MALNUTRITION AND ASSOCIATED RISK FACTORS IN CHILDREN AGED 6-59 MONTHS IN URBAN INDONESIA

A quantitative study

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"We are guilty of many errors and many faults, but our worst crime is abandoning the children, neglecting the foundation of life. Many of the things we need, can wait. The child cannot. Right now is the time his bones are being formed, his blood is being made and his senses are being developed. To him we cannot answer "Tomorrow". His name is "Today" *Gabriela Mistral, 1948*

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ABSTRACT – ***Malnutrition and associated risk factors in children aged 6-59 months in urban Indonesia***

Background There has been made substantial progress in Indonesia by reducing the magnitude of malnutrition during the last decades. However, great disparities exists among areas and malnutrition remains a significant public health problem in many parts of Indonesia. Our study will provide an understanding of risk factors in a specific population in Medan so that a local NGO and local policy makers can plan targeted and appropriate interventions.

Objectives To identify the prevalence and associated risk factors of stunting, wasting and underweight in children aged 6-59 months in an urban community Indonesia, with a main emphasis on breastfeeding, complementary feeding and acute watery diarrhea.

Methods The study was a cross-sectional survey with a structured questionnaire conducted between August and December 2010 on 405 households. All households with children between 6-59 months were included in the survey. Anthropometric measurements were performed on one randomly selected child from each household. Nutritional status was determined according to the WHO new growth reference.

Results The prevalence of stunting and severe stunting was 21.7% (95%CI±4.0) and 4.4% (95%CI±2.0). The prevalence of wasting and severe wasting was 12.6% (95%CI±3.2) and 2.7% (95%CI±1.6). The prevalence of underweight and severe underweight were 21.8% (95%CI± 4.0) and 3.5% (95%CI±1.8)Risk factor for stunting were: Consumption of ≥4 snacks per day, increased feeding during diarrhea, ≥5 children in the household, short maternal stature (<150cm)and LBW (<2500g). Protective factors for stunting were: Higher maternal education and knowledge about breastfeeding. Risk factors for wasting were: Consumption of carrot or yellow/orange fruit or vegetables within last 24h, age 6-23 months, treating acute watery diarrhea with traditional/herbal medicine and receiving vitamin A supplements within last 6 months. Protective factors for wasting were: Higher income (>$200) and washing children's hands before eating. Risk factors for underweight were: Short maternal stature (<150cm), LBW(<2500g) and receiving vitamin A supplements within last 6 months. Protective factors for underweight were: Higher paternal education and maternal knowledge about good complementary feeding.

Conclusion We failed to identify any significant association between breastfeeding practices or acute watery diarrhea and malnutrition. However, some dietary practices were significantly associated with malnutrition.

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Definitions and abbreviations

Acute watery diarrhea - Defined as 3 or more abnormally loose or watery stools within 24 hours

Anthropometry – Refers to physical measurements of the body in this context

BMI – Body mass index. Calculated by kg/m^2

DHS – Demographic and Health Survey

FAO – The Food and Agricultural organization of the Unitide Nations

HAZ – Height-for-age Z-score

Household - Includes people living under the same roof, sharing food and finances.

IDHS – Indonesia Demographic and Health Survey.

LBW – Low birth weight. Defined as birth weight below 2500grams

Mean - Describes the central location or average value of the data

Median – Describes the middle value of the data

ORS – Oral rehydration solution

SD – Se Z-score……..

Stunting Height-for-age below -2SD from median value

Tared weighing – Weighing scale is re-set to zero while someone is still standing on it.

Underweight Weight-for-age below -2SD from median value

UNICEF – Unitide Nations children's fund

Wasting Weight-for-height below -2SD from median value

WAZ – Weight-for-age Z-score

WHO – World Health Organization

WHZ – Weight-for-height Z-score

Z-score – A score that indicates how far the measurement is from the median value. Also known as standard deviation (SD) score

1. Introduction

1.1 Background

Malnutrition – remains an international public health problem Although the health and nutritional status of people in many countries has improved over the last decade, malnutrition still remains a threat to the health and well being of millions throughout the world. A recent report from FAO estimates than nearly a billion people are still suffering from malnutrition, as of 2010, and approximately 98% of them live in the developing world. (1) It is estimated that approximately 127 million (22%) children in the developing world are underweight today, and in South Asia the prevalence of underweight is 42%. It is also indicated that around 195 million children in the developing world suffer from stunting and nearly half of them live in South Asia. Children who suffer from wasting have a pronounced risk of death and in South Asia the prevalence of wasting has an average rate of 19%. (2)

Malnutrition contributes to more than one third of the child mortality, approximately 35% of the disease burden in children less than five years, and 11% of the total global DAYLY's. (3;4) Studies have shown that childhood malnutrition is associated with impaired physical growth, longer and more severe illness and higher risk of mortality. Childhood malnutrition has also been associated with delayed motor development,

lower cognitive function and school performance. In addition, it has been suggested that malnutrition in childhood could cause increased risk of chronic disease, impaired work capacity and worse reproductive performance in adulthood. (3,4).

UNICEFs conceptual framework for malnutrition identifies inadequate dietary intake and illness as immediate determinants of malnutrition. (5) Inadequate diet in both quantity and quality will impair the growth, health and development of children and make them susceptible to infections, which again may lead to malnutrition. (6) Studies have shown that inadequate breastfeeding practices (7), poor feeding practices during illness (8) and timing and quality/quantity of complementary feeding(8;9) are significant risk factors for malnutrition. Regarding illness, diarrhea seems to be particularly important. There is a vicious cycle between diarrhea and malnutrition, and studies have shown that diarrhea is associated with impaired growth of children, while malnutrition is associated with increased risk of diarrhea. (10;11;12)Growth faltering usually starts between 3-6 months, but could also start from birth. The first 2 years of life is known the "critical window of opportunity" for ensuring optimal growth and development through appropriate feeding. (6;13) Interventions should therefore be targeted at children in this age group.

Malnutrition – remains a public health problem in Indonesia There has been made substantial progress in Indonesia by reducing the under-five mortality rates as well as the magnitude of malnutrition during the last decades. The prevalence of underweight children under five has decreased from 31% in 1989 to 17.9% in 2010. This indicates that Indonesia is on track towards reaching MDG1 about halve, between 1990 and 2015 the proportion of people suffering from hunger. (14) However, great disparities exists, and malnutrition remains a significant public health problem in many parts of Indonesia, and millions of children are still suffering from it, both chronically and acute. (15) A resent report from UNICEF stated that Indonesia was among the 5 top countries contributing most to the number of stunted children in the world with a national prevalence is 37%. (3) Recent numbers also reveals that as much as 14% of the children are wasted in Indonesia, indicating a serious public health problem. (16)

1.2 Justification of study

The etiology of malnutrition is complex, and interrelated risk factors often vary in different biological, environmental and cultural settings. A local NGO is aiming to start a project in the research area, but there is limited information about the prevalence of malnutrition as well as other contributing factors. The NGO has reason to believe that malnutrition is a problem in the area. Our study will be beneficial in providing knowledge about the prevalence of malnutrition, as well as identifying associated risk factors in that particular setting. This will benefit the local NGO as well as the local government in planning targeted interventions towards appropriate and relevant factors.

