 4. College, bachelor or higher

3. What is your main occupation?

☐ 1. Unemployment ☐ 4. Government employ

☐ 2. Famer ☐ 5. Commerce/ handicraft

☐ 3. Laborer/factory worker ☐ 6. Other, please specify…….

4. Highest education level of your husband

☐ 1. Primary school ☐ 3. High school

☐ 2. Secondary school ☐ 4. College, bachelor or higher

5. What is the occupation of your husband?

☐ 1. Unemployment ☐ 4. Farmer

☐ 2. Government employee ☐ 5. Fisher

☐ 3. Business ☐ 6. Other, please specify…….

.

6. Marital status

☐ 1. Married (living together)

☐ 2. Separated/ divorced/ windowed

7. How many children do you have? ..... Children

8. Self estimate about family income:

☐ 1. Difficult living ☐ 3. Fair economic

☐ 2. Bare living ☐ 4. Plentiful economic

Part 2 Knowledge of mother

Chose only one answer for each question:

9. When is the appropriate time to introduce colostrums for newborn child?

☐ 1. Within 1 hour after delivery ☐ 3. 6 hour after delivery

☐ 2. Between 1-6 hours after delivery ☐ 4. Do not know

.10. When is the right age of the child to feed complementary food?

☐ 1. Under 4 month ☐ 3. At sixth month

☐ 2. Between fourth and sixth month ☐ 4. Do not know

.

11. What is the following answers containing enough 4 groups of essential food (such as group of carbohydrate, group of protein, group of oil or fat and group of vegetable or fruits):

☐ 1. Rice, noodle, egg and sesame oil ☐ 3. Rice, beef, fish and egg

☐ 2. Rice, fish, sesame oil and cabbage ☐ 4. Do not know.

12. Should the mother add 1-2 coffee-spoon(s) of oil into daily meal of the child?

☐ 1. Yes ☐ 2. No

13. What are kinds of following food that is good for health?

☐ 1. Green peas ☐ 3. Soy-bean and kinds of soy-bean

☐ 2. Kinds of seed ☐ 4. All above

14. When the child is suffered from inappetence, what following way is good to treat him/her?

☐ 1. Force the child eating ☐ 3. Stop feeding

☐ 2. Find out the causes ☐ 4. Do not know.
to feed child appropriately.

15. Vitamin C can be supplied naturally from many foods, particularly citrus fruits?

☐ 1. Yes ☐ 2. No

16. Vitamin A can be supplied naturally from fruits with red or yellow colour?

☐ 1. Yes ☐ 2. No

17. How often should the mother monitor the growth of healthy child 6-24 months?

☐ 1. Every 1 or 2 months ☐ 3. More than 3 months

☐ 2. Every 3 months ☐ 4. Do not know.

18. How should the mother monitor the growth of a malnourished child 6-24 months?

☐ 1. Every month ☐ 3. Every 3 months

☐ 2. Every 2 months ☐ 4.Do not know.

19. What direction on this growth chart showing a good growing child?

(The interviewer shows the direction of a growth chart and asks the mother what is the good direction)

☐ 1. The direction is upward ☐ 3. The direction is downward

☐ 2. The direction is no change ☐ 4. Do not know

20. What is the goal of using the growth chart for child 6-24 months?

☐ 1. To monitor the child growth ☐ 3. To monitor disease

☐ 2. To evaluate IQ ☐ 4. Do not know.

21. What are below foods not good for child when he/she gets sick?

☐ 1. Seafood

☐ 2. Meat

☐ 3. Fat food or oil

☐ 4. Fruit or vegetable

☐ 5. All of about

☐ 6. Do not know.

