RELATIONSHIP BETWEEN STUNTING AND FOOD PROVIDED TO CHILDREN AGED FROM 6 TO 24 MONTHS IN SOC SON DISTRICT, HANOI, VIETNAM

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ABSTRACT

A case-control study was conducted to determine the risk factors of stunted children in Soc Son district, Hanoi, Vietnam. The risk factors were classified into socio demographic factors, maternal knowledge, food provision practices, and maternal and child health care. The data were collected from January 12 to February 3, 2009. The subjects were 236 children aged 6 - 24 months, out of whom 118 stunted children were selected as a study group and 118 normal children were selected as a control group. Secondary data included nutritional status and information about the children. Mothers were interviewed and measured for their height after they gave consent to participate in the study.

From Chi-square test, the following factors increased the likelihood of stunted children: mothers less than 150 cms tall (P-value=0.047), low birth weight (P-value=0.011), mothers' lacking knowledge about iron supplementation (P-value=0.025), inappropriate duration of monitoring an underweight child (P-value=0.009), inappropriate eating of protein foods (P-value=0.013), inappropriate eating of all kind of foods (P-value=0.013) and having acute respiratory infection (ARI) (P-value=0.014). From the final model of Multiple Logistic Regression, the variables found most significantly associated with stunted children were low birth weight (OR=7.720, 95% CI = 1.672-35.687), inappropriate feeding practices (OR=1.929, 95% CI=1.124-3.308) and having ARI (OR=4.315, 95% CI=1.361-13.677).

Appropriate nutritional education, diet and iron supplementation should be given to pregnant women and adolescent girls to reduce low birth weight. Child malnutrition control programs should focus on appropriate feeding practices especially with high risk groups (low birth weight children and stunted children). Education programs for ARI prevention should include provision of appropriate food, good environment and hygienic practices.

KEY WORDS : STUNTING/ FEEDING PRACTICES/ CHILDREN AGED 6 TO 24 MONTHS

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LIST OF ABBREVIATIONS

MOH	:	Ministry of Health
WHO	:	World Health Organization
UNICEF	:	United Nation Children's Fund
NIN	:	National Institute of Nutrition
UN	:	United Nation
ANC	:	Antenatal Care
NCHS	:	National Center for Health Statistic
BMI	:	Body Mass Index
EB	:	Exclusive Breastfeeding
CF	:	Complementary Feeding
GC	:	Growth monitoring Chart
ARI	:	Acute Respiratory Infection

CHAPTER I
INTRODUCTION

1.1 Rationale and justification

Nutrition plays a very important role in the human life cycle, especially during childhood. Well nourished and healthy children are the foundation of a healthy, productive society. However, malnutrition, Vitamin A and iodine deficiency, and anemia are major primary health care problems in many countries in the world. In 2007, UNCEF estimated that about 32.5% of children aged < 5 years old in the world suffer from malnutrition, and 29.0% also suffer stunting (1).

In 2007, 90% of malnourished children in the world lived in the 36 poorest countries (including Vietnam) (2). One hundred and seventy eight million children under five years suffered from stunting. In Vietnam there were 7.56 million children under 5 years old of whom 1.63 million (21.2%) were underweight and 2.59 million (33.9%) were stunted. The prevalence of malnutrition differs by regions (1, 3).

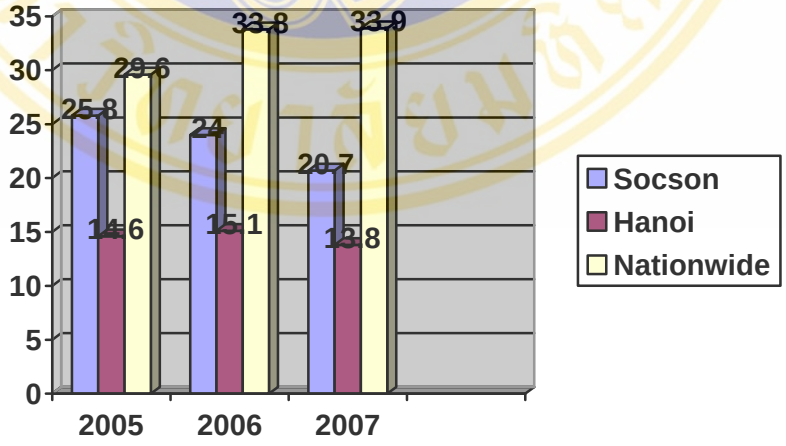
Over the past decade (1997-2007), the prevalence of underweight children in Vietnam decreased rapidly from 45% to 24.2%.The prevalence of stunting also declined quickly from 47% in 1997 to 36.5% in 2000, but then slowly decreased to 33.9% in 2007 (Table1).

Table 1 Trends malnutrition of under five years old children

	1997	2000	2005	2006	2007
Underweight	45	33.8	21.6	20.8	21.2
Stunting	47	36.5	29.6	33.8	33.9
Wasting	12	8.6	6.9	7.1	7.1

Sources: NIN, MOH.Vietnam.2000, 2005, 2007 (4-7).

Hanoi is the capital of Vietnam, and situated in the Red River Delta region. In 2007, the prevalence of stunting in Hanoi was 13.8%,the second lowest rate in Vietnam. However, the prevalence of stunting varied by district, and Hanoi has 9 urban districts and 5 rural districts. Soc Son is one of the 5 rural districts and has the highest prevalence of child malnutrition (both underweight and stunting). Soc Son is located southeast of Hanoi and comprises 26 different communities in different geographical regions: hills, mountains, river and delta. In 2007, the prevalence of stunting in Soc Son was 20.7% and high compared to Hanoi and nationwide (Figure1).



Source: Hanoi reproductive health care center. 2007(3).

Figure 1 Prevalence of stunting in Soc Son district, Hanoi city and nationwide

A priority malnutrition control program implemented in this district some years ago, but in 18 of the 26 communities over 20% of children aged ≤ 5 suffered

stunting. From 2006 to 2007, a pilot study monitored the length of children born in year 2006 to identify stunting trends in 2 communities in Soc Son district. The results showed that the prevalence of children aged ≤ 2 years with stunting was 16.8% (3,7).

Stunting occurs at a very young age in children, mostly before the age of two, and the effects are irreversible. The consequences of malnutrition and micronutrient deficiency are varied. Malnutrition weakens the immune system, making a child susceptible to diseases, increasing the severity of illnesses and impeding recovery, and impairing intellectual development and cognitive ability. Stunted girls in the future will become malnourished mothers and pose a greater risk of malnutrition for the future generation. If a child is malnourished in the first two years, he/she will have a greater risk of some chronic diseases related to nutrition in the future, such as obesity or diabetes (8,9).

Stunting is caused by long term insufficient nutrient intake and frequent infections. The main causes of malnutrition are lack of protein; micronutrient and energy deficiency; infection (diarrhea, pneumonia); and poor knowledge of mother. Other causes include poor protein supply for pregnant women, not breastfeeding, low family income, low education of mother and father, lack of safe water and poor sanitation. Low socio-economic status families are less able to provide children with proper nutrition and care (1, 9).

The stage from pregnancy to age 24months is the critical window of opportunity for the delivery of nutritional intervention. Therefore, if improper nutrition interventions are implemented during this time, the children can suffer irreversible damage extending into their adult life and to the subsequent generation (1).

Accordingly, the problem of stunting in the Soc Son district in particular, and Vietnam in general, requires intervention to reduce stunting. Exploring the main factors contributing to stunting, therefore, will contribute to the decline of stunting in not only Soc Son and Hanoi, but also nationwide in Vietnam.

This study is intended to identify the association between food provided, maternal child care factors and the stunted children aged from 6 months to 24months in Soc Son district, Hanoi, Vietnam.

1.2 Research question

What is the relationship between food provided, maternal and child health care and child stunting in Soc Son district, Hanoi, Vietnam?

1.3 Research Objective

1.3.1 General objective

To determine the relationship between food provided, maternal and child health care and stunted children in Soc Son district, Hanoi, Vietnam

1.3.2 Specific objectives

1.3.2.1 To determine the relationship between socio-economic demographic factors and child stunting.

1.3.2.2 To determine the relationship between maternal knowledge about food provision and stunting.

1.3.2.3 To determine the relationship between food provision practice factors and stunting.

1.3.2.4 To determine the relationship between maternal and child health care factors and stunting

1.4 Conceptual framework

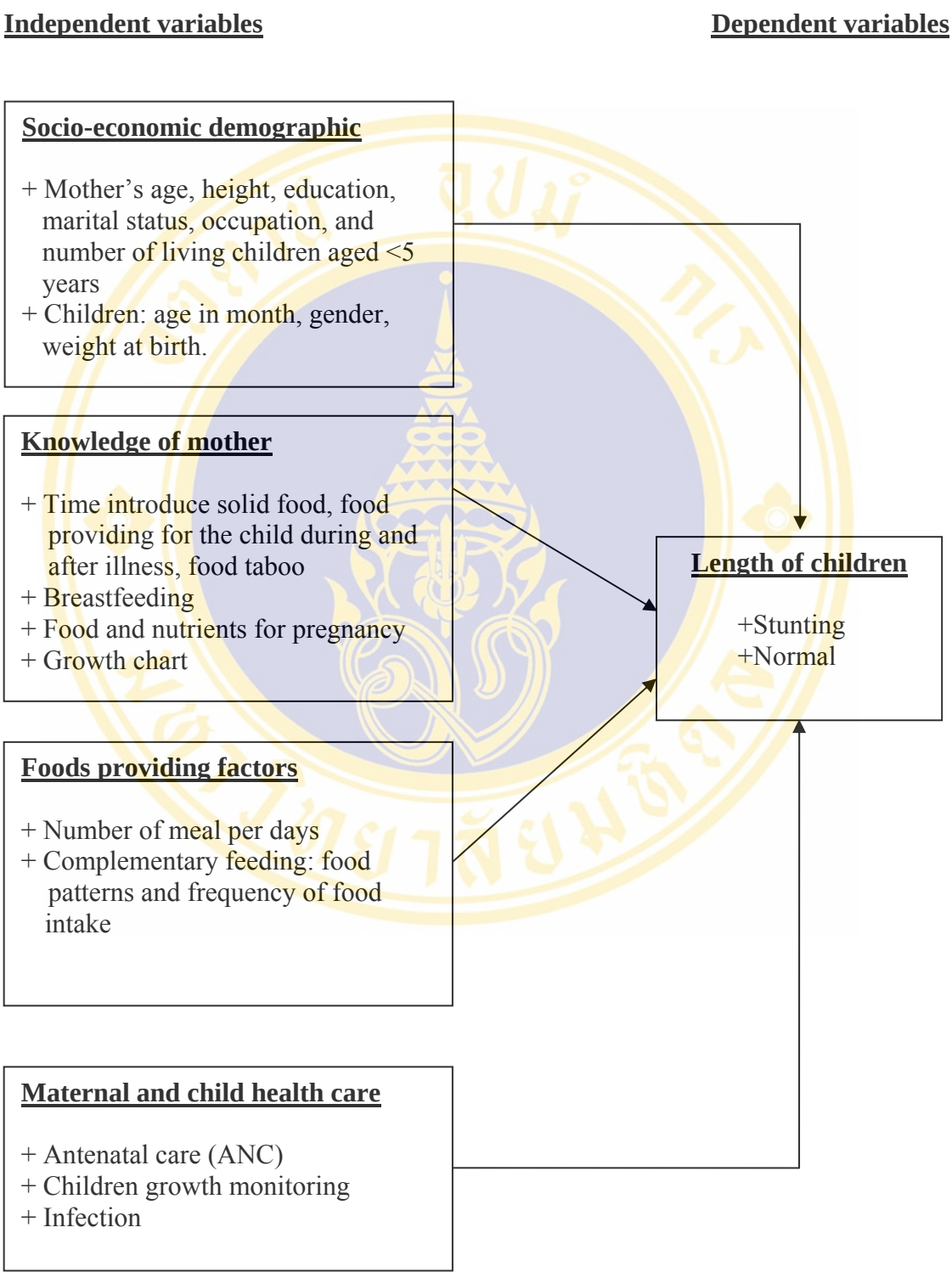


Figure 2 Conceptual framework

1.5 Research Hypotheses

1.5.1 There is a relationship between stunting and characteristics of mothers and children.

1.5.2 There is a relationship between stunting and knowledge of mother about food provision.

1.5.3 There is a relationship between stunting and food provision.

1.5.4 There is a relationship between stunting and maternal child care practices.

1.6 Operational definition of study

1.6.1 Outcome variable: Length/Height for age

Stunting means the length of a child for age less than minus 2 standard deviation (-2SD) from the median height for age of reference population.

Normal means the length of the child for age equal or greater than minus 2 standard (-2SD) deviation from the median height for age of reference population.

The child stunting or normal in this study will be chosen from secondary data at Soc Son district health office.

1.6.2 Socio-economic demographic factors

Socio-economic demographic factors in this study refer to month, age and gender of a child; characteristics of mother include age, height, marital status, education, number of children, and occupation.

1.6.2.1 Age in month is the number of months after the child was born.

1.6.2.2 Age of mother refers to complete year of maternal age.

1.6.2.3 Marital status is classified into two groups

+ Group1: Married (living together)

+ Group 2: Separated/divorced/widowed

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

1.6.2.5 Number of children refers to number of living children under 5 years old that a respondent has had.

1.6.2.6 Occupation is the main occupation of a mother. It is divided into 6 categories: housewife; farmer; laborer/factory worker; government employee; commerce/handicrafts; and others.