1.3 Study objectives

1.3.1 Primary objectives

The purpose of this study is to find the prevalence of stunting, wasting and underweight among children aged 6-59 months in a poor semi-urban community in Indonesia, and to identify the significant associated risk factors. The main emphasis will be on the immediate causes: inadequate dietary intake and illness. We have focused on breastfeeding, complementary feeding and acute watery diarrhea. However, we will also explore some of the factors related to the underlying socio-economic causes like: income, parental education and occupation, water and sanitation and access to health care services.

1.3.2 Secondary objectives

- To identify socio-economic factors related to the child's nutritional status.
- To study mothers knowledge and practices regarding breast-feeding and complementary feeding
- To assess whether children in the area are currently suffering from diarrhea or other illness.
- To study mothers practices regarding prevention and management of acute watery diarrhea.
- To assess whether the population has access to health care services, by exploring vaccination status and vitamin A supplementation coverage.

2. Theoretical framework

2.1 Malnutrition

Malnutrition is a term commonly used about suboptimal nutritional health. It encompasses both under- and over-nutrition. However, usually in international health, and in our study, it refers to undernutrition: *"The syndrome of inadequate intakes of protein, energy, and micronutrients, combined with frequent infections, which result in poor growth and body size."* [1]

2.1.1 Anthropometric indices of nutritional health

Anthropometric measurements are commonly used to determine childrens nutritional status. The most frequently used anthropometric indicators used are: height-for-age z-score (HAZ), weight-for-height z-score (WHZ) and weight-for-age z-score (WAZ). Although these indicators may share some determinants, it is important to note that they represent different biological processes in the body and should not be used interchangeably. (17)

1.Semba R and Bloem M W. Nutrition and health in developing countries. Second edition. Chapter 12: Malnutrition .Humana press. pp 344, 2008.

Stunting Height for age reflects the achieved linear growth of a child. Low height-for age is caused by insufficient nutrient intake and/or frequent infections over a longer period of time, and is referred to as stunting. (18) Because stunting is the result of a long term process, it is also often referred to as "chronic malnutrition". (17) Studies have shown that faltering in linear growth may occur from birth until 18 months, but can also continue until the third year of life. (19) Stunting of children in this age group indicates a failure to grow. However, for children above 3 years, low height for age indicates a "failure to have grown" and they are defined as being stunted because the effect is usually irreversible. (17)

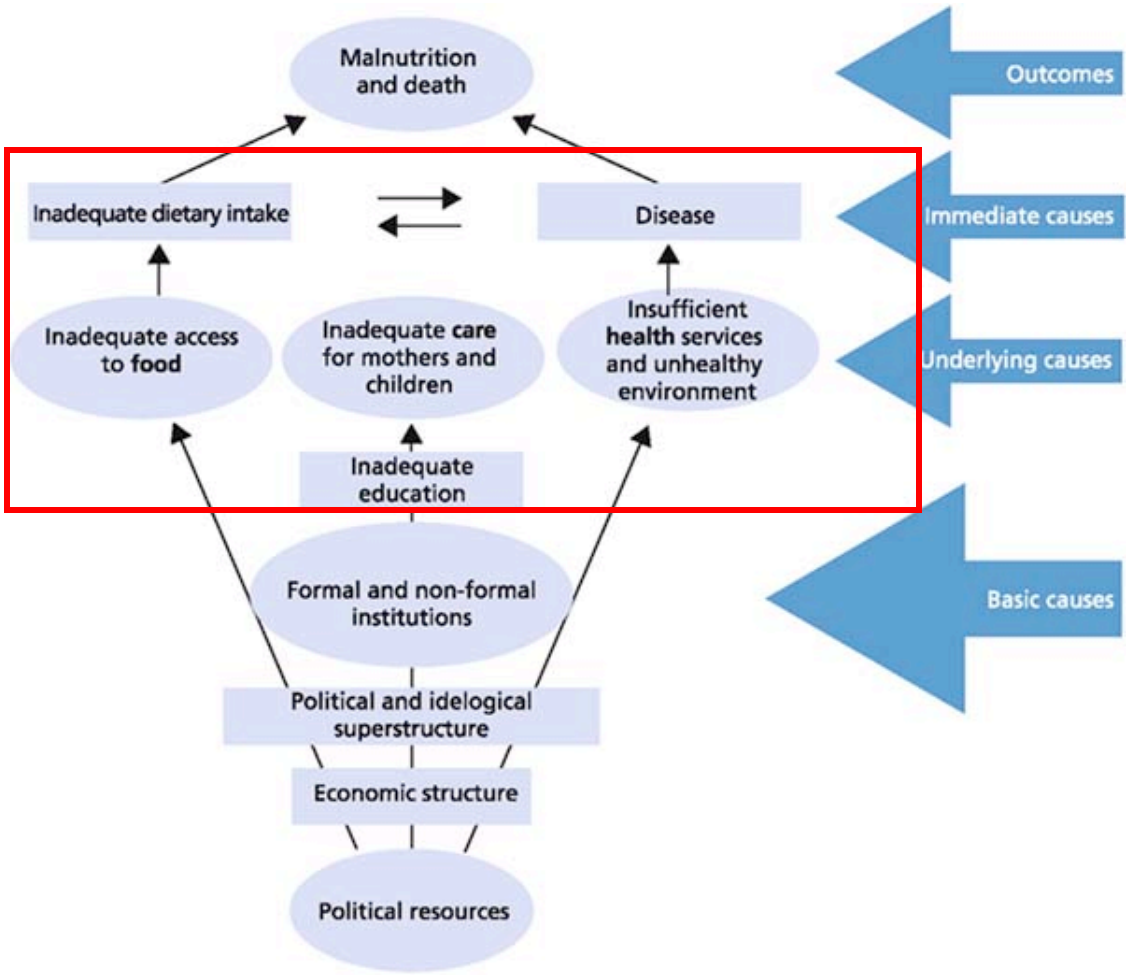
Wasting Weight-for-age reflects the body weight according to height and indicates the thinness of a child. Low weight-for-age usually indicates a recent process of severe weight loss due to insufficient nutrient intake and/or illness, and is often referred to as acute malnutrition. However, wasting can also in some cases result from long term dietary deficiencies. (17) Studies have shown that the prevalence of wasting is higher among younger children and usually peaks around the age of two. However, wasted children are usually able to catch-up growth after that, and the condition is reversible. (17;20)

Underweight Weight-for-age reflects the childs body mass in relation to chronological age. (17) Low weight-for-age encompasses both height and weight and it could be difficult to determine whether it is due to stunting, wasting or both. (21) Since underweight may include both stunting and wasting, it is used as an indicator for the magnitude of malnutrition. (17)

2.2 Conceptual framework for causes of malnutrition

The etiology of malnutrition is complex, and interrelated risk factors often vary in different biological, environmental and cultural settings. UNICEF has developed a conceptual framework for malnutrition that recognizes the complexity and interrelation between various factors. Our study has main focus on the immediate determinants of malnutrition: inadequate dietary intake and illness, with emphasis on breastfeeding, complementary feeding and acute watery diarrhea. However, some of the underlying socio-economic determinants will also be explored.

