วารสารสาธารณสุขและการพัฒนา
ปีที่ 7 ฉบับที่ 3 กันยายน - ธันวาคม 2552

Relationship between stunting and food provided to children aged from 6 to 24 months in Soc Son District, Hanoi, Vietnam

Vu Thi Nguyet Anh * Jiraporn Chompikul ** Sirikul Isaranurug ***

ABSTRACT

A case-control study was conducted to determine the risk factors of stunted children in Soc Son district, Hanoi, Vietnam. The data were collected from January 12 to February 3, 2009. One hundred and eighteen stunted children aged 6-24 months were selected as a study group and 118 normal children were selected as a control group. Secondary data included nutritional status and child's birth weight. Mothers were interviewed and measured for their height after giving consent to participate.

From Chi-square test, the following factors increased the likelihood of stunted children (P-value < 0.05): mothers less than 150 cms tall, low birth weight, mothers' lacking knowledge about iron supplement, inappropriate duration of monitoring an underweight child, inappropriate eating of protein foods, inappropriate eating of all kinds of foods and having acute respiratory infection (ARI). From the Multiple Logistic Regression, the factors 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 female adolescents. Appropriate feeding practices should be focused especially on high risk groups. Education programs for ARI prevention among young children should include appropriate food, good environment and hygienic practices.

Keywords Stunting Feeding practices Children aged from 6 to 24 months

Corresponding author : Associate Professor Dr. Jiraporn Chompikul
* M.D., Hanoi Reproductive Health Care Center, Vietnam
** Ph.D. ASEAN Institute for Health Development (AIHD), Mahidol University
*** M.D., M.P.H., Dip. Thai Board of Pediatrics, ASEAN Institute for Health Development (AIHD), Mahidol University

Journal of Public Health and Development
Vol. 7 No. 3 September - December 2009

ความสัมพันธ์ระหว่างการให้อาหารเด็กและภาวะเตี้ยของเด็กอายุ 6 -24 เดือน ในตำบลเซาะซัน เมืองฮานอย ประเทศเวียดนาม

วู้ ทิเหวียน อันห์ จิราพร ชมพิกุล ศิริกุล อิศรานุรักษ์

บทคัดย่อ

การศึกษานี้ใช้แผนการศึกษาแบบควบคุมกลุ่ม เพื่อค้นหาปัจจัยเสี่ยงต่อภาวะเตี้ยของเด็กอายุ 6-24 เดือน ในตำบลเซาะซัน ฮานอย ประเทศเวียดนาม เก็บรวบรวมข้อมูลระหว่างวันที่ 12 มกราคม ถึง 3 กุมภาพันธ์ 2552 โดยกลุ่มศึกษาประกอบด้วยเด็กที่มีภาวะเตี้ย 118 คน และกลุ่มควบคุมประกอบด้วยเด็กปกติ 118 คน สัมภาษณ์มารดาและวัดส่วนสูงหลังจากมารดายินยอมเข้าร่วมโครงการแล้ว ข้อมูลทุติยภูมิที่ใช้ ได้แก่ ภาวะโภชนาการของเด็กและน้ำหนักเด็กแรกเกิด

ผลจากการทดสอบด้วยไคกำลังสองพบว่าปัจจัยที่มีความสัมพันธ์กับภาวะเตี้ยของเด็ก ได้แก่ มารดาที่เตี้ยกว่า 150 เซนติเมตร น้ำหนักแรกเกิดน้อย มารดาขาดความรู้เกี่ยวกับการให้อาหารเสริมธาตุเหล็ก ช่วงเวลาการติดตามที่ไม่เหมาะสม ในการชั่งน้ำหนักเด็กที่น้อยกว่าเกณฑ์มาตรฐาน การรับประทานอาหารโปรตีนไม่เพียงพอ การรับประทานอาหารไม่ครบ 5 หมู่ และภาวะป่วยด้วยโรคติดเชื้อในระบบทางเดินหายใจเฉียบพลัน