22. Does the child need to eat more food after sickness?

☐ 1. Yes ☐ 2. No

23. What following food is nutrient richest food?

☐ 1. Candies ☐ 3. Liver

☐ 2. Noodle ☐ 4. Do not know

24. Mother should not feed their child legume, because child stomach can not digest.

☐ 1. Yes, mother should not

☐ 2. No, mother should feed

☐ 3. Mother should cook through and feed

☐ 4. Not sure

Part 3 Food provided to children

25. When was the child first fed by supplementary food at the age of months? (1)

☐ 1. Appropriate ☐ 2. Inappropriate

26- 33. How frequency did you feed your child with kinds of food below during last week? *(Usually: ≥ 5 days per week; Sometime: 3-4days per week; rarely/seasonally: 1-2 days per week; never eat)*

	Kinds and frequency of foods	Yes			No
		Usually	Sometime	Rarely	Never
26	**Carbohydrate foods** Rice, cereal, noodle				
27	**Protein foods** (chicken, pork, beef, fish, shrimp, crab, egg).				
28	**Milk**				
29	**Vegetable** Dark green vegetable or yellow vegetable, legumes.				
30	**Fruits** Mango, papaya, banana, orange.				
31	**Fat** Fat food or oil				
32	**Iodine Salt**				
33	**Poor value foods** Cake, candy, snack, and other.				

34. Besides breast milk, did you fed the child with supplementary milk?

☐ 1. No (no supplementary milk or only breast milk)

☐ 2. Yes (powdered milk, soy bean, yogurt and others)

35. Did you add 1-2 coffee-spoon(s) of oil into daily meal of the child?

☐ 1. Yes ☐ 2. No

36. Did you often make orange juice for the child to drink?

☐ 1. Yes ☐ 2. No

37. How many main meals did the child eat every day?

☐ 1. 1 meal ☐ 3. 3 meals

☐ 2. 2 meals ☐ 4. > 3 meals

38. How many sub-meals did the child eat every day?

☐ 1. 1 meal ☐ 3. 3 meals

☐ 2. 2 meals ☐ 4. > 3 meals

39. Did the child have separated food?

☐ 1. separated ☐ 2. Not separated

40. How much food did the child eat in yesterday?

☐ 1. Finish < 1/3 or not eat

☐ 2. Finish from 1/3 to 1/2 of amount of food

☐ 3. Finish all food or near all food

41. Did you boil water for the child to drink?

☐ 1. No ☐ 2. Yes

Part 4 Maternal and child health care

42. Did you have medical check before delivery?

☐ 1. No ☐ 2. Yes

43. If yes, how many times were you medically checked your pregnancy before delivery? …….. times.

44. Did the child has habit of day sleep or not?

☐ 1. No ☐ 2. Yes

(If no, go to Q52)

45. If yes, how long did the child often sleep at daytime?

……. Minutes

46. How long in average did the child often sleep every night... hours?

(The mother will be asked what time the child often goes to bed every night and what time the child often weak up)

47. How often did you wash your hands after taking care for the child defecated?

☐ 1. Never washing

☐ 2. Sometimes washing but without soap

☐ 3. Sometimes washing with soap

☐ 4. Always washing but with no soap

☐ 5. Always washing with soap

48. How often did you use soap to wash your hands before prepare food for the child?

☐ 1. Never washing

☐ 2. Sometimes washing but with no soap

☐ 3. Sometimes washing with soap

☐ 4. Always washing but with no soap

☐ 5. Always washing with soap

49. Did the child get diarrhea (2) in the last week?

☐ 1. Yes ☐ 2. No

50. Did you use ORS for your child when he/she got diarrhea in previous times?

☐ 1. No ☐ 2. Yes

51. Did the child drink ORS when the child got diarrhea?

☐ 1. No ☐ 2. Yes

52. Did the child get fever (3) or cough within the last 2 weeks?

☐ 1. Yes ☐ 2. No

53. Do you have hygienic latrine?

☐ 1. No ☐ 2. Yes

Notes:

(1) Appropriate at 6 months of age; inappropriate before or after 6 months of age

(2) Diarrhea: present of watery stool and three or more times passes stool per day