Figure 2.1 UNICEF's conceptual framework for the causes of malnutrition



Source: Redrawn from UNICEF http://www.fao.org/docrep/005/Y4249E/y4249e0d.htm

2.3 Immediate causes of malnutrition

2.3.1 Inadequate dietary intake

Inadequate diet in both quantity and quality will impair the growth, health and development of children and make them susceptible to infections, which again may lead to malnutrition. (6)

Breastfeeding Breastfeeding has great benefits for both mother and child, and one of the most important benefits is the immediate health and increased survival of infants. Breast milk provides all the energy and nutrients an infant needs the first months of life, in addition to antibodies that protects against infections. (22) Studies have shown that initiation of breastfeeding later than the first day after delivery, early introduction of fluids and food or absence of breastfeeding, is associated with increased risk of neonatal morbidity and mortality. (23;24;25)

According to the current recommendations from WHO and UNICEF, breastfeeding should be initiated immediately or within one hour after birth and fed exclusively to the child the first 6 months of life. (26) Exclusive breastfeeding means that the child is only given breast milk, or milk expressed from a wet nurse the first 6 months of life. The only exception from breast milk is ORS, drops or syrups with vitamins, minerals or medicines. (27) After 6 months it is recommended to continue breastfeeding for 2 years or beyond in addition to safe, nutritious and age appropriate complementary feeding. (26) Unfortunately, there are great variances in breastfeeding practices throughout the world, and it is estimated that 39% initiate breastfeeding within one hour after birth and only 40% of infants below 6 months are exclusively breastfed in the developing world. (3)

Regarding exclusive and prolonged breastfeeding and the effect on growth, studies show conflicting results. A study done in Vietnam found that children who were exclusively breastfed the first 6 months of life had significantly reduced risk of being stunted, wasted and underweight. (7) However, another study showed that children who were exclusively breastfed for 6 months had significantly lower height and weight gain during the first year of life. (28) There is an ongoing discussion about the evidence to support the change from exclusive breastfeeding in 4-6 months to 6 months, which was implemented by WHO in 2001. There is convincing evidence about the association

between breastfeeding and reduced incidences of infections. However, researchers claim that there is limited evidence about potential adverse effect on growth or development of iron deficiency in infants who are exclusively breastfed for 6 months. Considering the scientific evidence available, exclusive breastfeeding for 6 months is still recommended as eminent in countries where clean water and safe nutritious food are scarce. (25) A review about prolonged breastfeeding from 19 different countries showed that among older children aged 12-18 months, those who were still breastfed were shorter and thinner than children who had stopped breastfeeding. (22) However, another study with similar findings indicated that the inverse association between prolonged breastfeeding and impaired growth, could be explained by poorer complementary feeding of breastfed children compared to not breastfed. (29) However, other studies have found that continued breastfeeding throughout the second year is beneficial for the child and has been associated with increased growth in both height and weight. (30;31)

Exclusive breastfeeding is not widely practiced in Indonesia. It has been indicated that as much as 65% initiates fluids and food within 3 days after birth, and this practice is supported and sometimes recommended by midwives, nurses or family members. (15) Comparative research from different parts of Indonesia showed that 20-53% of infants received formula milk during the first 7 days after birth. These studies also fount that women delivering at hospital, midwife's house or maternity clinic were more likely to introduce formula milk to their infants than mothers who did not. They also found that samples of formula milk were distributed for free or sold at these facilities. (32) A report from the DHS in 2007 showed that 39% initiated breastfeeding within one hour after birth and only 32% practices exclusive breastfeeding the first 6 months of life, which is a decline from 40% in 2000. The same report also showed that there had been a steady decrease in the median duration of breastfeeding from 23.9 months in 1997 to 20.7 months in 2007. (33)

Complementary feeding After 6 months, breast milk alone is not sufficient to meat the nutrient need of a child, and complementary food should be introduced. (6) Even children who are exclusively breastfeeding during the first 6 months of life will become stunted if they don't receive adequate complementary food in quality and quantity after 6 months. (4) Studies have shown that the age between 0-24 is the time when growth

faltering is most dramatic and after the age of 3 years stunting is usually not reversible. (20) Children experience rapid growth the first years of life, which increases the demands of nutrient intake. Since their gastric capacity is low at this age, the quality of the complementary food is particularly important. (15)

Current international guidelines recommend breastfeeding on demand together with complementary feeding for children in the age between 6-24 months. (26) In general children who are breastfed could start with pureed, mashed or semi-solid food and be fed 2-3 meals per day from 6- 8 months. After 8 months children could eat 3-4 meals with fine chopped or mashed food and some finger food, and by 12 months most children can eat the same types of food as consumed by the rest of the family. Depending on the children's appetite, they could be offered 1-2 nutritious snacks besides the meals. For children who are not breast fed, it is recommended to give 1-2 cups of milk and 1-2 extra meals per day. (6)

Complementary food should be nutritious and energy dense. Generally, thicker or more solid food contains more energy and nutrients, than diluted or soft food. Staple food, such as cereals or roots provide mainly karbohydrate and energy. It is therefore recommended that additional foods containing iron, zinc, calcium, vitamin A, vitamin C and folate, are combined with the staple daily to add important nutrients to the diet. Good sources of protein, iron, zinc could be foods from animals and fish. However, vegetarian foods such as peas, beans, lentils and nuts also consist of protein and some iron. Egg yolk and liver are good sources of vitamin A and protein (liver also contains folat). Orange-coloured fruits and vegetables or dark-green leaves are good sources of carotene from which vitamin A is made, and are also rich in vitamin C, similarly to tomatoes, citrus and other fruits and vegetables. Diary products, such as milk, cheese and yoghurt is a recommended source of calcium, protein and energy. (6) Fats and oils are also important ingredients in the complementary food, because they increase the energy density of the food, provide essential fatty acids needed for growth and enable absorption and utilizations of vitamin a and other fat-soluble vitamins. (6;15) However, complementary food recommendations need to be locally adapted and appropriate according to availability and affordability of food.(6)

There are great variances in complementary feeding practices throughout the world, depending on resources available, traditions, beliefs and knowledge. Research has