1.6.2.7 Height of mother refers to the height in cm of a mother measured at the time of interview.

1.6.2.8 Gender of child is male or female

1.6.2.9 Weight at birth refers to the weight in grams of children at birth.

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

1.6.4 Foods provision factors refers to breastfeeding and complementary feeding.

1.6.4.1 Breastfeeding refers to the duration of breastfeeding.

1.6.4.2 Complementary feeding means food given to the children in addition to breast milk.

+ **Food patterns** refers to the kinds of food given to the children daily. Kinds of food is divided in to into 7 groups: 1.carbohydrate foods (rice, cereal, noodle), 2. protein (meat, fish, egg, shrimp), 3.vegetables, 4. fruit, 5. fat or oil, 6. iodine salt and 7. poor value food: soft drink, sweet candies, crisps. This food items intake is based on the WHO guidelines(10,11)(See appendix B).

+ **Frequency of food intake** is the divided in to 4 categories: Usually: eat every day or at least 5 days/week; Sometimes: 3-4 days/week; Rarely: 1-2 days/week or seasonal; and Never: do not eat any food.

+ Number of meals is defined as the number of meals or meal frequency provided for the children per day based on WHO recommended guideline principles for children of different ages (11). (See appendix B).

+ **Food provided during and after illness** refers to the food that a mother provides for children during and after illness.

+ Food taboo refers to cultural beliefs in different communities that mothers should avoid certain foods when child falls sick.

1.6.5 Maternal child health care

1.6.5.1 Antenatal care refers to the number of antennal carevisits during pregnancy.

1.6.5.2 Growth monitoring refers to measuring the weight of under 2 year old children periodically based on the guideline of National Institution of Nutrition that weight monitoring should occur every 3 months for normal children and every month for malnourished children.

1.6.5.3 Disease of children refers to some diseases or symptoms like diarrhea, fever, runny nose and cough that occurred during the last 2 weeks.

1.7 Limitation of the study

This study is only concerned with kind of food and frequency of food intake; it is not concerned with calculating the amount of food consumed by children.

The study group was selected from 1 rural district, and therefore may not be representative of the wider population.

A case-control study design can only measure the strength of an association; it cannot measure cause and effect. Thus, the finding of the study may not conclude that food provision affects child stunting.

CHAPTER II
LITERATURE REVIEW

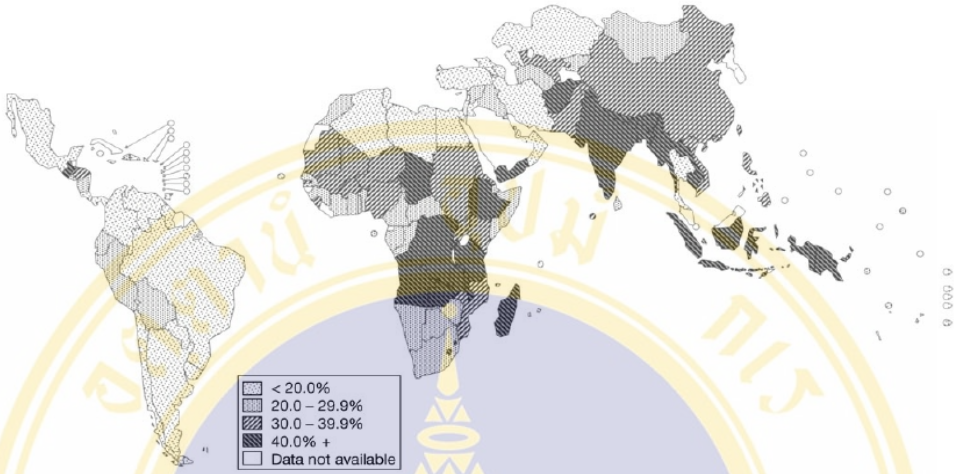
2.1 Stunting: situation, consequences and determinants

2.1.1 Global situation of stunting

Good nutrition is the cornerstone for survival, good health and development. Well-nourished children perform better in school, grow into healthy adults, and in turn give their children a better start in life. Ensuring the healthy children is not only a challenge for parents, but also for those who care for the health and well-being of the future generation. (8)

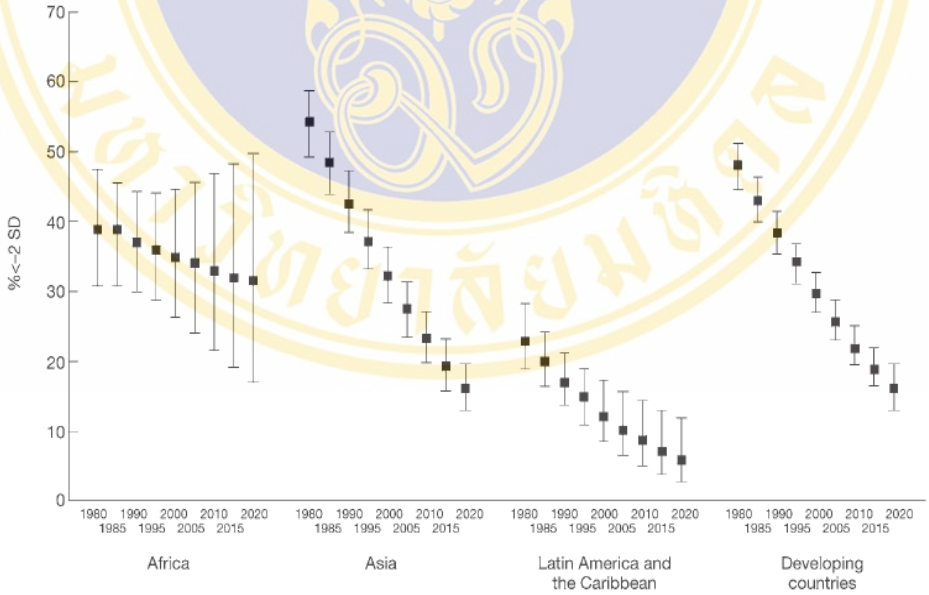
Figure 3 shows that stunting is very common in many countries of sub-Sahara Africa, south central Asia and south east Asia. Latin America and the Caribbean have low or moderate rates of stunting. Laos and Cambodia are among those countries with a very high prevalence of more than 40%; Vietnam and China are also in a high group with more than 30%; and Thailand is in a lower group with less than 20% (12).

In Africa, a minor improvement in the prevalence of stunted children from 34.9% to 31.1% is predicted for the next 20 years. In Asia, Latin America and the Caribbean the prevalence of stunted children will continue to decrease during the same time period. Stunting rates in developing countries are expected to continue to decrease from 29.8% to 16.3% by 2020 (Figure 4).



Source: WHO 2002 (12)

Figure 3 Global database on child growth and malnutrition



Source: WHO 2002(12)

Figure 4 Trends in percentage of stunting in preschool children (1980-2020) by UN Regions.

2.1.2 Stunting in Vietnam

During the last 10 years, Vietnam has achieved much socio-economic progress and development, and the prevalence of malnutrition has fallen rapidly. Since the malnutrition program began and National Plan of Action for Nutrition was approved in 1995, the prevalence of stunting has declined 1.8 percentage points per year (from 46.9% in 1995 to 29.6% in 2005) (6). Worldwide, the most rapid rate of progress has occurred in South East Asia at 0.9 percentage points per year. However, due to the low starting point (very high prevalence in the beginning), the prevalence of stunting is still high (according to WHO classification 30-39% means high). Since 2006, the standard for calculating whether a child was normal or malnourished was changed by WHO. Before 2006, the nutrition status of children was estimated based on the National Center for Health Statistics (NCHS)/ WHO international growth reference ("The NCHS reference"); since then, however, it has been based on the WHO Child Growth Standards ("The WHO standards").

Figure 5 compares the NCHS reference and the WHO standard. The prevalence of stunting according to the WHO standard is higher than by the NCHS reference. In contrast, the prevalence of underweight children by the WHO standard is lower than by the NCHS reference (13).

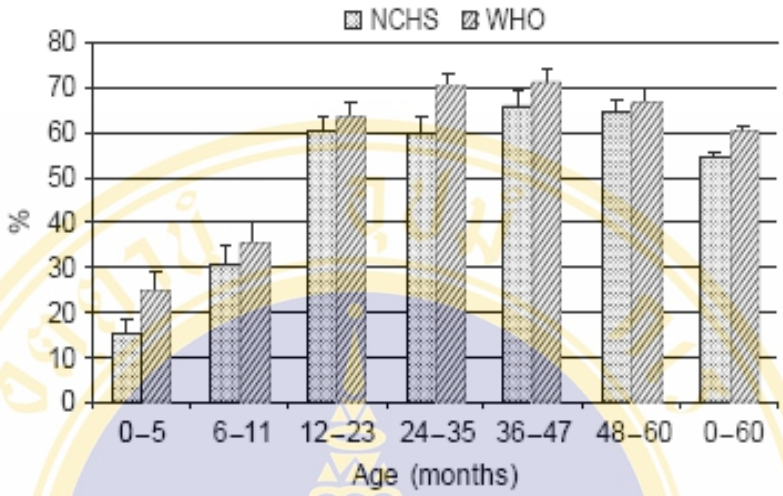


Figure 5 Prevalence of stunting (below – 2 standard deviation from the median for length/height – for – age) by age based on the World Health Organization (WHO) standard and the National Centre for Health Statistic (NCHS) reference in Bangladesh (13).

A 2005 survey of child stunting in 64 provinces in Vietnam revealed 29 provinces with stunting at low and medium levels, 28 provinces at a high level and 7 provinces at a very high level of stunting. This survey also revealed that stunting appeared very early in a child's life with 6.3% of children under 6 months of age, and 37.1% children from 12 to 24 months, stunted. It was documented that stunting was a cumulative process and resulted from poor health care and insufficient food consumption by pregnant women. Chronic energy deficiency (BMI<18.5) affected 26.7% of mothers who had children under 5 years old (6).

The prevalence of malnutrition varied between regions (Table 2)

Table 2 The prevalence of stunting by regions (%)

Regions	2000	2005	2007
Red River Delta region	31.9	24.1	28.9
North East region	41.5	33.6	36.2
North West region	43.9	35.6	37.6
North Central Cost region	44.1	35.1	36.2
South Central Cost region	36.9	29.3	33.2
West Highland region	49.9	41.5	43.3
South East region	26.9	21.6	28.1
Mekong River Delta region	34.0	28.1	30.8
Nationwide	36.5	29.6	33.9

Sources: General Nutritional Survey 2000, Annual report 2005 -7 (3,4,6)

2.1.3 Consequences of stunting

Stunting has been considered an indicator of chronic malnutrition or of an event in the past and the consequent process is still ongoing. Stunting can occur at different times in the development of children. Growth failure can occur as early as the second trimester of gestation. Growth impairment can be experienced from soon after birth until the second or even third year of life. In a stunted child, if the environmental factors do not change, the attainment of full growth potential is unlikely.(8,12). The small adult has limitations of working capacity compared to an adult of normal stature. Stunting can also lead to increased risk of hypertension (8).

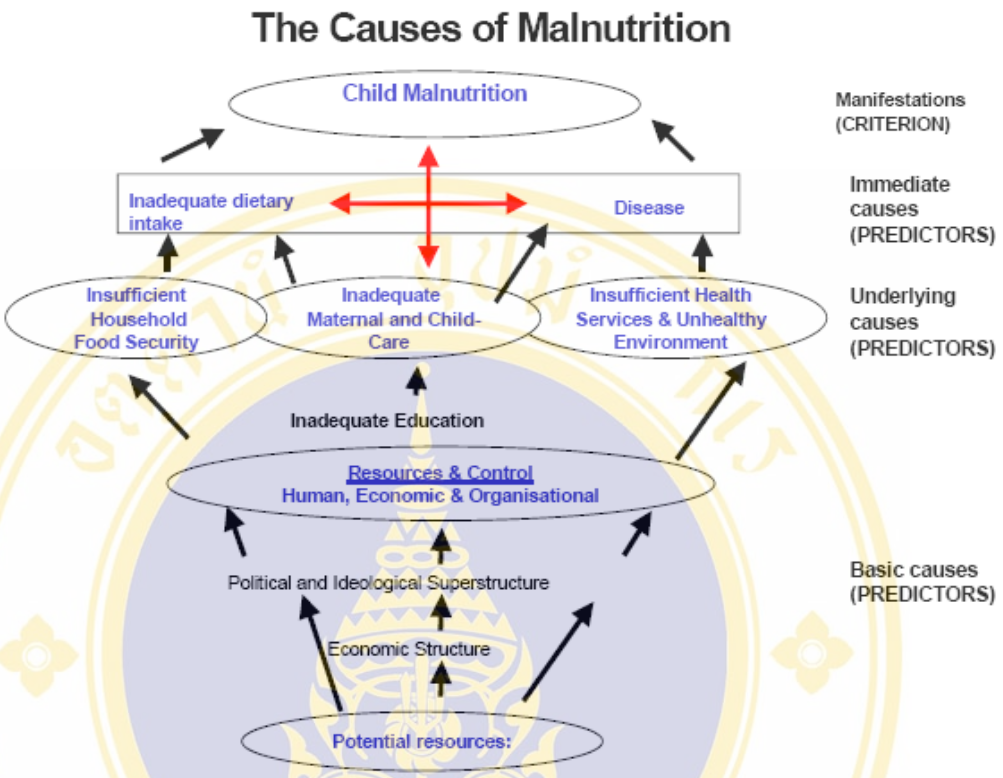
Berkman, et al. (2002) showed that stunted growth caused by chronic malnutrition during the first two years of life can adversely affect a child's cognitive ability later. Stunting is also associated with increased child morbidity and mortality (14).