(3) Fever: state of temperature under children's aim ≥ 37.5^0 C

ARI: present of cough and/or running nose

APPENDIX B

Table 4.15: The distribution of maternal knowledge

Knowledge statements	Correct answer	
	Frequencies (n=250)	**Percent (%)**
Colostrums	188	75.20
Complementary food	58	23.20
Groups of essential food	177	70.80
Spoon of oil	222	88.80
Kinds of food are good for health	144	57.60
Feeding the child appetizingly	149	59.60
Vitamin C	242	96.80
Vitamin A	227	90.80
Monitoring healthy child	103	41.20
Monitoring malnourished child	170	68.00
Direction of growth chart	167	66.80
Goals of using growth chart	197	78.80
Taboo food	68	27.20
Eating needs after sickness	204	81.60
The richest Nutritional food	180	72.00
Vegetables	140	56.00

Table 4.16 The relationship between the nutritional status of children and maternal Knowledge

Knowledge statements	Nutritional status n=250		Crude OR	95% CI	P-Value
	Normal	Underweight			
Colostrums					
Correct answer	68.62	31.38	1		
Incorrect answer	70.97	29.03	0.89	0.48-1.68	0.727
Complementary food					
Correct answer	74.14	25.86	1		
Incorrect answer	67.71	32.29	1.37	0.71-2.65	0.347
Groups of essential food					
Correct answer	74.01	25.99	1		
Incorrect answer	57.53	42.47	2.10	1.19-3.73	0.011*
Spoon of oil					
Correct answer	69.82	30.18	1		
Incorrect answer	64.29	35.71	1.29	0.56-2.93	0.555
Kinds of food are good for health					
Correct answer	67.36	32.64	1		
Incorrect answer	71.70	28.30	0.81	0.47-1.41	0.462
Feeding the child appetizingly					
Correct answer	75.84	24.16	1		
Incorrect answer	59.41	40.59	2.14	1.24-3.70	0.006**
Vitamin C					
Correct answer	69.42	30.58	1		
Incorrect answer	62.50	37.50	1.36	0.32-5.85	0.682
Vitamin A					
Correct answer	95.65	4.35	1		
Incorrect answer	66.25	33.48	11.07	1.46-83.71	0.020*

**** Significance at P-value< 0.05***

***** Significance at P-value< 0.01***

Table 4.16 The relationship between the nutritional status of children and maternal Knowledge (cont.)

Knowledge statements	Nutritional status n=250		Crude OR	95% CI	P-Value
	Normal (%)	Underweight (%)			
Monitoring healthy child					
Correct answer	72.82	27.18	1		
Incorrect answer	66.67	33.33	1.34	0.77-2.33	0.301
Monitoring malnourished child					
Correct answer	75.88	24.12	1		
Incorrect answer	55.00	45.00	2.57	1.47-4.52	0.001**
Understanding the direction of growth chart					
Correct answer	74.85	25.15	1		
Incorrect answer	69.20	30.80	2.17	1.24-3.79	0.007**
Goals of using growth chart					
Correct answer	75.63	24.37	1		
Incorrect answer	45.28	54.72	3.75	2.00-7.05	<0.001**
Taboo food					
Correct answer	76.47	23.53	1		
Incorrect answer	66.48	33.52	1.64	0.86-3.11	0.130
Eating needs after sickness					
Correct answer	67.65	22.35	1		
Incorrect answer	76.09	23.91	0.66	0.31-1.37	0.265
The richest Nutritional food					
Correct answer	71.67	28.33	1		
Incorrect answer	62.86	37.14	1.49	0.83-2.68	0.177
Vegetables					
Correct answer	67.86	32.14	1		
Incorrect answer	70.91	29.09	0.87	0.50-1.49	0.604