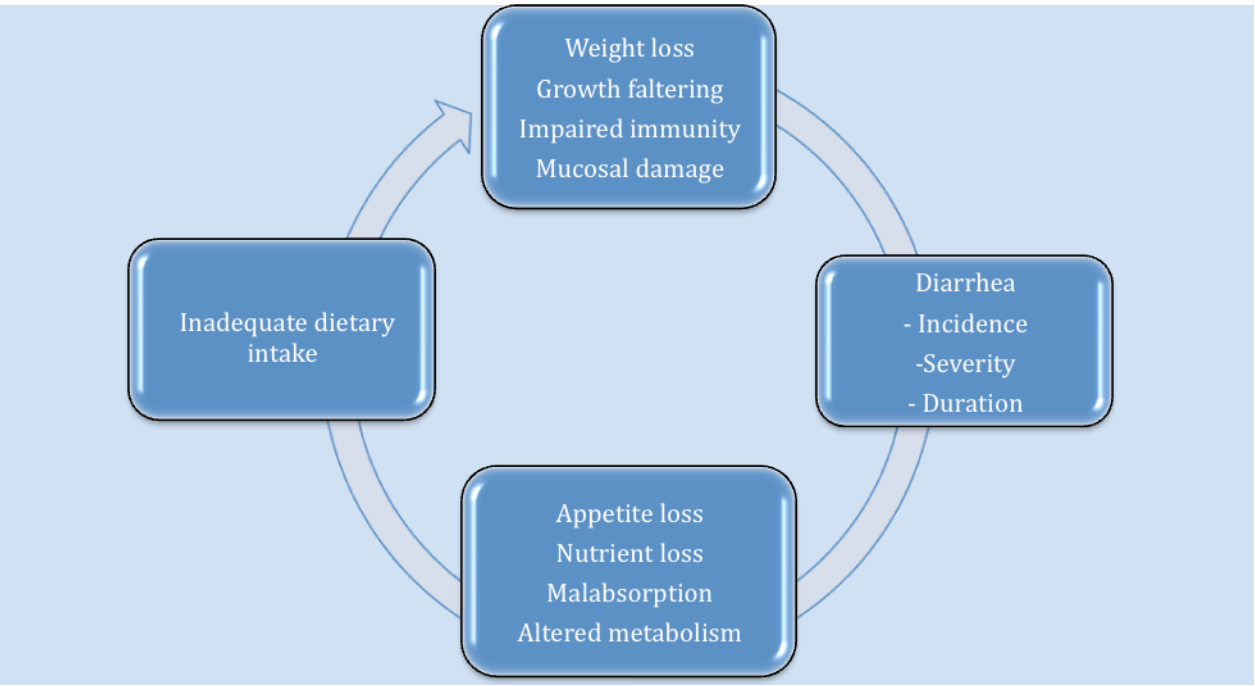
shown that common problems with complementary feeding is that it is initiated to early or to late, not given frequent enough or inadequate in energy and nutrients. (4;3) A review study showed that provision of complementary food and/or nutritional counseling of mothers were significantly associated with improvements in both height and weight in children aged 6-24 months. (34) Another study from Malawi showed that poor complementary feeding was associated with a three-fold risk of severe stunting in children aged 12 months. (19)

Studies from Indonesia have shown that as much as 50-75% of the infants received other food during their first week of life, including prelacterals, formula milk and water. (15;32) A recent study, from urban Indonesia, indicated that the children's needs for iron, zinc and calcium was difficult to achieve using local food sources. (35) In addition, findings from Jakarta indicated that only 9% of the children were fed according to best practice, and generally their food had little variance and were low in micronutrients. (15) A common problem in Indonesia is unhealthy snacking, and findings from Jakarta suggested that children consumed ready-to-eat snacks from street vendors every day. (15) Snacks usually consist of fat, salt and high amounts of sugar, but do not satisfy the childrens need for nutrients like vitamins or minerals. (6)

2.3.2 Disease

Acute watery diarrhea Acute watery diarrhea is defined as 3 or more loose or watery stools passed during 24 hours, and is one of the leading causes morbidity and mortality in children under five years. Those who are most vulnerable to the condition, are children suffering from underlying malnutrition. (36) Also, diarrhea incidence is usually higher during the 2 first years of life and peaks around 6-11 months and during hot or wet months. (12) There is a vicious cycle between malnutrition and diarrhea. Attacks of diarrhea in malnourished children tend to be more frequent, severe and of longer duration. At the same time, repeated attacks of diarrhea could lead to poor growth and malnutrition. (37;11;12) However, it has been indicated that diarrhea alone doesn't necessarily result in malnutrition, unless incidences occurs repeatedly. Studies with long term follow up of children have found that diarrhea doesn't contribute to causing malnutrition as long as there are diarrhea-free time for catch up growth. (38)

Figure 2.2 The vicious cycle of malnutrition and diarrhea



Redrawn from source: Andrew Tomkins and Fiona Watson, Malnutrition and Infection, ACC/SCN, Geneva 1989
http://www.unicef.org/sowc98/silent4.htm

Diarrhea usually reduces the appetite of a child, which could lead to insufficient intake of nutrients. In addition, diarrhea reduces intestinal absorption of nutrients, and increase the loss of nutrients through feces and sometimes associated vomiting. (12) These are all factors that could contribute to the development of malnutrition and impaired immunity, which again increase the risk of diarrhea. However, the vicious cycle of malnutrition and diarrhea can be broken, by ensuring that the children get proper and nutritious food during and after episodes of diarrhea. (36) Studies have shown that continued feeding during episodes of diarrhea in children is beneficial for their growth, and does not increase stool frequency, vomiting or result in additional weight loss. (39;40) Based on such findings, the current guidelines from WHO recommend continued feeding during diarrhea and increased feeding afterwards. Continued feeding accelerates the recovery of normal intestinal function and the ability to absorb and digest nutrients. Food should therefore never be withheld during episodes of diarrhea and breastfeeding should always be continued and preferably increased. The aim is to give as much nutrient rich food as the child will accept. In general, children could eat the same types of food as they eat when they are healthy and it is important that the food is nutritious and not diluted. Small, but frequent servings are recommended over less frequent large servings. When children are recovering from diarrhea they should get an

extra meal per day for at least two weeks or until they have regained normal weight-for-height. (36)

The greatest danger with acute watery diarrhea is dehydration, which in severe cases could lead to death. The first step in diarrhea management is therefore rehydration with increased amounts of appropriate fluids. International guidelines recommend the use of oral rehydration salts (ORS) together with zinc supplements. (41) ORS is a mixture of clean water, salt and sugar, and can be bought in packages for a very low price, or prepared at home if packages are not available. ORS replaces fluid losses as well as it helps restore the electrolyte balance and should be given in frequent sips from the onset of diarrhea until it has stopped. (36) Studies have shown that zinc supplements could reduce the duration of diarrhea as well as reduce the stool volume. Current recommended suggest that zinc-supplements are given once a day from onset of diarrhea for 10-14 days. It has been suggested that this regimen also could reduce the recurrence of diarrhea in the next 2-3 months. (37;42)

Indonesia has had a dramatic fall in diarrhea related mortality in children under five the last decades. This could be related to the intensive promotion of oral rehydration therapy (ORT) and continued feeding during diarrhea, from the Department of Health since the early 1970s. (41) But, the general progress in social and economic indicators could also have been strong influencing factor. However, diarrhea morbidity remains unchanged, and it is estimated that every child on average has 1.3 diarrhea episodes each year. (15) According to recent statistics from Indonesia, 52% of the households have improved sanitation facilities and 80% use an improved drinking water source. (44) In Indonesia, ORS packages can be bought at every pharmacy, and in many village shops for a very cheap price. However, other medications like Enterostop, Diarstop, herbal medications or antibiotics, are more frequently recommended at pharmacies and shops. (45) The ministry of Health in Indonesia integrated zinc treatment into the national guidelines and declared it a program drug in 2008. However, the treatment remains adopted by most of the Indonesian population. (41) According to findings from a demographic and health survey in 2007, as much as 90% know about ORS, however, only 35% use it. (33)