Walker, et al. (1986) conducted a prospective cohort study of stunted and non-stunted children at 9-24 months assessed at 17 years in Jamaica and found that the stunted participants reported significantly more anxiety, depressive symptoms and low self esteem than the non-stunted (15).

2.1.4 Determinants of stunting

The UNICEF conceptual framework shows that causes of malnutrition are multisectoral, taking into account food, health and caring practices. It also classified the causes of malnutrition in to 3 levels (individual, household or family, and societal) to help assessing, analyzing and deciding on what action to take at each level of society to solve nutritional problems. The immediate causes of malnutrition are both disease and nutrient intake, and the interaction between the two. The underlying causes are household food security; health, water and sanitation; inadequate maternal child health care and insufficient services, and unhealthy environment. The basic cause is potential resources. Equity in the distribution of such resources is related to the political and ideological superstructure. Education also influences to the use and distribution of resources to the community (Figure 6).

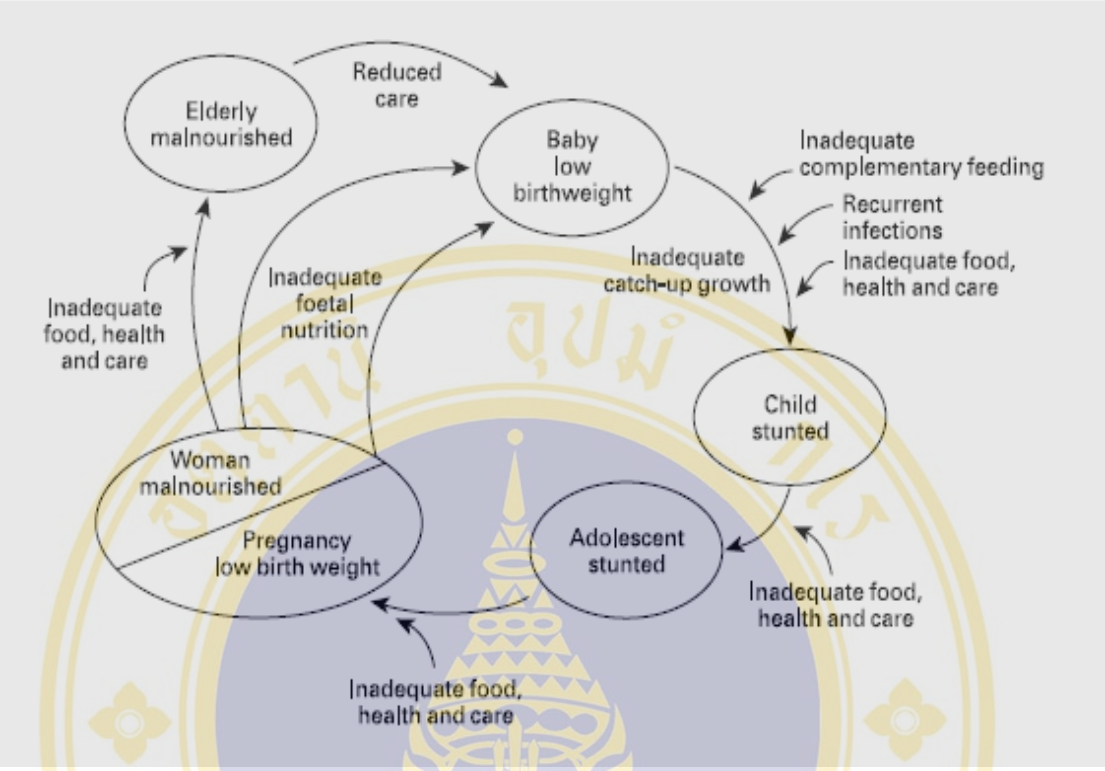
Hop LT, et al. (1981-1991) in their longitudinal observation of child growth in Hanoi from birth to 10 years revealed that the highest proportions of stunting occurred at 21 months (59.4%male and 58.3% female). Growth retardation at birth was due to the poor nutritional and health status of their mothers. From 3-4 months of age, children grew well but then growth faltered due to inadequate complementary feeding practices (16).



Source: UNICEF conceptual framework (9)

Figure 6 The UNICEF Conceptual Framework for basic causes of malnutrition

Figure 7 describes the cycle of stunting resulting from cumulative factors. Mothers malnourished because of inadequate food and health care are the main cause of low birth weight. Low birth weight children have difficulty catching up their normal development and, in turn, may become short mothers at addictional risk of delivering stunted children.



Source: Branca.F, Ferrari.M (8)

Figure 7 "The poor nutritional cycle"

2.2 Theoretical model

Conceptual framework of the study is constructed based on the UNICEF conceptual framework of the causes of malnutrition developed in 1990 as a part of the UNICEF Nutritional Strategy and the model of "The poor nutritional cycle"(Figure 6,7).

The outcome of study: Stunting

Immediate factors: Food intake and diseases

Underling factors: Antenatal care, care of ill children, breastfeeding

Basic factors: Education level of mothers, knowledge of mother, mother's height and age, number of children per mother, weight of children at birth.

2.3 Literature regarding independent variables

2.3.1 Socio-economic demographic factors

Mother's age

A recent study of risk factors associated with stunting (Vitolo MR, Gama CM, Bortolini GA, Canpagnolo PD, 2002) conducted in Brasil found that a mother's age < 20 year was associated with stunted children under 5 years old (OR 1.60; 95% CI 1.09-2.35) (17).

Educational level of mothers

Wamani H, et al. (2002) conducted a cross-sectional study of the nutritional status of children under 2 years old in rural Uganda and found that stunting was positively associated with a wide range of factors of which being born to a mother with an education level lower than primary school was one factor. (OR 2.1; 95% CI 1.1-4.0) (18)

The Vietnam Annual Report, 2005, found that the mothers with an educational level higher than high school had the lowest prevalence of child stunting (19.5%) compared to the illiterate mothers (37.4%) or mothers with only primary school (33.2%) or high school education (25.6%) (6).

Yaa AL and Sturla K (2005) conducted a case-control study to determine the relationship between a mother's knowledge, maternal education and child nutritional status. The study showed that maternal nutrition knowledge was independently associated with nutrition status but maternal education, on the other hand, was not.They concluded, therefore a mother's knowledge is more important than education level (19).

Number of children per mother

Vitolo MR, et al (2002) also found that there was significant association between child stunting children and having three or more siblings (OR 3.12; 95% CI 2.18-4.47). (17)

The annual report of nutritional status of children and mothers in Vietnam 2005, reported that the prevalence of stunting increased with the number of children under five years old per mother by 23.7%, 26.3% and 32.5% with mothers with one, two and three or more children respectively (6).

Height of mother

Maternal nutrition status affects child nutrition status at infancy and beyond (20). "The poor nutrition cycle" shows the inter-generational cycle of stunting. Short maternal status, low pre-pregnancy BMI, and low pregnancy weight gain are the main recognized determinants of intrauterine growth retardation (12).

Harnandes DS, et al. (1999) studied the relationship between stunting and short status of mothers, controlling for potential environmental confounders in under five year old children in Mexico. For crude analysis, a mother with short status (<145cm) was significantly more likely have stunted children. (OR 4.0; 95% CI 3.2-4.8), P value < 0.001. After adjustment for environment factors OR still high difference between regions: Mexico City OR 3.9, North Mexico OR 3.1, Central Mexico OR 2.0 and South Mexico OR 1.6. (21).

Marital status

A mother living alone is not interested in cooking and often buys fast food from food shops. This food does not have enough basic nutrients for their children's development. A mother living alone has to work hard to earn money, and may not have time to look after her children. Therefore, the children of single mothers easily suffer from malnutrition (22).

Child birth weight

Stunting was significantly associated with low birth weight in the cross sectional study conducted by Vitolo MR, Gama CM, Bortolini GA and Canpagnolo PD 2002 (OR 3.49 95% CI 2.53-4.80) (17).

Age of children in months

Kwena AM, et al. (2003) found that stunting increased rapidly from 3 to 18 months of age and was greatest in children 18-23 months. From 24 months of age onwards, stunting stabilized but still remained below the reference median with no evidence of catching up growth (22).

A nutritional survey in Vietnam also noted that the prevalence of stunting increased sharply before the age of two, and continued after that. The prevalence of stunting by age group: 0-5.9 months 6.3%, 6-23.9 months 32.7%, 24-35.9 months 38.5%, 36-47.9 months 38.5% and 48-60 months 39.4% (6).

Gender of children

Some studies of the relationship between stunting and gender of children have shown that the prevalence of stunting among boys is higher than girls (23,24).

2.3.2 Food provision

Breastfeeding

Early breastfeeding provides crucial nutrients, protects infants against deadly disease (by providing anti-infective factors), and fosters growth and development. Exclusive breastfeeding to the age of six months could prevent the death of 1.3 million children under 5 years old each year. Furthermore, early breastfed children after delivery provides several benefits to the infant and the mother such as prolonging the duration of lactation amenorrhea, and protecting the mother from another pregnancy in the first six month after delivery (10,11). The nutrient needs of full-term, normal birth weight infants typically can be met by human milk for the first six months if the mother is well nourished.(WHO/UNICEF,1998) (10,11). After this

period, introduction of complementary food while continuing to breastfed until the child is at least 2 year old is recommended.

Breast feeding is popular with the majority of mothers. The proportion of breastfed children is very high but more than half of mothers have poor breast feeding practices (25). Breast milk has a high fat content compared to most commentary food, and it may play an important role in utilizing pro-vitamin A. During illness periods, breast milk provides water for preventing dehydration and nutrients required for recovery while the child's appetite for foods decreases (10).

Many studies have revealed the crucial roles of breast feeding, however, Marquir, et al 1997 found a negative association between breastfeeding and growth to severe malnourished children after the second years. It reflected reverse causality. Increased breastfeeding did not lead to poor growth, poor child growth and health led to increased breastfeeding (26).

WHO estimated that about 20% of deaths among children under five years old world wide could be avoided if feeding guidelines are followed (2).

Many children can be saved by good breastfeeding practices, provision of proper food- micronutrient, and early disease treatment. In Vietnam, the rate of introduction of complementary foods for infants below 2 months is very high: 9.2%. The prevalence of exclusive breastfeeding in children at 4 and 6 months of age in 2005 was 18.9% and 12.2%, respectively (6).

The have been many studies about the advantages of breastfeeding. In 2004, Wang X, Wang Y and Kang C studied the feeding practices in 105 counties in rural China. Although the prevalence of breastfeeding was 98.22%, only 24.63% provided exclusive breastfeeding. It found that at age $\leq$ 4 months, the risk of pneumonia and diarrhea was 1.69% and 24.37%, but 3.36% and 40.86% respectively in exclusive breastfeeding groups and non-breastfeeding (27).

There was some controversy about the duration of breastfeeding. Grace S, Marqis PD, Jean-PiereH.(1987) implemented a follow up study from 1985 to 1987 to study the relationship between stunting and breastfeeding among toddlers in Lima, Peru. Increased breastfeeding was associated with lower linear growth only in children with low complementary food intakes and high morbidity. When divided by age groups they found that before 20 months of age the decrease of linear growth was associated with breastfeeding but from 13 – 23 months it reversed itself and linear growth increased with breastfeeding (28). Promotion of breastfeeding had a large effect on survival but little effect on stunting (23).

Food provision

According to WHO recommendations (9,10), optimal complementary feeding depends not only on what is fed, but also on how, when, where, and by whom the child is fed. Thus, applying the principle of psychosocial care, good feeding guidelines are:

a) Feed infants directly and assist older children when they feed themselves, being sensitive to their hunger and satiety cues;

b) Feed slowly and patiently, and encourage children to eat, but do not force them;

c) If children refuse particular foods, experiment with different food combinations, tastes, textures and methods of encouragement;

d) Minimize distraction during meals if the children loose interest easily;

e) Remember that feeding times are periods of learning and love. Talk to children during feeding, with eye to eye contact;

f) Complementary feeding starts at 6 months of age with small amounts of food and increases as children get older. Feed children a variety of food to ensure that nutrient needs are met. Practices good hygiene when preparing food for children. Use fortified complementary foods or vitamin-mineral supplements for the infants, as needed;

g) For the average healthy breastfed infant, 2-3 meals of complementary foods should be provided per day at 6-8 months of age, 3-4 meals per day at 9-11 months and 12-24 months of age, with additional nutritious snacks 1-2 times per day.

Snacks are defined as food eaten between meals. Good snacks provide both energy and nutrients such as mashed ripe banana, paw-paw, mango or other fruit; yoghurt, milk, pudding made with milk; bread or chapatti with butter, margine groundnut paste; biscuits, bean cakes or cooked potatoes. Poor value snacks are sofe drink or sweet candies. If energy density or amount of food per meal is low, or the child no longer breastfed, more frequent meals may be required. (10,11). The Vietnam National nutritional survey 2000 classified meals into main meals (breakfast, lunch, dinner) and sub meals (meals between main meals) (6).

h) During illness, increase fluid intake including more frequent breastfeeding, and encourage the child to eat soft, varied, appetizing, favorite foods. After illness, give more foods than usual and encourage children to eat more. Continue this until the child regains any lost weight and is going well again (10).