***** Significance at P-value< 0.01***

Table 4.17 The percentage distribution of essential food provision

Food provision	Frequency (n= 250).	Percent (%)
carbohydrate		
Appropriate (yes)	250	100.00
protein		
Appropriate (yes)	130	52.00
Inappropriate (no)	120	48.00
milk		
Appropriate (≥ 3 times)	177	70.80
Inappropriate (<3 times)	73	29.20
vegetable		
Appropriate (≥1 times)	132	52.80
Inappropriate (<3 times)	118	47.20
Fruits		
Appropriate (separated)	211	84.40
Inappropriate (not separated)	39	15.60
Fat or oil		
Appropriate	77	30.80
Inappropriate	173	69.20
Iodine salt		
Appropriate (yes)	203	81.20
Inappropriate (no)	47	18.80
Poor value foods		
Appropriate	191	76.40
Inappropriate	59	23.60

Table 4.18 The relationship between the nutritional status of children and essential food provision

Essential food provision	Nutritional status n=250		Crude OR	95% CI	P-Value
	Normal (%)	Underweight (%)			
Protein					
Appropriate	79.23	20.77	1		
Inappropriate	58.33	41.67	2.72	1.56-4.76	<0.001**
Milk					
Appropriate	73.45	26.55	1		
Inappropriate	48.90	41.10	1.93	1.09-3.42	0.025*
Vegetable					
Appropriate	75.76	24.24	1		
Inappropriate	61.86	38.14	1.93	1.12-3.32	0.018*
Fruits					
Appropriate	70.14	29.86	1		
Inappropriate	64.10	35.90	1.32	0.64-2.70	0.454
Fat or oil					
Appropriate	80.52	19.48	1		
Inappropriate	64.16	35.84	2.31	1.21-4.40	0.011*
Iodine salt					
Appropriate	70.94	29.16	1		
Inappropriate	61.70	38.30	1.51	0.78-2.94	0.218
Poor value food					
Appropriate	70.68	29.32	1		
Inappropriate	69.20	30.80	1.33	0.72-2.47	0.362

**** Significance at P-value< 0.05***

***** Significance at P-value< 0.01***

APPENDIX C

Participant Information Sheet

In this document, there may be some statements that you do not understand. Please ask the researcher or his/her representative to give the mothers explanations until the mothers are well understood.

Title of Research Project: Relationship between nutritional status and food provided to children aged from 6 to 24 months in Quang Ngai province, Vietnam.

Name of Researcher: Dr. Ho Dac Chien

Research Site - Office and its telephone number available for contact both in and out of the office hours:

Master of Primary Health Care Management (MPHM) Office, ASEAN Institute for Health Development (AIHD), Mahidol University, Salaya, Phutthamonthon, Nakhon Pathom, Thailand

Tel: (66)24419040-3. Fax: (66)24419044 (in office hours). Tel: 0866449247(out office hours)

Source of Fund: Self support

This research project aims to determine the relationship between nutritional status of children aged from 6 to 24 months and the food provided to them in Quang Ngai province, Vietnam, which expects the following benefits: This study will highlight nutrition status of children aged from 6 to 24 months in Quangngai province, Vietnam, causes of the high prevalence of malnourished children. In order to solve this

problem, it requires appropriate interventions and participation of different organizations in the society.

In light of the causes, the government and other organizations will be better able develop more effective strategies to solve and prevent child malnutrition.

You are invited to participate in this research project because you have children aged from 6 to 24 months.

There will be **249** participants, and the research project will last for 10 months from August 2009 to May 2010.

If you decide to participate in the research project, you will go through the following procedures

You are invited to answer the structured questionnaire and measured your child's weight. The questionnaire contains four parts including 59 questions. Time to complete this questionnaire is about 15 – 20 minutes. There is no tape record or home visit.

- After the questionnaire is done completely, the participants will be received milk cans as gifts to appropriate their participation.