2.4 Underlying causes of malnutrition

2.4.1 Inadequate access to food in the household

Poverty is an acknowledged determinant of malnutrition and economic growth could contribute to reduce the prevalence of the condition. However, the nutritional status of a population does not always depend on national prosperity and economic growth. Malnutrition also reflects individual households ability to access safe food in adequate quality and quantity to feed all its members. (3;5) Food security encompasses access to food physically, socially and financially. (5) Studies have shown that poverty (9), large number of children in the household (7) and few meals pr day (9), are factors associated with malnutrition in children. In Indonesia, availability of food is not the main problem. However, there are great disparities in the ability to purchase food, as well as equal distribution of food within households, and in some traditional cultures, the care for women and children are not prioritized. (15)

2.4.2 Inadequate care for mothers and children

Care provided to children becomes apparent through the way they are fed, nurtured, taught and guided. (5) Care provided to children are closely related to maternal education and knowledge, and studies confirm that the risk of malnutrition is higher when maternal education is low. (7;46;47) Other important factors are mother's workload, social support, time available for care and control over resources (13). Care for mothers is often linked to women's status, and in many countries low status of women is associated with malnutrition across the life cycle. (3) The element of care for women is especially critical during pregnancy and lactation. (5) In Indonesia, poor care for mothers during pregnancy and lactation including failure to decrease workload and protect breastfeeding combined with poor maternal nutrition are factors that are likely to contribute to malnutrition. (15)

2.4.3 Insufficient health services and unhealthy environment

An important element in ensuring good health is access to health care, both curative and preventive. (5) Common problem with health care services is that they are unavailable physically or because of expenses. A study done in Indonesia showed that children missed by the immunization program were more likely to be malnourished. (42) However, sometimes availability of services is not the main problem, rather the quality

of care. In Indonesia, access to health care varies across the country, but when available, the quality is not always adequate. E.g. Findings from a health center in Indonesia revealed that the person responsible for nutritional counseling of mothers where actually a representative from a formula company. (15) Regarding environmental health, lack of access to safe water or improved sanitation, unhygienic food handling or unhygienic conditions inside or around households, are important factors contributing to malnutrition. (5) These are all factors that indirectly could cause malnutrition through increasing the risk of infections and especially diarrhea. Nearly all diarrheal diseases are transmitted through direct contact with feces or indirectly through water, food, hands, flies or soil that has been contaminated with faces. (12) Prevention should therefore target to break the path of contamination. Studies have shown that risk of diarrhea could be reduced by more than 50% by promoting handwashing with soap and water after defecation, before preparing food and before eating. (48;49)

2.5 Country profile Indonesia

Figure 2.3 National statistics Indonesia

 **Indonesia**	Sources: WHO(50) Ministry of Health Republic of Indonesia (51)
Population:	237 million (2010)
Religion:	Muslim 86.1%
Population below $1per day:	29.4% (2007)
Low birthweight (<2500):	9% (2007)
Infant mortality rate:	30 deaths/ 1.000 live births (2009)
Under-five mortality rate:	39 deaths/1.000 children born (2009)
Under-fives suffering from stunting:	36.8% (2007)
Under-fives suffering from wasting:	13.6% (2007)
Under-fives suffering from underweight:	17.9% (2010)
Population with improved drinking-water:	Rural: 71% Urban 89% Total 80% (2008)
Population with improved sanitation:	Rural: 36% Urban: 67% Total: 52% (2008)
Measles vaccine:	89.8% (2007)
Life expectancy at birth:	Male: 66 years Female: 71 years Total: 68 (2009)

2.5.1 History and socio-economic characteristics

Indonesia is a former Dutch colony, but proclaimed their independence in 1945. Since then there have been several political shifts, but had a turning point in 1965, after an aborted coup by the communist party. The New Order Government was established in 1966, followed by 30 years of substantial economic progress and political stability. In 1998, Indonesia had a financial crisis, and the economic growth rate dropped to -13%,

which again led to political instability and the president was replaced, and have changed four times since then. Since 2000, there has been a slight decrease in population growth combined with a steady economic growth with a rate of 5-6%. (33) Indonesia has also accomplished major improvements in education during the last three decades. According to numbers from the latest DHS, there has been a dramatic increase in the literacy rate among 10 year old, from 61% in 1971 to 93% in 2007. However, despite economic progress, Indonesia still struggles with inadequate infrastructure, poverty, unemployment, unequal distribution of resources and corruption. (52)

2.5.2 Geography

The Republic of Indonesia is situated in Southeast Asian and consists of more than 17.000 islands of which 6000 are inhabited. (52). The country is divided in 33 provinces and has five main islands: Sumatra, Kalimantan, Java, Sulawesi and Irin Jaya. (51) Indonesia is rich in natural resources and is one of the countries with highest levels of biodiversity in the world. (52) Because of the proximity to equator, the climate in Indonesia is tropical and typically hot and humid. There are two seasons: dry and rainy season, and the timing of each season varies somewhat across the country. (51) Indonesia is prone to natural hazards like, floods, severe droughts, tsunamis, earthquakes, forest fires and volcano eruptions, and some areas are frequently affected by natural disasters. (52)

Figure 2.4 Map of Indonesia with highlighted study area

Source: Central intelligence agency: Factbook.https://www.cia.gov/library/publications/the-world-factbook/geos/id.html

2.5.3 Health system

Decentralization was implemented in Indonesia in 2001, and this also affected the health system in many ways. Each province was subdivided into districts and municipalities. After this process, the responsibility of prioritizing sectors for development and care rested in the hands of the district government. As a result, many health problems did not get any attention or funding. In addition, data flow in the surveillance system almost collapsed, making it problematic to develop strategies and monitor health programs. (53)

Public health services are financed by public budgets together with user fees. There is also a health insurance for poor people that cover inpatient and outpatient health care, advanced referral and emergency care. (51) At primary health care there are adequate levels of provision with one health center for every 30.000 people. However, there are great disparities between areas, and people living in remote places sometimes have poor access to health care services. In 2007 there were more than 8000 health centers in sub districts. However, patients in some areas have reported that they live close to the health center, but there is no one there to serve them. (15) In urban areas, private providers often dominate health care services, even among the poor. Private providers are difficult to regulate and are more susceptible to be influenced by formula marketing or pharmaceutical marketing. The quality of care offered by private health care providers varies greatly and the users can easily become subject to excessive treatment and high costs. (53)

2.5.4 Characteristics of study area

Our study was done in Medan, which is the fourth most populated city in Indonesia, with approximately 2 million inhabitants. The research area was an urban village called Tanjung Sari. The areas consisted of low-to -middle-class households with clusters of small slum areas in between. Medan belongs to the province, Sumatra Utara. The literacy rate of the population > 10 years in the province is high (97%), but only 50 % graduated from junior high school or higher in 2007. The percentage of household with protected drinking water source is around 77% and 71% has private toilet facilities. There are on average 3.6 health centers per 100.000 population in the province. (44). According to numbers from a IDHS in 2007, the prevalence of stunting, wasting and underweight in Sumatra Utara was 43%, 18.3% and 22.7%, respectively. (25)

3. Methodology

3.1 Study design

The design used in this study is a quantitative cross-sectional analytical survey. The reason for choosing the cross-sectional design was that it was most feasible since the objective was to find the prevalence of stunting, wasting and underweight. Cross-sectional studies are often called prevalence studies. In the cross-sectional design the prevalence of exposures and disease is measured at a point or over a short period of time, and was therefore the most suitable design considering the limited timeframe of our project, which was five months. We wanted to investigate the etiology of malnutrition in a specific population and believed that the data we got from using the cross sectional design, would be useful to explore the relationship and associations between malnutrition and different characteristics of the society.