In 2000, the National Institute of Nutrition of Vietnam implemented a general nutritional survey to assess the food consumption and nutritional status of Vietnamese people, and to compare the data from the last general nutritional survey in 1990. Some changes in food consumption patterns were noted such as increased consumption of animal foods, fat, beans and some fruits, and reduced consumption of rice, potato and tubers. Food consumption patterns differed according to region, and between low and high income groups. The mean energy intake was 1,931Kcal per capita per day. Protein intake was 61.96 g per capita per day, of which animal protein accounted for 33.5%. This mean of energy intake did not meet the requirements set by the National Plan of Action for Nutrition of 2.100Kcal per capita per day by the year 2000 (4).

A cross-sectional study of children aged from 3 to 24 months in the Kilosa District, Tanzania, was conducted in 2005. The aim of that study was to ascertain the extent to which complementary food intakes recommended by WHO could meet the nutrition and micronutrient needs of children by age group. The results showed that complementary food intakes only covered 15%, 20% and 27% of the recommended iron intakes for children aged 6-8 months, 9-11 months and 12-24 months

respectively. The assessment 24 hours diary revealed that most energy was derived from carbohydrates (69%), followed by fats (18.6%), and protein (12.1%)(29).

Schroder DG, et al. (1995) studied the impact of nutritional supplementation on the growth of children and found that the greatest impact occurred in the first 3 years with the additional consumption 100Kcals per day. From 3 to 7 years there was no significant difference (30).

Marquis GS, et al. (1997) studied whether breast milk contributed to improved linear growth between 12-15 months of age. They found that complementary foods, animal product foods and breast milk all promoted toddlers' linear growth. Low intake of animal product foods and breastfeeding were associated with linear growth. (P value < 0.005) (31).

Kulwan KB, Kinabo JND, Modest B (2006) studied children from 6 to 24 months in Tanzania to examine the mean age at which complementary foods and fruits were introduced and noted that it was early at 3.26 $\pm$ 1.12 months (range from 1 to 5 months). The prevalence of chronic malnutrition and morbidity are high, and child-feeding practices are inadequate in their study population (32).

2.3.3 Knowledge of mother about breastfeeding and children's daily food intake

Langi GKL found that many mothers lack knowledge about breastfeeding and complementary feeding (20). In terms of food and nutrient consumption, the proportion of all food items was lower in child malnutrition groups compared to normal groups (33).There were more stunted children among those who were given foods like bananas, boiled rice soup, glucose and honey for complementary foods. Children who ate less food during illness were significantly underweight compared to those who ate the same quantity or more. Children whose mothers withheld fruits and juices during diarrhea were more stunted compared to the children who were fed on fruits (20). Poor complementary feeding was very high and affected child malnutrition (6).

2.3.4 Child care practices

Growth monitoring

The best way to monitor growth is to plot a child's weight on a growth chart. The child should be weighed regularly, preferably every month in the first year. The direction of the child's growth line on the chart can then be seen and compared to the direction of the reference line (10). In Vietnam, National Institution of Nutrition has recommended that children aged < 2 years old with normal nutritional status should be weighed every 3 months, and every month if malnourished.

There were significantly more stunted children among mothers who felt that it was not necessary to continue with growth monitoring after a child finished immunizations than among those who felt the need to continue (20).

Infectious disease

In a Philippine study case of stunted children aged ≤ 24 months in 1997, Adair LS and Guilkey DK recognized that stunting was associated with increased disease, early supplementary feeding, and low birth weight (34).

Wamani H, et al. (2002) found that stunting was associated with a history of fever. (OR 1.7;95% CI 1.0-2.9) (18).

CHAPTER III
RESEARCH METHODOLOGY

3.1 Study design

A case control study was conducted to determine the relationship between foods provided to children and maternal child health care and stunting in children in Soc Son district, Hanoi, Vietnam. The study was conducted in January, 2009.

3.2 Study population

Study area Soc Son district is the largest district of Hanoi. In 2008, the population was 280,800, including 9,785 children under 2 years old (7). There was no ethnic minority group but Soc Son is divided into 3 different regions in terms of geography, health status, and economy: the hilly and mountainous region, the delta region, and the river region. The distance from the district hospital to the remote communities is approximately 20 km. All community health centers could be accessed by car and were located in the community centres. Each community health centre had one doctor and 4 or 5 other staff such as nurses, midwives and pharmacy assistants. In 2008, there were 330 village health workers (VHWs) in this district (7).

The study population: children aged ≤ 2 years who were measured for length on 1st June, 2008 at Soc Son, Hanoi, Vietnam.

Criteria for selection of study group and control group

+ **Inclusion criteria:**
  - Study group: Stunted children (< - 2SD)

- Control group: normal children (≥ -2SD)

The members of both groups were chosen from lists of children measured for length on 1st June, 2008 only, and were matched with month age and communities.

+ **Exclusion criteria**:

- Children of multiple births
- Congenitally malformed children

3.3 Sample size

Sample size was computed according to the following formula

$$n = \frac{(Z_{\frac{\alpha}{2}}\sqrt{2\bar{P}\bar{q}} + Z_{\beta}\sqrt{p_2q_2 + p_1q_1})^2}{(p_2 - p_1)^2} = \mathbf{116}\ (35)$$

Where:

P2 = 0.168 (prevalence of stunted children age ≤ 2 years) (7).

P1 = P2/(P2+(1-P2)/OR) = 0.168/(0.168+(0.832/2)) = 0.287

Odds ratio = 2

$\bar{P}$ = (P1+P2)/2 = (0.168+0.287)/2 = 0.228

$\bar{q}$ = 1-P= 1-0.228=0.772

90%CI → Zα/2 = 1.645

Zβ = 0.53 (Power of the test 70%)

The sample size was increased by 4% to allow for withdrawal by some participants. Accordingly, a total of 240 children were required for this study, 120 children for each group.

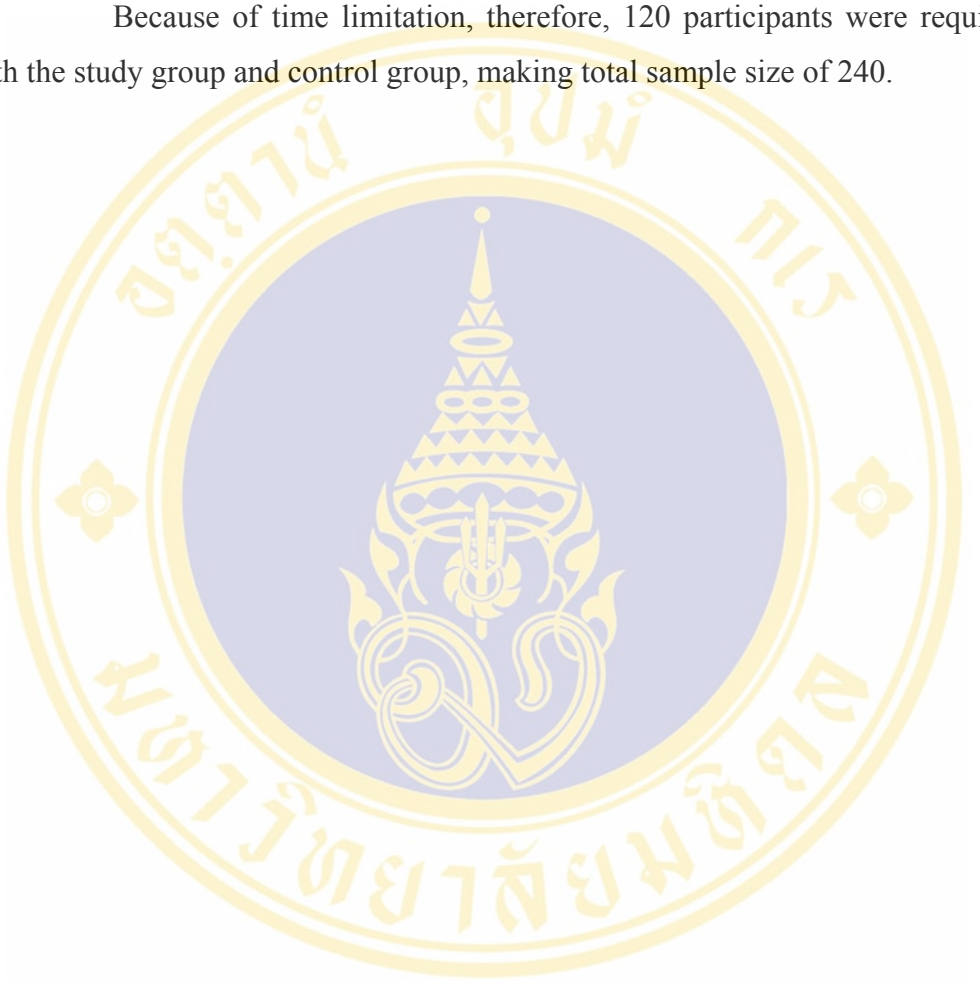
Alternative sample size

If use 95% CI, power of the study 80% → n = 193→ sample size = 401

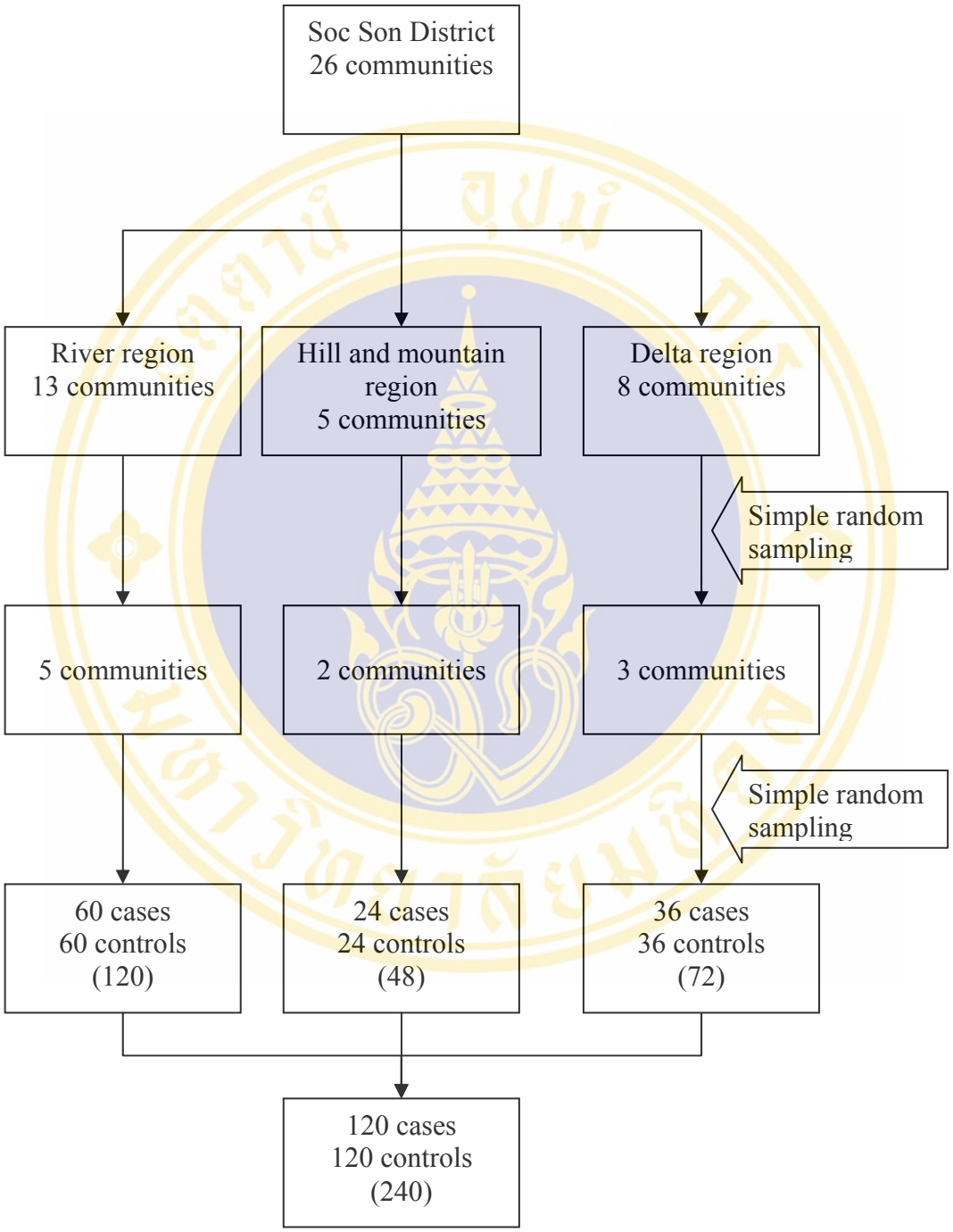
If use 90% CI, power of the study 80% → n = 151→ sample size = 314

If use 95% CI, power of the study 70% → n = 152→ sample size = 316

Because of time limitation, therefore, 120 participants were required for both the study group and control group, making total sample size of 240.



3.4 **Sampling technique**: Stratified sampling



The study population was selected by 3 steps:

First: 26 communities were divided into 3 difference regions: river, hill and mountain, and delta region;

Second: 5 communities of the river region, 2 communities of the hill and mountain region and 3 communities of the delta region were randomly selected;

Third: From each community 12 cases and 12 controls were randomly selected from list of children matched with month age and community.

3.5 Research instrument used for data collection

3.5.1 A structured questionnaire was used for data collection. The questionnaire was prepared in Vietnamese and comprised the following sections:

Part one: questions about socio-economic demographic factors: mother's age, height, education, marital status, occupation, and number of children; children's ages, genders, and weights at birth.