จากผลการวิเคราะห์ลอจิสติคพบว่าปัจจัยที่มีความสัมพันธ์กับภาวะเตี้ยของเด็ก ได้แก่ น้ำหนักแรกเกิดน้อย (OR = 7.720, 95% CI = 1.672 – 35.687) การให้อาหารที่ไม่เหมาะสมกับวัย (OR = 1.929, 95% CI = 1.124 – 3.308) และภาวะป่วยด้วยโรคติดเชื้อในระบบทางเดินหายใจเฉียบพลัน (OR = 4.315, 95% CI = 1.361 – 13.677) มารดาที่ตั้งครรภ์และหญิงสาววัยรุ่น ควรจะได้รับคำแนะนำเรื่องความรู้ทางโภชนาการ (สารอาหารเสริม เช่น ธาตุเหล็ก) ที่เหมาะสมสำหรับเด็ก มารดาที่มีลูกที่เสี่ยงต่อภาวะเตี้ยควรได้รับการฝึกปฏิบัติการให้อาหารเด็กครบทุกหมู่และเพียงพอ โครงการการให้ความรู้ในเรื่องการป้องกันภาวะป่วยด้วยโรคติดเชื้อทางเดินหายใจในเด็กเล็ก ควรให้คำแนะนำเรื่องอาหารที่ถูกอนามัย สร้างสภาพแวดล้อมที่ไม่มีมลภาวะ และการปฏิบัติอย่างถูกอนามัย

คำสำคัญ ภาวะเตี้ย พฤติกรรมการให้อาหารลูก เด็กอายุ 6 – 24 เดือน

INTRODUCTION

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. In 2007, UNICEF 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.

Stunting has been considered an indicator of chronic mulnutrition, or something having happened in the past which is still ongoing and affecting on the child's cognitive ability. With child stunting, if the environmental factors do not change, the attainment of full growth potential seems unlikely [4,5]. Stunting is also associated with increased child morbidity and mortality [6].

Stunting has many causes: inappropriate breastfeeding [2,7], inadequate food intake[8], nutritional status of mother [5], maternal child health care [9] and socio-economic demographic factors [5,10]. It occurs at an early age in children, mostly before the age of two and is caused by long term insufficient nutrient intake and frequent infections [10].

Hanoi is the capital of Vietnam, and consists of 9 urban and 5 rural districts. In 2007, the prevalence of stunting was 13.8% , althouth, the prevalence of stunting varied by district. 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 [11].

As Soc Son district has the highest prevalence of stunted children, this study was conducted in this district to determine the relationship between stunting and food provision, and maternal and child health care to children aged from 6 to 24 months in Soc Son district, Hanoi, Vietnam.

METHODOLOGY

A case-control study was conducted by matching community and age of children. The sample size formula for the case-control study was used to calculate number of children by setting power of the test (70%) and confidence interval (90%). The subjects comprised 236 children aged from 6 to 24 months, out of which 118 stunted children were selected

Journal of Public Health and Development
Vol. 7 No. 3 September - December 2009

as cases and 118 normal children were selected as controls. The data were collected from January 12 to February 3, 2008. Secondary data included nutritional status and information of children. A written information sheet was given to their mothers and their informed consent was obtained. Mothers were interviewed using a structured-questionnaire, and measured for their height. The questionnaire was prepared in Vietnamese and consisted of four parts. Part one comprised questions about socio demographic factors: mother's age, education, marital status, occupation, and number of children; children's age, gender; Part two contained questions about knowledge of mothers regarding breastfeeding, time of introducing solid food, food providing for the child during and after illness, and food and nutrients for pregnancy. Part three contained questions about food provided (ask about complementary feeding): meal frequency and kinds of food. Part four was questions about maternal and child health care: antenatal care (ANC), growth monitor for the children, history of diseases.

There were three questions about the number of meals per day. Meal frequency was classified as: 1) Appropriate (at least three main meals and one sub meal) 2) Inappropriate (less than three main meals and no food for sub meal).