3.2 Study population

The study population was children in the age between 6-59 months and their mothers or caretakers. A total of 405 mother/caretaker-child pairs were interviewed. The research area was not randomly selected, but chosen by a local NGO who was aiming to start a project in the area. Four areas in the district Medan Selayan were selected to be included in the research. Medan is the capital of the province called Sumatra Utara

(North-Sumatra) in Indonesia. It is situated north in the province and is the fourth most populated city in Indonesia. (52)

3.3 Questionnaire

3.3.1 Development and translation

UNICEF's conceptual framework for malnutrition was used as a framework for the design of our study. According to this framework, the immediate causes of malnutrition are insufficient intake of food and illness. Based on that we chose to focus our questionnaire on breastfeeding, complementary feeding and acute watery diarrhea. However, some other factors found to be significant in previous research were also included. To create the questionnaire we used findings from previous research, as well as recommendations and guidelines from WHO, and adopted questions used in nutrition surveys by, WHO and FAFO. (54) The questionnaire was pre coded and designed to be used in face-to face interviews. Our interpreter translated the questionnaire into the national language Bahasa Indonesia, and an Indonesian English teacher translated it back to English to check the reliability of the translation.

3.3.2 Independent variables

Demographic characteristics

Children: Age, sex and birth-weight.

Mothers/caretakers: Age, number of children, civil status and level of education.

Socio-economic status: Income per month and number of people supported by it, monthly expenditures, savings.

Environmental characteristics: Observations of wall material, number of people living in the household, number of children, type of water source, sanitation facilities.

Nutritional knowledge and practices

Breastfeeding practices: Exclusive breastfeeding-timing and duration, feeding of colostrum, knowledge about recommended breast-feeding practices

Complementary food and food habits: Timing of initiation of fluids and food, 24 hour food recall and food frequency according to a variety of food groups, knowledge about recommended feeding practices for children.

Acute watery diarrhea prevention/management

Prevention: Hand-washing practices, breastfeeding, safe food and drinking water, appropriate sanitation.

Management: Feeding and amount of fluids during diarrhea, use of ORS/ORT and zinc supplements, use of other medications or traditional treatment.

Health characteristics

Infections: Symptoms of illness during the two weeks prior to or during interview.

Access to health care: Vaccination card, vaccination status, received vitamin A supplement or deworming during last 6 months.

Physiological factors: Height and BMI of mothers, birth weight of child.

3.3.3 Dependent variables

Stunting

Height-for- age, indicating the level of stunting in children aged 6-59 months. Children with height-for age z-scores <-2SD from reference value were defined as stunted.

Wasting

Weight-for-height, indicating the level of wasting in children aged 6-59 months. Children with weight-for-height z-scores <-2SD from reference value were defined as wasted.

Underweight

Weight-for-age, indicating the level of underweight in children aged 6-59 months. Children with weight-for age z-scores <-2SD from reference value were defined as underweight.

3.4 Preparations

3.4.1 Training of interpreter and assistant

The interpreter received training for 2 weeks including the pilot phase. During the training of the interpreter, the questionnaire was reviewed and explained. The interpreter studied the research protocol and had several dialogues with the principal investigator about the purpose, methods and implementation of the study. Training in interviewing technique was given during the pilot study, where the interpreter also was trained in anthropometric measurements. The assistant received training for one day

about how to perform anthropometric measurements of young children. During the training, the equipment was tested on children between 6-59 months, and the methods of measurements explained. During measurements the first week in the field the assistant was given guidance from the principal investigator.

3.4.2 Pilot study

A pilot study including 10 people from an area not far from the study area was performed to make sure the questions were understandable. During the first five interviews the researcher performed the interviews, while the interpreter translated. During all interviews notes were taken when a question seemed difficult or had to be asked differently compared to what was written in the questionnaire. During the last interviews the interpreter performed the interviews solo, assisted by the researcher. The measuring equipment was also tested during the pilot study. After the pilot study the questionnaire was revised in cooperation between the researcher and the interpreter. The questions that were difficult to understand or failed to measure what they intended, were rewritten in cooperation with the local interpreter, or excluded from the questionnaire.

3.5 Criteria for participation

3.5.1 Inclusion criteria

All households with children in the age group 6-59 months were included.
For the questionnaire, mothers or caretakers of children in the age group 6-59 months was included. For anthropometric measurements of children, one child in the age group 6-59 months was randomly selected from each household. For anthropometric measurements of adult, only the child's biological mother was included.

3.5.2 Exclusion criteria

Households who didn't have children in the age group 6-59 months were excluded from the survey. Also households who were unwilling to participate or were not home during the time of survey were excluded. For anthropometric measurements, children in the age group 6-59 months who were severely handicapped were excluded. For anthropometric measurements of adult, everyone who was not the child's biological mother was excluded.

3.6 Data collection

3.6.1 Recruitment

Data collection was carried out between August and November 2010. Recruitment of participants was done in 4 areas in an urban poor area of Medan. All households were visited, but only households with children aged 6-59 months were invited to participate in the survey. All houses were visited systematically to find the houses with children aged 6-59 months. If a house was empty, the neighbors were asked if the household had children in the age group 6-59 months. The neighbors were also asked if they knew what time the family usually was home, so that we could revisit the house at a later occasion. The households that were empty and had children in the age group 6-59 months was registered as not home, after being revisited at least once. Data was collected from Monday to Friday every week, except for some public holidays. The researcher collected the data together with an interpreter and one assistant.

3.6.2 Interview

Before the interview, all potential participants were given information about the project and asked to sign a written informed consent form. Mothers were the primary participants, but when mother was not present the child's main caretaker was interviewed. The interpreter performed face-to face interviews with a structured questionnaire. The interviews took place in participants' homes and lasted for around 30 min. For each day 5-8 interviews were carried out.

3.6.3 Scoring system for knowledge about infant and child feeding

Mothers were asked about their opinion about various statements about breastfeeding and complementary feeding. Answers that corresponded with international recommendations were given 1 point, while answers that did not, were given -1 point. The sums were added up in the two categories, and each mother got one score for knowledge about breastfeeding and one score for knowledge about complementary feeding. For each category the sum was divided by maximum score and multiplied with 3, which is the number of rating categories. E.g. If a mother got 3 out of 5 correct answers about breastfeeding the calculation would look like this: (3:5) x3 = 1,8. The result from the calculation decided which category the mothers answers belonged in.

Results from 0-1 were graded as poor knowledge, results from 1-2 were graded as adequate knowledge and results from 2-3 were graded as good knowledge. In the example given the result was 1.8, and the mother would have been graded with adequate knowledge.

3.6.4 Selection of focus child

For the anthropometric measurements and the interview, one child from each household was selected as a focus child. If a household had more than one child between 6-59 months, a child was selected by random draw. The children were given numbers starting with 1 for the youngest 2 for the second youngest and so on. A small box containing numbers was used to randomly select a child. Eg. If there were 3 children in the household, the numbers 1 – 3 was added into the box. One person drew a number from the box and matched it with the child who had been given this number.