Part two: thirteen questions about maternal knowledge of breastfeeding, introduction of solid food, food provided during and after illness, food and nutrients during pregnancy, and healthcare for mothers and children. For each question, one point was given for a correct answer and no points for an incorrect answer. Total scores ranged from 0-13. Bloom (41) has suggested that knowledge can be categorized into 3 levels as follows:

High knowledge: percentage of correct answers >80% of total maximum score. The scores will be above 10.4.

Moderate knowledge: percentage of correct answers from 60% to 80% of total maximum score. The scores range from 7.8 to 10.4.

Low knowledge: percentage of correct answers < 60% of total maximum score. The scores will be below 7.8.

Part three: questions about food provided to children: meal frequency, and frequency kind of food intake.

The criteria to classification appropriate and inappropriate

Meal frequency

There were three questions about number of meal per day.

- Appropriate: at least three main meals and one sub meal
- Inappropriate: less than three main meals and no food for sub meal

Kind of food was divided into 7 groups: 1. carbohydrates (rice, cereal, noodles), 2. protein foods (meat, fish, egg, shrimp), 3. vegetables, 4. fruit, 5. fat or oil, 6. iodine salt and 7. poor value food: soft drink, sweet candies, and crisps.

There were 7 questions for those groups.

For any item of food usually eaten by the children 4 points, sometime 3 points, rarely 2 points, and rarely or never 1 point were given

Criteria for carbohydrates, protein foods, vegetables, and fat or oil group:

- Appropriate: 4 points
- Inappropriate: 1 to 3 points

Criteria for fruit and iodine salt group:

- Appropriate: 3 or 4 points
- Inappropriate: 1 or 2 points

Criteria for poor value food group:

- Appropriate: 1 or 2 points
- Inappropriate: 3 or 4 points

Criteria for all kind of food was eaten daily

According to WHO guidelines, children should eat all kinds of food. Therefore, any kinds of food children eaten appropriate was given 2 scores, inappropriate 1 score.

Total score rang from 7 to 14 and divided into 2 categories as follow

- Appropriate: 14 scores (appropriate eating all kinds of food)
- Inappropriate: from 7 to 13 scores (inappropriate eating at least 1 kinds of food)

Part four: questions about maternal and child health care: ANC, growth monitoring of children, history of diseases.

ANC divided into 2 groups: < 3 times: 1 point; ≥ 3 times: 0

Growth monitoring: every month: 1 point; >1 to 3 months: 2 points; > 3 months:3 points.

3.5.2 Secondary data about the nutritional status of children: stunting or normal children

3.5.3 Height of mother was measured by a USA wooden ruler with the precision of 1mm.

3.6 Data collection procedure

1. The pre-test questionnaire was administed to 30 respondents in one community similar to communities in the study area on January 3, 2009. The reliability of knowledge was analyzed by Kruder- Richardson methods (KR 20). The result showed that KR 20 was equal to 0.69.

2. Researcher selects cases and controls by using secondary data of nutritional status and information of children from Community health Department,

Soc son district health office. This data was collected by measuring the height and weight of all children under 5 years old on June 1, 2008.

3. Research assistances were trained by the investigator for collecting data consistently.

4. Village Health Workers went to eligible mother's houses and invited mother to the community health centre.

5. A written information sheet was also be given to the invited mothers.

6. When mothers visited community health centre, the researcher explained purposes and processes of the study, and the protection of human right to them. A participant who was willing to participate in the study would be asked to sign a written consent form.

7. Nurses at community centre measured the height of mothers.

8. Researcher used constructed-questionnaire directly interview mothers. It took about 15 minutes to complete the questionnaire.

9. The participants also were assured that all of the information would be confidential, that their identity would not be revealed, and that their answer would not be linked to any participants.

10. The participants would be confirmed that they have the right to participate in and the right to withdraw from this study at anytime and their decision will not be affected to all treatment or the care given for their infants.

11. Upon the completion of the questionnaire, the researcher said thanks for mother's cooperation and gave a book to mother.

3.7 Data analysis procedure and statistics used

After collection, the data was coded, edited, entered and computed using Epidata and then analyzed using Minitab.

Statistics used

- Descriptive statistics using percentage to describe the distribution;
- Chi-square test for determining the relationship between each independent variable and the outcome variable;
- Crude Odds ratio was used to show the strength of association with 95% confidence interval;
- Multiple logistic regression was performed to determine the relationship between all independent variables and the outcome variable.

CHAPTER IV
RESULTS

The case-control study was conducted to determine the relationship between stunting and food provided to children aged from 6 to 24 months in Soc Son district, Hanoi, Vietnam.

One hundred eighteen stunted children were selected for the study group and 118 children with normal height for age were selected for the control group. The data were collected from January 12 to February 3, 2009. The results of this study are considered under 5 headings:

Part 4.1 The association between maternal socio demographic and stunting

Part 4.2 The association between maternal knowledge and stunting

Part 4.3 The association between food provision practice and stunting

Part 4.4 The association between maternal child health care and stunting

Part 4.5 Factors predicting child stunting

4.1 The association between maternal socio demographics and stunting

The maternal socio demographics (i.e. age, marital status, education, occupation, number of children and children's birth weight and gender) are set out in Table 3. All mothers in this study were married and living together with their husbands.

Maternal age

Most of mothers in this study were aged 20 to 35 years old group, 84.8% in the study group and 89.0% in the control group. The percentage of mothers aged > 35 years old in the cases group was higher than in the control group (9.3% in the study group and 4.2% in the control group). However, there was insufficient evidence to conclude that maternal age affected the risk of having stunted children (Table 3).

Maternal height

35.6% of the mothers in the study group and 23.7% of mothers in the control group were shorter than 150 cms. The mothers who were less than 150 cms tall were about twice as likely to have stunted children than the mothers who were more than 150 cms tall (P-value= 0.047) (Table 3).

Maternal education

Table 3 shows that most of mothers in this study finished secondary school (77.1% in the study group and 72.9% in the control group). The percentage of mother with higher education (16.9%) was greater in the control group than in the study group but there was no statistically significant association between maternal education and stunting.

Maternal occupation

Most mothers in this study were farmers, 85.6% in the study group and 84.7% in the control group. No significant association was found between any kind of mother's occupation and stunting (Table 3).

Total number of living children

Families with three or more children accounted for 20.3% of the study group and 14.4% of the control group. Percentages of families with smaller numbers of children were quite similar in the case and control group. However, no significant association was found with stunting (Table 3).

Two thirds of the mothers in this study had only one child aged ≤ 5 years old. Percentages of mothers having 1 child or 2 children were almost the same in each group (66.9% in the study group and 69.5% in the control group). 33.1% in the study group and 30.5% in the control group had 2 children. None of mothers in this study had 3 children aged ≤ 5 years old. The association was not found to be statistically significant (Table 3).

Gender of children

The percentage of girls in the study group was higher than that in the control group (46.6% and 43.2 % respectively) but there was no significant association (Table 3).

Children age in months

The percentage of children from 6 to 12 months, 13 to 18 month and 19 to 24 months were 29.7%, 34.7% and 35.6% respectively (Appendix C). Because of the study and the control were matched by age, therefore these percentages were the same in the study and the control group.

Child birth weight

The percentage of low birth weight children was 11.0% in the study group and higher than in the control group (1.7%). The result showed that the children with low birth weight had 7.2 times greater risk of being stunted than children with normal birth weight (P-value=0.011) (Table 3).

Table 3 The association between socio demographic factors and stunting

Socio-demographic factors	Stunted (n=118) (%)	Normal (n=118) (%)	Crude OR	95% CI	P-value
Age of mother					
20-35	84.8	89.0	1		
< 20 years	5.9	6.8	0.919	0.321-2.627	0.874
> 35 years	9.3	4.2	2.310	0.775-6.884	0.133
Height of mother					
≥ 150cm	64.4	76.3	1		
< 150cm	35.6	23.7	1.776	1.007-3.133	0.047*
Education					
High school and higher	13.6	16.9	1		
Primary school	9.3	10.2	1.146	0.401-3.273	0.799
Secondary school	77.1	72.9	1.323	0.644-2.719	0.447
Occupation					
Housewife	2.5	0.9	1		
Farmer	85.6	84.7	0.337	0.034-3.291	0.349
Labors/factory works/ Government employ	6.8	11.0	0.205	0.018-2.327	0.201
Commerce/handicraft/ Others	5.1	3.4	0.500	0.037-6.683	0.600
Total number of children					
1 child	34.8	37.3	1		
2 children	44.9	48.3	0.994	0.566-1.758	0.994
≥ 3 children	20.3	14.4	1.515	0.714-3.217	0.280
Number children age ≤ 5					
1 child	66.9	69.5	1		
2 children	33.1	30.5	1.124	0.650-1.946	0.675
Gender of child					
Male	53.4	56.8	1		
Female	46.6	43.2	1.147	0.686-1.916	0.601
Child birth weight					
≥ 2500grams	89.0	98.3	1		
< 2500grams	11.0	1.7	7.181	1.583-32.569	0.011*

* Significance at P-value < 0.05

4.2 The association between maternal knowledge and stunting

4.2.1 The distribution of knowledge of mothers

Most of mothers in the control group had a higher number of correct answers than those in the study group. The biggest difference concerned knowledge about monitoring the weight of underweight children. Only 45.8% of mothers in the study group had satisfactory knowledge compared with 62.7% of mothers in the control group.

The percentage of correct answers about iron supplementation in the study group was lower than in the control group (33.1% in the study group and 47.5% in the control group). For other knowledge statements, the percentage of correct answers was about the same in both groups. Conversely, a high percentage of mothers in the study group had reasonable knowledge about properly feeding a sick child (68.8% in the study group and 66.9% in the control group) (Table 4).

Table 4 The distribution of knowledge of mothers

Knowledge statement	Correct answer	
	Stunted (%) (n=118)	Normal(%) (n=118)
Commence colostrums	63.6	74.6
Give water or other juice	94.9	96.6
Optimum duration of EB	68.6	76.3
Age cease breastfeeding	77.9	82.2
Age to start CF	67.8	74.6
Food is not benefit	68.6	66.9
Food after illness	99.2	99.2
Iron supplementation	33.1	47.5
Vitamin A supplementation	88.1	91.5
Monitor weight of a normal child	94.9	96.6
Monitor weight of an underweight child	45.8	62.7
Usefulness of using the GC	77.1	85.6
Direction on GC	58.5	62.7

4.2.2 The association between maternal knowledge and stunting

The result shows hat mothers who provided incorrect answers about iron suplementaition had a 1.8 times higher risk of having stunted children than mothers who provided correct answers (P-value=0.025). Mothers who gave incorrect answers about monitoring weight of underweight children were nearly twice more likely to have stunted children than mothers who answered correctly (P-value= 0.009). For other knowledge statements, there was no statistically significant association between the case and control groups (Table 5).

Table 5 The association between maternal knowledge and stunting

Knowledge statement	Stunted (n=118) (%)	Normal (n=118) (%)	Crude OR	95% CI	P-value
Commence colostrums					
Correct answer	63.6	74.6	1		
Incorrect answer	36.4	25.4	1.682	0.962-2.941	0.068
Give water or other juice					
Correct answer	94.9	96.6	1		
Incorrect answer	5.1	3.4	1.527	0.420-5.556	0.521
Optimum duration of EB					
Correct answer	68.6	76.3	1		
Incorrect answer	31.4	23.7	1.468	0.826-2.610	0.191
Age cease breastfeeding					
Correct answer	77.9	82.2	1		
Incorrect answer	22.1	17.8	1.305	0.687-2.480	0.416
Age to start CF					
Correct answer	67.8	74.6	1		
Incorrect answer	32.2	25.4	1.393	0.791-2.455	0.251
Food is not benefit					
Correct answer	68.6	66.9	1		
Incorrect answer	31.4	33.1	0.925	0.536-1.598	0.781
Food after illness					
Correct answer	99.2	99.2			
Incorrect answer	0.8	0.8	1.000	0.062-16.178	1.000
Iron supplementation					
Correct answer	33.1	47.5	1		
Incorrect answer	66.9	52.5	1.830	1.080-3.099	0.025*
Vitamin A suppl.					
Correct answer	88.1	91.5	1		
Incorrect answer	11.8	8.5	1.454	0.618-3.419	0.391
Weight a normal child					
Correct answer	94.9	96.6	1		
Incorrect answer	5.1	3.4	1.527	0.420-5.556	0.521
Weight an underweight					
Correct answer	45.8	62.7	1		
Incorrect answer	54.2	37.3	1.993	1.185-3.353	0.009*
Usefulness of using GC					
Correct answer	77.1	85.6	1		
Incorrect answer	22.9	14.4	1.763	0.902-3.444	0.097
Direction on GC					
Correct answer	58.5	62.7	1		
Incorrect answer	41.5	37.3	1.194	0.708-2.014	0.506

* Significance at P-value < 0.05

4.2.3 The association between levels of maternal knowledge and stunting

Table 6 shows the association of levels of maternal knowledge with stunting. 50.9% of mothers in the control group and 39.0% of mothers in the study group had high levels of knowledge. Only 12.7% of mothers in the control group and 16.9% of mothers in the study groups had low levels of knowledge.

The result shows that mothers with low levels of knowledge had a 1.7 times higher risk of having stunted children than those with high levels of knowledge, but the association with stunting was not found to be statistically significant (Table 6).