- This is a research project in the field of social or behavioral sciences distributing self-administered questionnaires to the participants, the likely risks include uneasiness or discomfort due to some questions. In that case, the participant has the right not to reply and withdraw from the study in anytime

If adverse events/unanticipated events occur, please do not hesitate to contact Dr. Ho Dac Chien Tel: (84)055.3824960

Remuneration: The researcher's appreciation for participation in this study will be expressed by giving some gifts such as milk cans.

Expense: There is no expense for the participants**.**

If relevant information arises about benefits and risks of the research project, the researcher will inform the participant immediately and without concealment.

The participant's private information will be kept confidential, it will not be subject to an individual disclosure, but will be included in the research report as part of the overall results. Individual information may be examined by groups of persons e.g. from a funding organization, a government agent in charge, the ethics committee, etc.

The participant has the right to withdraw from the project at anytime without prior notice. And the refusal to participate or the withdrawal from the research project will not at all affect to him/her.

On the condition that the paticipants are not treated as indicated in this information sheet, you can contact the Chair of Mahidol University Institutional Review Board (MU-IRB) at the office of MU-IRB, Research Administration Division, Office of the President, Mahidol University, Tel 66-2-8496223-5, Fax 66-2-8496223.

I thoroughly read the details in this document.

Signature…… Participant

(.....)

Date…….....

Form of Informed and Voluntary Consent to Participate in Research

My name is……, aged……..years old, now living at subdistrict/tambon……..district/amphur……..province…… Postal code…….…Tel. No.:……

I hereby express my consent to my child's participation as a subject in the research project entitled**:**

Relationship between nutritional status and food provided to children aged from 6 to 24 months in Quang Ngai province, Vietnam.

In so doing, I am informed of the research project's origin and purposes; its procedural details to carry out or to be carried out; its expected benefits and risks that may occur to the subjects, including methods to prevent and handle harmful consequences; and remuneration, and expense. I thoroughly read the detailed statements in the information sheet given to the research subjects. I was also given explanations and my questions were answered by the head of the research project.

I therefore consent to participate as a subject in this research project. On the condition that I have any question about the research procedures, or on the condition that I suffer from an undesirable side effect from this research, I can contact Dr. Ho Dac Chien Tel. (84)055.3824960

On the condition that I am not treated as indicated in the information sheet distributed to the subjects, I can contact the Chair of Mahidol University Institutional Review Board (MU-IRB) at the office of MU-IRB, Research Administration Division, and Office of the President, Mahidol University, Tel 66-2-8496223-5, and Fax 66-2-8496223.

I am aware of my right to further information concerning benefits and risks

from the participation in the research project and I have right to withdraw or refrain from the participation anytime without any consequence on the academic result in the future. I consent to the researchers' use of my private information obtained in this research, but do not consent to an individual disclosure of private information. The information must be presented as part of the research results as a whole.

I thoroughly understand the statements in the information sheet for the research subjects and in this consent form. I thereby give my signature.

Signature..... Participants/ Proxy/ Date.....

(.....)

Signature..... Person in Charge of Informing and Requesting a Consent/ Head of (.....) Research Project/ Date.....

In case that the participant is not literate, the reader of all the statements for the participant is (Mr. /Mrs./Ms……), who gives his/her signature as a witness.

Signature.....Witness/Date.....

(.....)

BIOGRAPHY

NAME	Ho Dac Chien
DATE OF BIRTH	April 19, 1969
PLACE OF BIRTH	Quang Ngai, Vietnam
INSTITUTIONS ATTENDED	Medical and Pharmacy University, HCM City, Vienam Medical Doctor (1987 – 1993) ASEAN Institute for Health Development, Mahidol University, Master of Primary Health Care Management (2009 – 2010)
FELLOWSHIP/ RESEARCH GRANT	IFP (International fellow program)
PRESENT POSITION	Medical Doctor (Officer of Quang Ngai Health Information Education Communication Center) Quang Ngai health service. Quang Ngai, Vietnam