Food provided to children 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 eaten by a child, 4 points were given if usually ate, 3 points if sometimes, 2 points if rarely, and 1 point if never. Criteria for carbohydrates, protein foods, vegetables, and fat or oil group was: 1) Appropriate (4 points) 2) Inappropriate (1 to 3 points). Criteria for fruit and iodine salt group was: 1) Appropriate (3 or 4 points) 2) Inappropriate (1 or 2 points). Criteria for poor value food group was: 1) Appropriate (1 or 2 points) 2) Inappropriate (3 or 4 points).

According to WHO guidelines for criteria for all kind of food was eaten daily, children should eat all kinds of food. Therefore, any kinds of food children eaten appropriate was given 2 points, inappropriate 1 point. Total scores ranged from 7 to 14 and divided into 2 categories as follows: 1) Appropriate (14 points for appropriate eating all kinds of food) 2) Inappropriate (7 to 13 points for inappropriate eating at least 1 kind of food).

Chi-square test was used to assess significant association between each independent variable and outcome variable. Crude odds ratio was used to show the strength of association with 95% confidence interval. Multiple logistic regression using Forward (Wald) selection was performed to explore the relationship between all independent variables and the outcome variable.

RESULTS

The association between socio demographic and stunting

The maternal socio demographics were maternal age, marital status, maternal education, maternal occupation, number of children, children's birth weight and gender.

All mothers in this study were married and living together with their husbands. Most 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). 77.1% of mothers in the study group and 72.9% of mothers in the control group finished secondary school. Most mothers in this study were farmers (85.6% in the study group and 84.7% in the control group). Families with three or more children accounted for 20.3% of the study group and 14.4% of the control group. 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. None of mothers in this study had 3 children aged ≤ 5 years old. There was no statistically significant association between any of the above factors with stunting.

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).

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).

The association between maternal knowledge and stunting

Table 1 shows most of mothers in the control group had higher levels of knowledge 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 1 also shows the association of levels of overall maternal knowledge with stunting. 50.9% of mothers in the study group and 39.0% of mothers in the control group had high levels of knowledge. Only 12.7% of mothers in the study group and 16.9% of mothers in the control groups had low levels of knowledge. 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.

Journal of Public Health and Development
Vol. 7 No. 3 September - December 2009

Table 1 The association between maternal knowledge and stunting

Knowledge statement	Stunted (n= 118) (%)	Normal (n= 118) (%)	Crude OR	95% CI	Chi-square 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		0.062-16.178	
Incorrect answer	0.8	0.8	1.000		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

Table 1 The association between maternal knowledge and stunting (Cont.)

Knowledge statement	Stunted (n= 118) (%)	Normal (n= 118) (%)	Crude OR	95% CI	Chi-square p-value
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
Level of overall knowledge					
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

The association between meal frequency and stunting

The results showed that 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. Children having inappropriate complementary feeding during the day preceding the interview day were twice as likely to be stunted compared with children having appropriate complementary feeding practices, but there was no significant association between food provision practices and stunting. 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 significantly associated with stunting in this study (Table 2).

Journal of Public Health and Development
Vol. 7 No. 3 September - December 2009

Table 2 The association between meal frequency and stunting

Meal frequency provision	Stunted (n= 118) (%)	Normal (n= 118) (%)	Crude OR	95% CI	Chi-square 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

The association between kind of food and stunting

Table 3 shows 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 control 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 vegetables, fat and iodine salt. Most of children in both groups were rarely fed poor value foods.

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). Children who inappropriately ate vegetables had a 1.8 times greater risk of being stunted than those who ate appropriately, but there was no statistically significant association with stunting. All mothers in this study fed iodine salt appropriately to their children, and 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. For all kinds of food, 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 3 The association between different kind of food and stunting

Kind of foods	Stunted (n= 118) (%)	Normal (n= 118) (%)	Crude OR	95% CI	Chi-square 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
All kind of food					
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

The association between maternal and child health care and stunting.