3.6.5 Anthropometric measurements

Recording age Age was recorded by asking the mother/caretaker about the child's birth date and age. When it was possible, the child's birth date was cross checked with the birth certificate. However, few caretakers could show us the child's birth certificate. Consequently, the recorded age was mostly based on the memory of their mother/caretaker. The age was measured to the nearest completed month. For example if a child was 5 months and 20 days, the age was recorded as 5 months.

Measuring weight The equipment used for measuring weight was: Uniscale Seca 877 Floor Scale with Mother-child-function. This scale can measure up to 150kg with a precision of 0.1 kg (100g). The scale had adjustable feet, so if the surface was uneven, the feet could be adjusted to make the scale straight. A window on the scale would show if the scale was level or not. In this window there was liquid and an air-bubble, and on top of the window there was a drawn circle. If the air-bubble was inside the circle this indicated that the scale was level, but if the air-bubble was outside the circle that the scale was not level and needed to be adjusted.

The weighing scale was put on a suitable flat, even hard surface away from direct sunlight. Children who were less than 2 years old, or unable to stand were weighed by tared weighing. First the mother was weighed. After the weight was recorded, the

mother was asked to remain standing on the scale. Then the scale was zeroed off, by pressing the tare button. When zero appeared in the display, the child was given to the mother and the weight of the child appeared in the display. The weight was recorded to the nearest 100g. Children above 2 years and the mothers were measured alone standing on the scale. Both mothers and children were measured with limited clothing and without shoes.

Measuring length The equipment used for measuring length was: Seca 210 mobile measuring mat from GYMO medical supply. This measuring mat has a fixed headpiece and an easy slide footpiece. The measuring range is 10-99 cm with a precision of 5mm. Length of children in the age 6 to 23 months was measured recumbent. A suited place with an even surface was chosen to put the measuring mat on. The baby's head was put against the head top of the measuring mat and the baby's legs was stretched out by pressing its knees down to the mat. The foot stop on the mat was then pushed up to the soles of the baby's heals, making it possible to record the body length to the nearest 0,5cm.

Measuring height The equipment used for measuring height was: KaWe Medizintechnik seit 1890 person-check height measurer from Gymno medical supply. The height measurer has a moveable headpiece and can measure up to 200 cm with a 1mm increment. The height measurer was fixed at the top of a 200cm long yardstick. Height of children in the age 24-59 month and all mothers was measured standing. The yardstick was put against a flat and steady surface. We made sure that heals, buttocks, shoulder blades and head was pressed against the yardstick, and that the shoulders were level with both hands at the side. When the position was right, the headpiece was pushed down until it reached the head. The measurement was recorded to the nearest 0,1 cm.

Adjustments of length/height In general, standing height is about 0.7 cm less than recumbent length. This difference was taken into account in developing the WHO growth standards used to make the charts in the Growth Record. Therefore if a child less than 2 years would not lie down for measurement of length, standing height was measured instead and added 0.7 cm to convert it into length. And if a child aged 2 years or older could not stand, recumbent length was measured and subtracted 0.7 cm to

convert it into height. (55)

Reliability of weighing scale

The weighing scale was cleaned and tested daily before onset to the field.

Procedure for testing the weighing scale: The researcher stepped on the scale and the tare button was pressed. When zero appeared in the display, known weights of 1 and 2 kg was added to check reliability of measures. The daily testing of the weighing scale showed that the equipment used was accurate and reliable.

3.6.6 Scoring system for anthropometric measurements of children

WHO growth standard During data collection, values of recorded age, length/height and weight was plotted in to the WHO growth chart in the appropriate sex and age group. The growth charts used for plotting was: WHO growth standards called z-scores boys and z-score girls for the age groups 6 months to 5 years. (56) During data entering, these values was cross checked by using the WHO anthropometric calculator version 3.2.2 (57)

Interpretation of results The anthropometric measurements were interpreted by the WHO growth standard. The z-score or the standard deviation unit (SD) indicated how far the measurement was from the median value. The cut-off values used was below -2 or -3 SD from the median value according to the WHO growth reference. Stunting was defined as length/height-for age z-score below -2SD and severely stunted as z-score below -3SD from the median height of the reference population. Wasting was defined as weight-for-height z-score below -2SD and severely wasted as z-score below -3 SD of reference population. Underweight was defined as z-score below -2SDand severely underweight as z-score below -3SD of reference population. (55)

Follow-up Children who were found to be severely wasted or severely underweight were advised to seek urgent specialized care for further investigation and follow up.

3.6.7 Scoring system for anthropometric measurements of mothers

Body mass index (BMI) The calculation of the mothers BMI was be done based on the following formula: BMI = kg/m^2

Calculations were performed by BMI calculator from WHO. (58) BMI of pregnant mothers' were not calculated.

Cut-off points for BMI

It has been indicated that some Asian populations have higher risk of diabetes and cardiovascular disease at lower BMI values, and Indonesia is one of the populations mentioned. Our main focus in this study is on child malnutrition, and we have therefore used the international BMI standard in our analysis. However, we have also presented numbers and frequencies from both the international and Asian standard.
International standard: < 16.0 kg/m^2 = severely underweight, 16.0 - 18.49 kg/m^2 = underweight, 18.5 – 24.9 kg/m^2 = normal weight, 25 – 29.9 kg/m^2 = overweight and >30 kg/m^2 = Obese
Asian standard: < 16.0 kg/m^2 = severely underweight, 16.0 - 18.49 kg/m^2 = underweight, 18,49 – 22.9 kg/m^2 = normal weight, 23.0 – 27.49 kg/m^2 = overweight, 27.5 kg/m^2 = obese. *(*59)

3.6.8 Response rate

The sample size was calculated to be 340 people without calculating for dropouts. After increasing the sample by 15% to include possible dropouts, the sample size was set at 391 people. 340/100 x 15 = 51 340+51 = 391

The estimated sample size was based on the prevalence of stunting on a national level in Indonesia in 2007, which was 37%. (25)
p=0.37 95% CI: (0.32 , 0.42) <=> SE(p) = 0.025.

In all 4 areas there were some houses we could not collect data from, because they were not home or did not want to participate. The total response rate was 81%.

Table 2. 1 Descriptive table of participation from all 4 areas

Areas	Interviewed	Not home	Don't want	Total number	Response rate
Area 9	71	10	12	93	76%
Area 10	148	15	14	177	84%
Area 11	143	16	11	170	84%
Area 14	43	8	7	58	74%
Total	**405** (81%)	**49** (10%)	**44** (9%)	**498** (100%)	**81%**

3.7 Data handling

3.7.1 Data entry

All data was entered into SPSS in the field by the researcher. After data entry, all numbers added into SPSS was checked again for errors. One person went through each questionnaire reading up the coded numbers out loud, while another person checked if the numbers were consistent with the numbers entered into SPSS.

3.7.2 Transforming Indonesian Rupia (IR) into American dollars (US$)

Regarding financial status, participants were asked about their monthly income and expenses. Their answers were in Indonesian Rupia (IR) and were transformed into American dollars (US$). Since currency is constantly changing, all amounts were converted into US$ in the same day using an online currency converter. (60)

3.7.3 Storing of data

During data collection, completed questionnaires were stored in folders in an office in Medan. After data entry, all completed questionnaires were scanned and stored in an external hard drive. The external hard drive was transported back to Norway and stored in the researchers home. The completed questionnaires in paper are still stored in an office in Medan and will be destroyed after the completion of the research in June 2011.