Table 6 The association between levels of maternal knowledge and stunting

Levels of knowledge	Stunted (n=118) (%)	Normal (n=118) (%)	Crude OR	95% CI	P-value
High (> 80%)	39.0	50.9	1		
Moderate (60-80%)	44.1	36.4	1.577	0.903-2.754	0.109
Low (<60%)	16.9	12.7	1.739	0.804-3.763	0.160

* Significance at P-value < 0.05

4.3 The association between food provision practice and stunting

4.3.1 The association between meal frequency and stunting

78.8% of children in the study group and 88.1% of children in the control group had appropriate complementary feeding in terms of meal frequency during the day before the interview day. For main meal, appropriate complementary feeding accounted for 86.4% in the study group and 92.4% in the control group. The percentage of children who received inappropriate complementary feeding or had no food for sub meal in the study group (13.6%) was higher than in the control group (Table 7).

Children having inappropriate complementary feeding during the day preceding the interview day had about twice risk of being stunting compared with children with appropriate complementary feeding practices, but there was no significant association between food provision practices and stunting (Table 7).

The percentage of children having appropriate main meals in the control group (92.4%) was higher than that in the study group (86.4%). Sub meal provision was also found higher percentage of appropriateness in the control group than that in the study group. The result showed there was no significant association between inappropriate number of main or sub-meals and stunting (Table 7).

The percentage of children having same foods cooked together for families was higher among the study group than the control group. Preparing food separately was not found to be associatated with stunting in this study (Table7).

Table 7 The association between meal frequency and stunting

Meal frequency provision	Stunted (n=118) (%)	Normal (n=118) (%)	Crude OR	95% CI	P-value
Total number of meal					
Appropriate (≥ 4 times)	78.8	88.1	1		
Inappropriate(<4 times)	21.2	11.9	1.997	0.980-4.068	0.057
Number of main meal					
Appropriate (≥ 3 times)	86.4	92.4	1		
Inappropriate(<3 times)	13.6	7.6	1.900	0.804-4.490	0.144
Number of sub- meal					
Appropriate (≥ 1 times)	89.0	94.1	1		
Inappropriate(no)	11.0	5.9	1.963	0.754-5.111	0.167
Same food or separately					
Appropriate	66.1	72.9	1		
Inappropriate	33.9	27.1	1.378	0.790-2.405	0.259

* Significance at P-value < 0.05

4.3.2 The association between kind of food and stunting

4.3.2.1 The distribution of kind of food

Table 8 shows the distribution of food intake during the week preceding the interview day. Almost all mothers usually fed their children with carbohydrate foods (94.1% in the study group and 96.6% in the control group). The percentage of children in the study group who usually ate protein foods (59.3%) was lower than in the control group (74.6%). The majority of children sometimes ate fruits (71.2% in the study group and 66.9% in the control group). At least two thirds of the children in both groups usually ate vegetable, fat and iodine salt (Table 8). Most of children in both groups were rarely fed poor value foods.

Table 8 The percentage distribution of kind of food

Kind of foods	Stunted (n=118) (%)	Normal (n=118) (%)
Carbohydrate foods		
Usually	94.1	96.6
Sometime	5.9	3.4
Protein foods		
Usually	59.3	74.6
Sometime	40.7	25.4
Vegetable		
Usually	75.4	84.7
Sometime	24.6	13.7
Rarely	0.0	1.6
Fruits		
Usually	19.5	20.8
Sometime	71.2	66.9
Rarely	8.5	4.2
Never	0.8	0.8
Fat		
Usually	72.9	77.1
Sometime	27.1	22.9
Salt		
Usually	62.7	68.6
Sometime	37.3	31.4
Poor value foods		
Usually	0.0	0.0
Sometime	3.4	1.7
Rarely	55.9	58.5
Never	40.7	39.8

4.3.2.2 The association between different kind of food and stunting

Carbohydrate foods

The association between the appropriate provision of carbohydrate foods to children and being stunted was not found to be statistically significant (Table 9).

Protein foods

The result showed that children whose mothers inappropriately fed protein foods to them had twice the risk of being stunted compared to those whose mothers adopted appropriate practices (P-value=0.013) (Table 9).

Vegetables

Children who inappropriately ate vegetables had a 1.8 times of greater risk of being stunted than those who ate appropriately, but there was no statistically significant association with stunting (Table 9).

Fruits

90.7 % of the children in the study group, and 94.9% in the control group, had appropriate practices eating fruits. No significant association was found (Table 9).

Fat

Appropriate fat food practices had 72.9% of children in the study group, and 77.1% in the control group. The study revealed that different practices feeding fat foods did not affected the risk of becoming stunted (Table 9).

Salt

All mothers in this study fed iodine salt appropriately to their children (Table 9).

Poor value foods

From the Table 9, it can be seen that almost all mothers practised appropriately about poor value foods to their children (96.6%in the study group and 98.3% in the control group). However, the association was not found to be significant (Table 9).

Table 9 The association between different kind of food and stunting

Kind of foods	Stunted (n=118) (%)	Normal (n=118) (%)	Crude OR	95% CI	P-value
Carbohydrate foods					
Appropriate	94.1	96.6	1		
Inappropriate	5.9	3.4	1.797	0.512-6.311	0.360
Protein foods					
Appropriate	59.3	74.6	1		
Inappropriate	40.7	25.4	2.011	1.156-3.499	0.013*
Vegetable					
Appropriate	75.4	84.7	1		
Inappropriate	24.6	15.3	1.810	0.941-3.481	0.075
Fruits					
Appropriate	90.7	94.9	1		
Inappropriate	9.3	5.1	1.919	0.686-5.372	0.215
Fat					
Appropriate	72.9	77.1	1		
Inappropriate	27.1	22.3	1.254	0.695-2.264	0.453
Poor value foods					
Appropriate	96.6	98.3	1		
Inappropriate	3.4	1.7	2.035	0.366-11.330	0.417

* Significance at P-value < 0.05

4.3.2.3 The association between all kinds of food and stunting

Around 63.6% of the children in the study group and 47.5% of the children in the control group were not fed a variety of foods during the week preceding the interview day. 36.4% of the children in the study group and 55.4% of children in the control group had appropriate feeding all kind of food. The association between eating all kinds of food and stunting was found to be statistically significant (P-value=0.013) (Table 10).

Table 10 The association between all kinds of food and stunting

Kind of foods	Stunted (n=118) (%)	Normal (n=118) (%)	Crude OR	95% CI	P-value
Appropriate	36.4	55.4	1		
Inappropriate	63.6	47.5	1.931	1.147-3.250	0.013*

* Significance at P-value < 0.05

4.4 The association between maternal and child health care and stunting

Pregnant examination

All mothers in this study examined their babies during pregnancy at least once. 90.7% mothers in the study group and 94.1% in the control group received at least 3 times ANC. No significant association was found (Table 11).

Children weight monitoring

The result showed that duration of monitoring children's weight longer than 3 months was 28.0% in the study group and 21.2% in the control group. The

association between monitoring weight for children and stunting was not found to be significant (Table 11).

Diarrhea within last 2 weeks

Most of the children had no diarrhea during perious two weeks. The results of the study failed to detect any statistically significant association between having diarrhea and stunting (Table 11).

ARI within the last 2 weeks

Children having fever or acute respiratory infection had a 4.2 times higher risk of being stunted than those who did not (P-value 0.014) (Table 11).

The relationship between ARI and children birth weight was not found in this study. 6.7% of children with low birth weight and 8.1% of children with normal weight had ARI (Appendix C)

Table 11 The association between maternal child care with stunting

Maternal and child care	Stunted (n=118) (%)	Normal (n=118) (%)	Crude OR	95% CI	P-value
Pregnant examination					
≥ 3 times	90.7	94.1	1		
< 3 times	9.3	5.9	1.630	0.609-4.362	0.330
Weight monitoring					
≤ 3 months	72.0	78.8	1		
> 3 months	28.0	21.2	1.444	0.795-2.624	0.228
Diarrhea last 2 weeks					
No	94.9	97.5	1		
Yes	5.1	2.5	2.054	0.501-8.412	0.317
ARI last 2 weeks					
No	87.3	96.6	1	1.335-	
Yes	12.7	3.4	4.150	12.908	0.014*

* Significance at P-value < 0.05

4.5 Factors predicting child stunting

4.5.1 Full model of Multiple Logistic Regression

Chi-square test was conducted to investigate the relationship between each of independent variables and the outcome (stunted and normal children). For further analysis to determine which independent variables had a significant association with stunting, multiple logistic regression was applied. Forward selection was used to obtain the final model.

All variables were included in the initial full models. The results of the full model are set out in Table 12. The following factors were found to be significant predictors of child stunting: child birth weight and having ARI. Meal frequency was nearly found to be a significant predictor of child stunting in this study.

Table 12 : The full model of multiple logistic regression

Independent variables	Ajusted OR	90%CI for OR Lower	Upper	P-value
Child birth weight				
< 2500 grams	8.785	1.788	43.173	0.007*
≥ 2500 grams	1			
Maternal height				
< 153 cm	1.439	0.759	2.730	0.265
≥ 153 cm	1			
Maternal age				
<20 years, > 35 years	0.956	0.389	2.350	0.921
20-35 years old	1			
Maternal education				
Primary school	0.660	0.250	1.740	0.401
Secondary and higher	1			
Maternal occupation				
Employed	4.510	0.418	48.704	0.215
Unemployed	1			
Total number of children				
≥ 3 children	1.364	0.621	2.994	0.440
< 3 children	1			
Living children ≤ 5 y				
≥ 2 children	1.172	0.639	2.152	0.608
< 2 children	1			
Level of knowledge				
Moderate and low	1.158	0.645	2.079	0.624
High	1			
Food provision				
Inappropriate	1.657	0.932	2.945	0.085
Appropriate	1			
Meal frequency				
Inappropriate	2.213	0.999	4.905	0.050*
Appropriate	1			
Pregnant examination				
< 3 times	1.146	0.375	3.506	0.811
≥ 3 times	1			
Weigh monitoring				
> 3 months	1.608	0.824	3.139	0.164
≤ 3 months	1			
Diarrhea				
Yes	2.262	0.491	10.420	0.295
No	1			
ARI				
Yes	4.666	1.407	15.472	0.012*
No	1			

* Significance at P-value < 0.05

4.5.2 Final model of Multiple Logistic Regression

The most significant risk factors related to child stunting were low birth weight (OR=7.720, 95% CI = 1.672-35.687), inappropriate feeding practices (OR=1.929, 95% CI=1.124-3.308) and having fever or acute respiratory infection during last two weeks (OR=4.315, 95% CI=1.361-13.677) (Table 13).

After adjusting for other factors in the model, children whose mothers inappropriately provided food to them had a 1.9 times greater risk of getting stunted than those whose mothers fed them appropriately (Table 13).

Table 13 The final model of multiple logistic regression

Predictors	Adjusted OR	90%CI for OR		P-value
		Lower	Upper	
Child birth weight				
< 2500 grams	7.720	1.672	35.687	0.009
≥ 2500 grams	1			
Food provision				
Inappropriate	1.929	1.124	3.308	0.017
Appropriate	1			
ARI				
Yes	4.315	1.361	13.677	0.013
No	1			

CHAPTER V
DISCUSSION

A case-control study was conducted at Soc Son district, Hanoi, Vietnam. There were 118 stunted children chosen as cases and 118 normal height children as controls. Cases and controls were matched for age and residence. Mothers of those children were invited to community health centers for interviewing by structured questionnaire. The data were collected from January 12 to February 3, 2008.

This study aimed to determine the relationship between stunting and socio-demographic factors (maternal age, maternal height, maternal education, maternal occupation, number of living children, children age and children gender), maternal knowledge, food provision practice (meal frequency and kinds of food intake), maternal and child health care factors, and to recommend appropriate feeding practice.

For this study, the nutritional status of children aged from 6 to 24 months was assessed from secondary data. Children's height was measured on June 1st, 2008. Children were divided into two groups (stunted and normal) based on WHO standards 2006. Since then, no special care program was provided for the stunted children.

5.1 Socio-demographic factors

The study failed to indicate that young mothers (less than 20 years old) or older mothers (more than 35 years old) had a higher risk of having stunted child. This study may have insufficient cases for young /older mother because of all most of mothers aged from 20 to 35 years. This result was not similar to the study of Vitolo MR, et al (17) in Brasil. It was found that mothers' age < 20 years old had a 1.6 times of risk of having stunted children under 5 years old compared to mothers aged from 20

to 35 years old. Nor was it similar to the study of Shrimpton R, et al. (9) which showed that stunting was more common in children whose mothers were aged >35 years.

The percentage of children living in families with three or more children was higher in the control group than in the control group (20.3% and 14.4% respectively). It was similar to the result of a survey in Vietnam 2005 (6), but it was not found to be significant association. This result differed from the study of Vitolo MR, et al. (17) that children with three or more siblings had 3.1 times risk of being stunted than those with one or two siblings.

The percentage of girls in the control group was higher than that in the control group but there was not significant association. Kanao BJ, et al. (23) in their study found no significant association between gender of children and stunting. However, prevalence of stunted boys was slightly higher than stunted girls.

Vietnam has been facing the problems of an increasing percentage of mothers with more than two children and this happens mostly in rural areas. Parents tend to have more than two children because they may wish to get more boys and families can now afford to rear their children. As a result, boys out number girls and boy receive more care than girls.

Most mothers in this study finished secondary school both in the case and control groups. The present study did not suggest that mothers who finished primary school have a higher risk of having stunted children because there were only about 10% mothers in this education group, in both the case and control groups. This result was not similar to the study of Wamani H, et al. in Uganda, which found that mothers who finished lower than primary school were twice as likely have stunted children than those who had higher education (18).