Table 4 reveals all mothers in this study examined their babies during pregnancy at least once. 90.7% of mothers in the study group and 94.1% in the control group received ANC at least 3 times. Duration of monitoring of children's weight longer than 3 months was 28.0% in the study group and 21.2% in the control group. Most of the children had no diarrhea during pervious two weeks but children having fever or acute respiratory infection (ARI) had a 4.2 times higher risk of being stunted than those who did not (P-value 0.014).

Journal of Public Health and Development
Vol. 7 No. 3 September - December 2009

Table 4 The association between maternal and child health care and stunting

Kind of foods	Stunted (n= 118) (%)	Normal (n= 118) (%)	Crude OR	95% CI	Chi-square 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		
Yes	12.7	3.4	4.150	1.335-12.908	0.014*

* Significance at P-value < 0.05

The association between all study variables and stunting.

All variables were included in the initial full models. The results of the full model shows in Table 5. 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 5 The full model of multiple logistic regression

Independent variables	Adjusted OR	95 % CI for OR		P-value
		Lower	Upper	
Child birth weight				
< 2,500 grams	8.785	1.788	43.173	0.007
≥ 2,500 grams	1			
Maternal height				
< 153 cms	1.439	0.759	2.730	0.265
≥ 153 cms	1			

Table 5 The full model of multiple logistic regression (Cont.)

Independent variables	Adjusted OR	95 % CI for OR		P-value
		Lower	Upper	
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

Journal of Public Health and Development
Vol. 7 No. 3 September - December 2009

The most significant risk factors related to child stunting obtained form the final model of Multiple Logistic Regression 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). 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.

DISCUSSION

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 children. This result was not similar to the study of Vitolo MR et al [12] in Brasil which found that mothers' age < 20 years old had a 1.6 times the 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. [10] 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 study group than in the control group (20.3% and 14.4% respectively). It was similar to the result of a survey in Vietnam in 2005 [3], but it was not found to be significantly associated with stunting. This result differed from the study of Vitolo MR et al. [12] which found 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 study group was higher than that in the control group but there was no significant association. Kanao BJ et al. [7] in their study found no significant association between gender of children and stunting. However, the prevalence of stunted boys was slightly higher than stunted girls.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 study 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 to have stunted children than those who had higher education [9]. 85.6% of mothers in the study group and 84.7% of mothers in the control group were farmers. This result was similar to the result of the Vietnam Nutritional Survey 2005 [3].

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 previous studies also illustrated the association between maternal height and stunting [9,12,16,21]. Shimpton R and Kachonndham Y [10] 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 [13] 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. [12] 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. A stunted child is going to be a 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.

Maternal knowledge

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

Foods provision

No significant association was found between adequacy of meal frequency and child stunting, either by Crude OR (OR=1.99, 95% CI 0.980-4.068) or

Journal of Public Health and Development
Vol. 7 No. 3 September - December 2009

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.

Children who consumed an inappropriate variety foods had a significant association with stunting. The risk of being stunted was nearly 2 times in the study 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 [8, 10, 14, 15]. Fat food is very important for children because it helps Vitamin A and D absorption [10] and provides energy for children. In this study, 27.1% of the mothers in the study group and 22.3% mothers in the control group did not feed enough fat food to their children in accordance with WHO recommendation. Vegetables and fruits provide a variety of vitamins and children should eat them daily. However, 24.6% in the study 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 study group and 90.7% in the control group). Most children did not consume poor value foods.

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

Maternal and child health care

At least 90% mothers in both groups received ANC at least 3 times. In this district, every community has a health center with basic facilities for checking pregnant women. 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.

Having diarrhea was not significantly associated with child stunting in this study. This result differs from the study of Shrimpton R [10] 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. [9] which found that a history of fever was associated with stunting. But it was not consistent with result of Shrimpton R [10]. 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 also studies of Wamani H et al. [9] and Shrimpton R [10]. However, repeated diseases were not mentioned.

RECOMENDATIONS

The significant factors associated with stunting were birth weight less than 2500 grams, eating an inappropriate variety of food and having fever or ARI. Other factors that may be associated but which were not significant in this study were being mothers less than 150 cms tall, mothers'lacking knowledge of iron supplementation for pregnant women, and child weight monitoring. The following public health activities are recommended. Appropriate nutritional education, food and iron supplementation should be given to pregnant women and adolescent girls to reduce low birth weight. Children malnutrition control programs should focus on appropriate feeding practices and 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.

Recommendation for further studies: 1. Concentrate on both quantity and quality of daily food intake especially protein foods for children to ensure that WHO guideline are followed. 2. Conduct qualitative studies to ascertain the reasons for inappropriate feeding. 3. Identify the factors related to low birth weight. 4. Ascertain the frequency of disease in underweight and stunted children.

ACKNOWLEDGEMENTS

The author would like to express sincere thanks to the mothers who participated in this study.

REFERENCES

1. The Lancet. The Lancet's series on Maternal and child undernutrition. Executive Summary. Atlanta,GA: The Lancet; 2008. [Online] Available from: http://www-tc.iaca.org//Acweb/aboutk/teseminar/sem6.exesum.pdt [Accessed 2008 Oct 10].
2. Hanoi Child Malnutrition Control Program. Annual report. Hanoi: Reproductive Health Care Center; 2007.
3. National Institute of Nutrition. General statistic office. Nutritional status of children and their mothers in 2005. Annual reports. Vietnam: Medical Publishing House; 2006.
4. Branca.F, Ferrari.M. Impact of Micronutrient Deficiencies on Growth: The Stunting Syndrome. Annuals of Nutrition and Metabolism 2002; 46(suppl 1): 8-17.
5. WHO. The World Health Organization Global Database on Child Growth and Malnutrition: methodology and applications. International Journal epidermiology. 2003; 32: 518-25.
6. Berkman DS, Lescano AG, Gilman RH, Lopez SL,Black MM. Effects of stunting, diarrheal diseas and parasitic infection during infancy on cognition in late childhood : A follow up study. Lancet. 2002; 359: 564-71.
7. Bhutta ZA, Ahmed T, Black RE, Couseus S, Denwey K, et all. What works? Intervention for maternal and child undernutrition and survival. The Lancet. 2008; 371(9610): 417-40.
8. Marquis GS, Habitch JP, Ladata CF, Black RE, Rasmussen KM. Breast milk or animal product foods improve linear growth of Peruvian Toddlers consuming margin diets. American Journal of Clinical Nutrition. 1997; 66(5): 1102-09.
9. Wamani H, Astrom AN, Peterson S, Tumwine JK, Tylleskar T. Predictors of poor anthropometric status among children under 2 years of age in rural Uganda. Public Health Nutrition. 2006; 9(3): 320-26.
10. Shrimpton R, Kachondham Y. Analysing the Cause of Child Stunting in DPRK (Democratic People's Republic of Korea). October 2003. [Online] Available from http://www.unicef.org/dprk/further_analysis.pdf. [Accessed 2008 Oct 10].
11. Soc Son district health office. Socson district health report. Vietnam: Community Health Department; 2007.
12. Vitolo MR, Gama CM, Bortolili GA, Campagnolo PB. Some risk factors associated with overweight, stunting and wasting among children under 5 years old. Journal de Pediatria.2008; 84(3):251-57.
13. Hop LT, Gross R, Giay T, Schultick W, Thuan B, et al. Longitudinal observational of growth of Vietnamese children in Hanoi from birth to 10 years of age. European Journal of Clinical Nutrition.1997; 51(3): 164-74.
14. Kulwan KB, Kinabo JLD, Modest B. Constraints on good child care practices and nutritional status in urban Dar-es-Salaam, Tanzania. Handbook of environmental Chemistry. 2006; 27(3): 236-44.
15. Ahmed FS. Factors affecting nutritional status of five Years old children in Islamabad, Pakistan. [M.P.H.M Thesis in Primary Health Care Management] Nakhonpathom: Faculty of Graduate Studies, Mahidol University; 2007.