The most common occupation was farmer, 85.6% in the study group and 84.7% in the control group. This result was similar with the result of Vietnam

Nutritional Survey 2005 (6). No significant association was found between mother's occupation and stunting.

This study found a significant association between mothers who were less than 150 cms tall and child stunting. Mothers who were shorter than 150 cms had about a 2 times greater risk of having stunted children than mothers who were taller than 150 cms (P-value= 0.047). However, by multiple logistic regression maternal height was not a significant risk of having stunted children. Many pervious studies also illustrated the association between maternal shortage and stunting (9,12,16,21). Shimpton R and Kachonndham Y (9) studied the causes of child stunting and found that there was an association between child stunting and maternal nutritional status, child immunization and maternal food item consumption. A ten years longitudinal study in Vietnam in 1981 (16) observed the physical growth of children and related factors, and indicated that growth retardation at birth was due to the poor nutritional and health status of mothers.

Children with low birth weight had a 7.2 times greater risk of being stunted than children with normal birth weight in this study. This result is similar to the study of Vitolo MR, et al. (17) which found that low birth weight had a significant association with stunting in children (OR 3.49 95% CI 2.53-4.80).

The association between low birth weight, short maternal stature and stunting may imply accumulate factors that are described in Figure 7. A stunted child is going to be an stunted adolescent if he/she receives inadequate food and health care. A small woman with inadequate food and health care will deliver a low birth weight baby. This baby may not catch up the growth if it receives inadequate complementary feeding and health care.

5.2 Maternal knowledge

The percentage of mothers who had high and moderate knowledge was quite high in this study. Only 12.7% in the control group and 16.9% in the control

group had low levels of knowledge. No significant association was found between levels of knowledge and child stunting. However, there were some associations between knowledge statements and stunted children.

Both mothers in the control group and in the control group lacked knowledge about duration monitoring weight for an underweight child. Mothers with incorrect answer this knowledge statement had twice the risk of having stunted children than mothers with correct answer (P-value=0.009). In contrast, knowledge of duration monitoring weight for a normal child was very good in both groups (94.6% in the control group and 96.6% in the control group).

Nearly half the mothers lacked knowledge about timing for iron supplementation. There was a significant association between incorrect answers and child stunting (Crude OR=1.8, 95% CI 1.080-3.099, P-value=0.025). Nevertheless, most mothers had good knowledge about vitamin A supplementation. This may be due to the efficient Vitamin A program that provides Vitamin A capsule directly to all mothers during one month after delivery.

Knowledge about breastfeeding and recommended complementary feeding practices was correct from 60% to 80% in both groups and slightly higher in the control group. No significant association was found between these knowledge statements and stunting.

Regarding unbeneficial food feeding for sick children, correct answers were higher in the control group than the control group. It is because children got sick more frequently so their mothers had more chance to get information from health personnel.

Nearly half of the mothers did not indicate right directions on the Growth chart despite the fact that a high percentage knew about the usefulness of using Growth chart. There may be mothers had in adequate practices of using child growth monitoring chart.

5.3 Foods provision

5.3.1 Meal frequency

No significant association was found between adequate of meal frequency and child stunting, both by Crude OR (OR=1.99, 95% CI 0.980-4.068) and adjusted OR (OR=2.213, 95% CI 0.999-4.905). Based on the WHO recommendation for appropriate complementary feeding, about 21% of stunted children did not eat often enough. Children may refuse food because of illness or untimely feeding. Meals for some children were the same as family meals so that the number of meals for children equaled the number of meals for the family – three meals per day.

5.3.2 Different kinds of food

Children who consumed inappropriate variety foods had a significant association with stunting. The risk of being stunted was nearly 2 times in the control group higher than in the control group. Analyzing the association between different kinds of food and child stunting, the study revealed that protein foods were a significant risk factor (P-value=0.013). This finding was similar to some previous studies (9, 31,32, 33).

Fat food is very important for children because it helps Vitamin A and D absorption (9) and provides energy for children. In this study, 27.1% of the mothers in the control group and 22.3% mothers in the control group did not feed enough fat food to their children in accordance with WHO recommendation (See Appendix B).

Vegetables and fruits provide a variety of vitamins and children should eat them daily. However, 24.6% in the control group and 15.3% in the control group did not eat appropriate vegetables. For fruits, percentage of appropriate feeding was high in both groups (94.9% in the control group and 90.7% in the control group). Most children did not consume poor value foods.

If children not consume a proper variety of foods, they will lack energy and micronutrients. From 6 to 24 months, children have to become to familiar with

complementary food. Children sometimes refuse foods especially new foods. This requires mothers and family members to spend more time feeding their children and encouraging them to eat.

The roles of energy and micronutrient are obvious. Schrolder DG, et al. (33) in their study pointed out the greatest impact of additional consumption of 100 Kcal per day to the growth of children less than 3 years old. Fahimida U (39) studied the role of Zinc, Iron and Vitamin A to the linear growth of stunted children. They found that children with Zinc plus Iron and Vitamin A increased the linear growth more than group with Zinc alone. Aert D et al. (41) in their study also found an association between Vitamin A and D supplementation and child growth retardation.

5.4 Maternal and child health care

Pregnancy examination

At least 90% mothers in both groups had 3 or more times for ANC. Therefore, no significant association was found. In this district, every community has a health center with basic facilities for checking pregnant women.

Children weight monitoring

The knowledge of mothers about monitoring the weight of underweight children was not good. However, more than 70% of children in both groups were monitored their weight properly, probability of the of the community health workers system. No significant association between monitoring weight of children and stunting was found.

Diseases presented within last 2 weeks

Having diarrhea was not significantly associated with child stunting in this study. This result differs from the study of Shrimpton R (9) which found that diarrhea was significantly associated with stunting in children less than 2 years old.

Fever and ARI had a significant association with child stunting in this study and it was one of the three significant risk factors of child stunting (P-value 0.013). This conclusion was the same as the finding of Wamani H, et al. (18) which found that a history of fever was associated with stunting. But it was not consistent with result of Shrimpton R (9). Who found that only diarrhea, but not ARI, was associated with stunting.

This study was conducted in January in Vietnam. Because it was winter, children tend to catch cold and get ARI, particularly malnourished children. If the study had been conducted in summer, the occurrences of diarrhea might have been a risk factor of stunting.

Diarrhea and ARI were obtained during two weeks in this study and similar to studies of Wamani H, et al. (18) and Shrimpton R (9). However, repeated diseases were not mentioned. If the data during past three months, the occurrences of others disease might play an important role on child stunting.

5.5 Factors predicting stunting

After analyzing all independent variables by multiple logistic regression to determine which factors could be significant for stunted children, two variables were revealed as significant risk factors to child stunting. They were low birth weight and having fever or ARI during last two weeks. The meal frequency factor was almost found to be a significant risk factor. The final model retained three variables as significant risk factors: low birth weight (OR=7.720, 95% CI = 1.672-35.687), inappropriate feeding practices (OR=1.929, 95% CI=1.124-3.308) and having fever or ARI during last two weeks (OR=4.315, 95% CI=1.361-13.677).

CHAPTER VI
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This case-control study was conducted in Soc Son district, Hanoi, Vietnam. It is a rural district. In 2007, the prevalence of stunting in this district was 20.7%. In 18 of the 26 communities over 20% of children under 5 years old suffered from stunting. The aim of this study was to determine the risk factors of stunting.

The data was collected from January 12 to February 3, 2009. The sample size for each group was 118 children. The study group and the control group were selected by using secondary data from Community health Department. Secondary data included nutritional status and information of children. A written information sheet and informed consent were given to their mothers. Mothers were interviewed and measured for their height after they gave consent to participate to the study. The constructed questionnaire was prepared in Vietnamese and consisted of four parts. Part one was questions about socio demographic factors: mother's age, education, marital status, occupation, and number of child; children's age, gender. Part two was questions about knowledge of mothers regarding breastfeeding, time introduces solid food, food providing for the child during and after illness, food and nutrients during pregnancy, care for mothers and children. Part three was questions about complementary feeding: meal frequency and kinds of food. Part four was questions about maternal and child health care: ANC, growth monitor for the children, and history of illness.

Chi-square test was used to assess significant association between each independent variable and outcome variable. Crude odd ratio was used to show the

strength of association with 95% confidence interval. Multiple logistic regression using Forward selection was performed to explore the relationship between all independent variables and the outcome variable.

The significant association factors by Chi-square test were height of mothers (P-value=0.047), children birth weight (P-value=0.011), knowledge of mother about iron supplementation (P-value=0.025), duration of monitoring an underweight children (P-value=0.009), inappropriate eating protein foods (P-value=0.013), inappropriate eating all kind of foods (P-value=0.013) and having ARI (P-value=0.014). Others factors failed to find significant association with child stunting.

By Multiple Logistic Regression using Forward selection, it found that three factors were significant risk factors: low birth weight (OR=7.720, 95% CI = 1.672-35.687), inappropriate feeding practices (OR=1.929, 95% CI=1.124-3.308) and having fever or acute respiratory infection during last two weeks (OR=4.315, 95% CI=1.361-13.677). Children malnutrition control program should focus on all these factors together.

6.2 Recommendations

The significant factors associated with stunting were birth weight less than 2500 grams, inappropriate eating variety food and having fever or ARI. Other factors that may be associated but which were not significant in this study were height of mother, iron supplementation for pregnant women, and child weight monitoring. The following public health activities are recommended.

6.2.1 Recommendation for reduction of low birth weight

a) Identify high risk groups: pregnant women with poor weight gain (less than 6 kg for first six months of pregnancy), have symptoms of complication and poor nutritional status. An appropriate nutritional education; food and iron supplementation, and antenatal care should be given to them regularly to ensure the adequate gained weight during pregnancy.

b) Encouraging family members and community involvement in maternal and child health care, particularly the care during pregnancy such as couple's health education, providing proper and adequate food for pregnant women, promoting intervention for preventive contraction, etc.

c) School programs should provide reproductive health care knowledge for adolescents to prevent early pregnancy and stunting in adolescent girls.

6.2.2 Recommendation for improvement of food provision for children especially for stunted children

a) Counsel and educate caregivers regarding appropriate feeding practices. Children should be fed all kinds of family food and focus on protein foods. This action should be implemented in households, schools and health centers. At health centers, health education should be implemented at any immunization times and focus on low birth weight children.

b) Promote exclusive breastfeeding. Encourage families members to support mothers while breastfeeding children.

c) High risk groups should be identified such as children with low birth weight; child stunting or under weight. These groups should be monitored regularly by health personnel to ensure that the children get enough food. Provision of food coupons for children with severe malnutrition is encouraged.

d) Promote home and community-based food technology to improve the variety of daily food intake for family and especially for children.

e) Explore local barriers to feed children and then find solutions. There may include local beliefs, household food security, maternal and child health care.

f) Encourage the participation of community organizations and committees in solving their community nutritional problems.

g) Provincial child malnutrition control program should establish programs not only for underweight children but also for stunted and overweight children.

6.2.3 Recommendation for ARI prevention

a) Counsel and educate caregivers regarding appropriate feeding practices for children during and after getting sick particularly for children with repeated ARI. This action should be implemented in households, schools and health centers.

b) Establish ARI prevention and treatment guideline, disseminate widely at school and health centers.

b) Encourage the participation of households, community's organizations and committees in improving their environment.

6.2.4 Recommendation for maternal knowledge

a) Health education should concentrate on maternal knowledge about Iron supplementation and duration of monitoring weight for underweight children.

b) Channel of education should include public media and health personnel, particularly community health workers.

6.3 Recommendation for further studies

a) Further studies should concentrate on both quantity and quality of daily food intake especially protein foods for children to ensure that WHO guideline are followed.

b) Conduct qualitative studies to ascertain the reasons for inappropriate feeding.

c) Implement an experimental study with intervention of appropriate food provision to ensure the reduction of stunting for children from birth to 2 years old.

d) Further studies should be conducted to reveal the factors related to low birth weight the study area.

e) Explore in detail the environmental factors in the study area related respiratory tract infection.

f) Conduct further studies to ascertain the frequency of disease in underweight and stunted children.

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APPENDIX

APPENDIX A

QUESTIONNAIRES

Title of project: Relationship between stunting and food provided to children aged from 6 to 24 months in Soc Son district, Hanoi, Vietnam.

Objective of questionnaire

This questionnaire is constructed for collecting data of socio-demographic characteristic, mother's knowledge and practices on food providing and maternal child health care. All the information is considerate to the researcher and will be use only for the purpose of the study.

Researcher aims to know factors related to stunted children, so there is no RIGHT or WRONG answer to the question. Normally your first response is best.

The important answer is your opinion. If you have any suspect please do not hesitate to ask. Researcher is very please to answer your question.

THANK YOU

QUESTIONNAIRE

Background information:

Name of mother……

Address (community)……

Interviewer……

Date of interview……..

Weight of children at birth……*

Month age ……*

Gender……..*

Nutritional status measure on 1st June, 2008*

□ 1. Normal □ 2. Stunted

(* Information from secondary data)

Part one: Socio-economic demographic

1. Name of child: ……..

2. Mother's height ……cm

3. Mother's age … ….… years old

4. Highest education level of mother

□ 1. Primary school □ 3. High school

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

5. Major occupation of mother

□ 1. Housewife □ 4. Government employ

□ 2. Farmer □ 5.Commerce/ handicrafts

□ 3. Laborer/ factory worker □ 6. Others, please specify……

6. Marital status

□ 1. Married (living together)

□ 2. Separated/divorced/windowed

7. How many living children do you have now? …….children

8. How many children age ≤5 do you have? …….children

Part two: Knowledge of mother

Chose only one answer for each question:

9. When is the best time to commence colostrums for newborn child?

□ 1. Within the first hour after delivery

□ 2. > 1 to 6 hours after delivery

□ 3. > 6 hours after delivery

□ 4. Don't know

10. Is it more beneficial to give new born child water or other juice before breast milk?

□ 1. Yes

□ 2. No

11. What is the optimum duration of exclusive breastfeeding?

□ 1. < 4 months

□ 2. 4 - 6 months

□ 3. 6 months

□ 4. > 6 months

12. What is the right age of your baby that you should cease breastfeeding?

□ 1. ≤ 12 months

□ 2. 13- 23 months

□ 3. 24 months

□ 4. > 24 months

13. What is the right age of your child to start having complementary food?

□ 1. Under 4 months

□ 2. From 4 months to under 6 months

□ 3. At 6 months

□ 4. > 6 months

14. What kind of food is not beneficial to feed to a child when he/she get sick?

□ 1. Fish, shrimp, crab

□ 2. Meat

□ 3. Fat food and oil

□ 4. Fruit or vegetable

□ 5. All of above

□ 6. None of above

15. Do children need more food after illness?

□ 1. Yes

□ 2. No

16. When is the most appropriate time to commence iron supplementation during pregnancy?.

□ 1. From the beginning of pregnancy until one months after delivery

□ 2. From the second semester(1)

□ 3. From the third semester

17. When is the most appropriate time for women to start having Vitamin A supplement during pregnancy and lactation?.

□ 1. From first semester of pregnancy onward

□ 2. From the second semester onward

□ 3. From the third semester onward

□ 4. Within one months after delivery

18. How often does a mother monitor weight of a normal child aged under 2 years old?

□ 1. Every 1 or 2 month

□ 2. Every 3 months

□ 3. More than 3 months

19. How often does a mother monitor weight of an underweight child aged under 2 years old?

□ 1. Every month

□ 2. Every 2 months

□ 3. Every 3 months

□ 4. More than 3 months

20. What is the usefulness of using the Growth chart?

□ 1. to monitor IQ

□ 2. to monitor obesity condition

□ 3. to monitor disease

21 .What direction on those Growth charts are good for children?

Show a growth chart with direction of the child's line on the chart up, down, and no change compare to the direction of the reference line and ask mothers identify which signals are good.

□ 1. The direction is up ward □ 3. The direction is down

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

Part three: Food provided

22. How many meal did you feed your child yesterday from the time the child woke up until go to bed at night?.....meals

23. In which, how many main meals? (2)

□ 1. one □ 3. 3 meals

□ 2. 2 meals □ 4. > 3 meals

24. How many sub- meals? (3)

□ 1. one □ 3. 3 meals

□ 2. 2 meals □ 4. > 3 meals

25. The daily food of your child is the same as family food or separately?

□ 1. Separately cooked □ 2. The same

26. How often do you feed your child with this kind of food below during last week?
Usually: ≥ 5days per week; Sometime: 3-4 days per week; rarely/seasonally: 1-2 days per week; never: never eat

	Kinds and frequency of foods	**Yes**			**No**
		Usually	**Sometime**	**Rarely**	**Never**
26.1	**Carbohydrate foods**				
	Rice, cereal, noodle				
26.2	**Protein foods**				
	Meat (chicken, pork, beef); Fish, shrimp, crab, egg.				
26.3	**Vegetable**				
	Dark green vegetables or yellow vegetables				
26.4	**Fruits**				
	Mango, papaya, banana, orange.				
26.5	**Fat**				
	Fat food or oil				
26.6	**Salt**				
	Iodine salt				
26.7	**Poor value foods**				
	Candies, soft drink or plastic bag food (crips)				

Part four: Maternal child health care

Now I will ask some information related to your child and times you get pregnant with this child.

27. Did you examine you pregnancy before birth?

□ 1. Yes □ 2. No

28. How many times did you examine your pregnancy before birth?.....times

29. How often do you monitor weigh of your child?

□ 1. Every month

□ 2. >1month to 3 months

□ 3. > 3 months

30. Dose your child have diarrhea within last 2 weeks?(4)

□ 1. Yes □ 2. No

31. Has your child had fever or acute respiratory infection (ARI) within the last 2 weeks?(5)

□ 1. Yes □ 2. No

Thank for your kind cooperation

Note:

(1) Semester: First semester: from 1st months to the end of 3th months
Second semester: from 4th months to the end of 6th months
Third semester: from 7th months to delivery.

(2) Main meal: breakfast, lunch and dinner

(3) Sub- meals: meals between main meals

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

(5) Fever: state of temperature under children's aim $\geq 37.5^0$ C
ARI: present of cough and/or running nose

APPENDIX B

Participant Information Sheet

In this document, there may be some statements that you do not understand. Please ask the principal investigator or his/her representative to give you explanations until they are well understood. To help your decision making in participating the research, you may bring this document home to read and consult your relatives, intimates, personal doctor or other doctor.

Title of Research Project- Relationship between stunting and food provided to children aged from 6 to 24 months in Soc Son district, Hanoi, Vietnam.

Name of Researcher Mrs.Vu Thi Nguyet Anh

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 At ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon, Nakhonpathom, Thailand. Tel. (66)24419040-3 Fax : (66)2441-9044[in office hours] Tel: 08.77549785[Out office hours]**.**

Address at Vietnam: Hanoi Reproductive Health Care centre. N^{o} 86 Tho Nhuom street, Hoan Kiem district, Hanoi city, Vietnam. Tel. 8.223.303 or 0988636740.

This research project aims: To find the association between stunting and food provided factors to the children aged from 6 to 24 months.

The expected benefit is giving information about food providing and maternal child health care factors to stunting children to health care provider management that seful

for implementing nutritional program. That will contribute to the reduction of stunting not only in Soc Son district but also to the others districts.

You are invited to participate in this research project because:

The prevalence of stunting was high in your community and there are many factors related to it. This study will help to find out those factors and help health care provider to set up actions to improve the nutritional status of children especially for children under 2 year old and their mothers because at this age the children are more likely get stunting.

There will be 240 **mothers who have children aged from 6 to 24 months participate on this project, and the research project will start from August 2008 to April 2009.**

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

First we measure your height and then ask you some questions and information related to you and your child. There will be 31 questions divided into 4 parts: socio-economic demographic; understanding about food providing and maternal child health care; food providing practices; and maternal child health care practices. It will take you abut 15 minutes.

If adverse events/unanticipated events occur or you have any question regarding with the study, please do not hesitate to contact Mrs. Vu Thi Nguyet Anh Tel. 098.8646740 (in Vietnam) or 08.77549785(in Thailand).

Remuneration. The investigator's expression of appreciation and might give book (15 baht/book) to encouraging mother to read book to get information of maternal and child health care.

Expense: There is no expense to participate in this study.

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 the proper service or treatment that he/she will receive.

On the condition that you 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

Date..... /…../….....

My name is....., aged...…..years old, now living at the address no…....road/street.....district/amphur.....province……..
...
Postal code…...…Tel. No.:.....

I hereby express my consent to participate as a subject in the research project: **Relationship between stunting and food provided to children aged from 6 to 24 months in Soc Son district, Hanoi, 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 questions about the research procedures, or on the condition that I suffer from an undesirable side effect from this research, I can contact Mrs. Vu Thi Nguyet Anh at Master of Primary Health Care Management (MPHM) Office, ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon, Nakhonpathom, Thailand. Tel.(66)24419040-3 Fax: (66)2441-9044[in office hours] Tel.:08-77549785[out offices hours]. Address at Vietnam: Hanoi Reproductive Health Care Centre. N^{o} 86 Tho Nhuom street, Hoan Kiem district, Hanoi city, Vietnam. Tel. 8.233.303 or 0988646740.

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, Office of the President, Mahidol University, Tel 66-2-8496223-5, 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 my right to withdraw or refrain from

the participation anytime without any consequence on the service or health care I am to receive 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.....
(.....)

APPENDIX C

Table 14 The distribution of children's age

Age group	Number	Percentage
6-12 months	70	29.7
13-18 months	82	34.7
19-24 months	84	35.6

Table 15 The relationship between LBW and ARI

	ARI	
	Yes N(%)	No N(%)
LBW	1(6.7)	14(93.3)
Normal weight	18(8.1)	203(91.9)

APPENDIX D

WHO GUIDING PRINCIPLES FOR COMPLEMENTARY FEEDING OF THE BREASTFEED CHILD

1. DURATION OF EXCLUSIVE BREASTFEEDING AND AGE OF INTRODUCTION OF COMPLEMENTARYFOODS. Practice exclusive breastfeeding from birth to 6 months of age, and introduce complementary foods at 6 months of age (180 days) while continuing to breastfeed.

2. MAINTENANCE OF BREASTFEEDING. Continue frequent, on-demand breastfeeding until 2 years of age or beyond.

3. RESPONSIVE FEEDING. Practice responsive feeding, applying the principles of psychosocial care. Specifically: a) feed infants directly and assist older children when they feed themselves, being sensitive to their hunger and satiety cues; b) feed slowly and patiently, and encourage children to eat, but do not force them; c) if children refuse many foods, experiment with different food combinations, tastes, textures and methods of encouragement; e) minimize distractions during meals if the child loses interest easily; f) remember that feeding times are periods of learning and love - talk to children during feeding, with eye to eye contact.

4. SAFE PREPARATION AND STORAGE OF COMPLEMENTARY FOODS. Practice good hygiene and proper food handling by a) washing caregivers' and children's hands before food preparation and eating, b) storing foods safely and serving foods immediately after preparation, c) using clean utensils to prepare and serve food, d) using clean cups and bowls when feeding children, and e) avoiding the use of feeding bottles, which are difficult to keep clean.

5. AMOUNT OF COMPLEMENTARY FOOD NEEDED. Start at 6 months of age with small amounts of food and increase the quantity as the child gets older, while maintaining frequent breastfeeding. The energy needs from complementary foods for infants with "average" breast milk intake in developing countries are approximately 200 kcal per day at 6-8 months of age, 300 kcal per day at 9-11 months of age, and 550 kcal per day at 12-23 months of age. In industrialized countries these estimates differ somewhat (130, 310 and 580 kcal/d at 6- 8, 9-11 and 12-23 months, respectively) because of differences in average breast milk intake.

6. FOOD CONSISTENCY. Gradually increase food consistency and variety as the infant gets older, adapting to the infant's requirements and abilities. Infants can eat pureed, mashed and semi-solid foods beginning at six months. By 8 months most infants can also eat "finger foods" (snacks that can be eaten by children alone). By 12 months, most children can eat the same types of foods as consumed by the rest of the family (keeping in mind the need for nutrient-dense foods, as explained in #8 below). Avoid foods that may cause choking (i.e., items that have a shape and/or consistency that may cause them to become lodged in the trachea, such as nuts, grapes, raw carrots).

7. MEAL FREQUENCY AND ENERGY DENSITY. Increase the number of times that the child is fed complementary foods as he/she gets older. The appropriate number of feedings depends on the energy density of the local foods and the usual amounts consumed at each feeding. For the average healthy breastfed infant, meals of complementary foods should be provided 2-3 times per day at 6-8 months of age and 3-4 times per day at 9-11and 12-24 months of age, with additional nutritious snacks (such as a piece of fruit or bread or chapatti with nut paste) offered 1-2 times per day, as desired. Snacks are defined as foods eaten between meals-usually self-fed, convenient and easy to prepare. If energy density or amount of food per meal is low, or the child is no longer breastfed, more frequent meals may be required.

8. NUTRIENT CONTENT OF COMPLEMENTARY FOODS. Feed a variety of foods to ensure that nutrient needs are met. Meat, poultry, fish or eggs

should be eaten daily, or as often as possible. Vegetarian diets cannot meet nutrient needs at this age unless nutrient supplements or fortified products are used (see #9 below). Vitamin A-rich fruits and vegetables should be eaten daily. Provide diets with adequate fat content. Avoid giving drinks with low nutrient value, such as tea, coffee and sugary drinks such as soda. Limit the amount of juice offered so as to avoid displacing more nutrient-rich foods.

9. USE OF VITAMIN-MINERAL SUPPLEMENTS OR FORTIFIED PRODUCTS FOR INFANT AND MOTHER. Use fortified complementary foods or vitamin-mineral supplements for the infant, as needed. In some populations, 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. FEEDING DURING AND AFTER ILLNESS. Increase fluid intake during illness, including more frequent breastfeeding, and encourage the child to eat soft, varied, appetizing, favorite foods. After illness, give food more often than usual and encourage the child to eat more.

BIOGRAPHY

NAME	Vu Thi Nguyet Anh
DATE OF BIRTH	May 5, 1973
PLACE OF BIRTH	Hanoi, Vietnam
NSTITUTION ATTENDED	Hanoi Medical University, Hanoi, Vietnam Medical Doctor 1992 – 1998
	Mahidol University, Thailand ASEAN Institute for Health Development M.P.H.M. (Master of Primary Health Care Management) 2008 - 2009
FELLOWSHIP/ RESEARCH GRANT	Hanoi people's committee
PRESENT POSITION	Medical Doctor (Officer on Hanoi Reproductive Health Care Center) Hanoi Department of Health Hanoi, Vietnam