3.8 Statistical analysis

The statistical package used to analyze all our data was SPSS (PAWS)18 for MacOS.

3.8.1 Cleaning of data

The first step in the statistical analysis was cleaning the data set. Descriptive analysis was run to check for errors in all categorical and continuous variables. The output for each variable was checked for minimum and maximum values as well as valid and missing cases. Values that fell outside the range of possible values were cross checked with the numbers from the original questionnaire and corrected or recoded if necessary. Missing values were coded as discreet missing values in the data file, so they would not influence the output from the various statistical analysis performed. Only valid percentage was used in the presentations. We also assessed the normal distribution of

cases in the continuous variables by using explore. The output of the Kolmogorov-Smirdnow statistic was checked for significance (a non significant result indicated normality). Also, the output from the histogram, normal probability plots and boxplot was checked for confirming or disproving normal distribution of scores and to see if there were outliers. According to the analysis, none of our continuous variables had normal distribution. However, it has been suggested that in larger sample sizes (+30), unevenly distributed cases should not cause any major problems (61) We identified some outliers that interfered more than we liked with the mean value in some of the variables. These outliers were recoded into less extreme values. However, if the mean and trimmed mean values did not differ much, the outliers were retained as they were. (61) The consequence of recoding some of the variables was that the mean values became more accurate. However, it did not influence the grouping into categorical variables in any way.

The following four variables had outliers that were recoded:
Months of exclusive breastfeeding: Five cases had values between 9 –12, and they were all changed to 7.
Age in months introduced to food: Five cases had values of 12, and they were all changed to 7.
Number of meals per day: One case had the value 10 and was changed to 5.
Number of snacks per day: One case had the value 10 and was changed to 5.

3.8.2 Descriptive statistics

After our data set was cleaned, we run descriptive analysis to present numbers (n) and frequencies (%) of the categorical data. Continuous variables were presented as mean values and standard deviation (SD). For continuous variables where there was a big difference between the mean value and the trimmed mean, we presented median value with range instead of the mean value. Next step in our analysis was crosstabulation of categorical variables by using Chi-square test for independence. This test was used to explore the relationship between our outcome variable with all the other independent variables. For the association between the two variables to be significant, the Pearson Chi-Square test had to show a Sig. value of 0.05 or lower. (61) If less than 80% of the cells had expected count less than 5, Fishers Exact test was used to determine the significance level between the two variables. For continuous variables we used the

independent sample t-test to compare the mean difference between groups. For the continuous variables where there was a big difference between mean and trimmed mean, the Mann-Whitney U Test was used to compare median instead of mean values. The mean difference was determined to be significant if the tests showed a Sig. value of 0.05 or lower. We presented mean values with 95% confidence intervals (95%CI) and medina values with range. In all the descriptive analysis, missing values were excluded pairwise. This meant that all cases with necessary information were included for each analysis.

3.8.3 Logistic regression

Factors that were found to be significantly associated with our outcome variables in the Chi-Square test, were analyzed with univariate logistic regression analysis. This analysis gave an indicator on which variables significantly increased the odds of the outcomes. The next step was to do multiple logistic regression analysis for each of our 3 outcomes, to determine which of the variables had strongest influence on the outcomes. Before we completed the model for multiple regression, we checked the correlation between the variables we intended to include. if any of the variables we intended to use in our regression model had strong correlations. A correlation of 0.5 – 1.0 was regarded as strongly correlated (62) If variables were strongly correlated, only one of the variables were included in the multiple regression analysis. We found that household size and nr of children per mother was strongly correlated (0.58). Consequently, we chose to include only the variable “number of children per mother”. The correlation between mother and fathers education was borderline (0.46), so we chose to include both variables. The factors found significant in the crude analysis were included in the final multiple regression model. We were investigating 3 different outcomes (stunting, wasting, underweight) and had to create 3 models for the multiple logistic regression analysis. In the multiple logistic regression analysis, all cases were excluded listwise. Consequently, only cases with complete information on all variables included in the model were included. This led to a reduction in the number of cases, and 70-76% of the total sample size was analyzed.

3.9 Ethical considerations and approvals

3.9.1 Risks and benefits

Our main focus in this study was on children between 6-59 months and their mothers. The study area was a poor urban community, and some of the participants were unemployed, had limited or no education, had low income and limited resources. These are all factors defining vulnerable people according to the CHIOM`s guidelines. (63) As researchers we designed our study in a way that protected their rights welfare of the participants, by assessing the risks and the benefits before entering the field. The measurements taken were simple measurements of height and weight and did not pose any risk or possible harm to the children and our questionnaire did not include sensitive questions. The most important findings from our study will be given to the village leaders in the area in a written report. Also, the results of this study will be used by a local NGO to plan targeted and appropriate interventions that could benefit the community.

3.9.2 Informed consent

Participants of our study were given proper information about the study and asked to sign an informed consent form. Most often the translator informed the mothers orally about the project, but sometimes they also read through the written information on the informed consent form. Participation in our study was voluntary and the mothers were informed that they at any time during or after the interview could decide to withdraw their participation, without having to give any explanations for why. Since the children were to young to consent to participation their mothers gave consent to do anthropometric measurements on their childrens behalf.

3.9.3 Confidentiality

Participants were informed that the data we collected would be kept confidential. Each questionnaire was coded with a registration number instead of the participants name, and all data entered into the computer was entered under this number. The data collected was not possible to trace back to the participants by anyone else but the principal investigator and the assistants in the field. The completed questionnaires were stored in a locked office away from the research area.

3.9.4 Ethical approval

Our project received clearance from the Regional Committee for Medical and Health Research Ethics in South-East in June 2010. In addition, our project received a delayed approval by the Health Research Ethical Committee in North-Sumatra in May 2011.

3.10 Deviations from research protocol

3.10.1 Ethical approval

According to our research protocol, we were supposed to get ethical approval for our study from both Norway and Indonesia, before we started data collection. However, localizing the ethical committee in Indonesia was very difficult, and at first we were told that there was no existing ethical committees in Indonesia. We therefore decided to settle for the second best. Before entering a new area, we met with the village leader for the area to get approval. However, when we had already started to collect data, we finally got in contact with a person who could help us localize the ethical committee. Consequently, we applied to the ethical committee in Indonesia after we had started data collection, and the approval was not received until the 4th of may 2011.

3.10.2 Recruitment

According to the research protocol, the plan was to select the participants randomly or systematically by every second household, but this turned out to be difficult. Because of time limitation, it was not possible to map out the area to see which households had children in the age between 6 -59 months. In addition, only some houses had house numbers, so it was impossible to randomize based on that. In the beginning we were told that there were 700 households in the area. Based on that information we computerized 400 random numbers out of 700. The plan was to work through the area systematically while giving numbers to each house along the way. Then we would select houses according to the computerized random numbers. However, this method did not work well since we could not be sure that the randomly selected house had children in our target group 6-59 months. After only one day in the field, we realized that the best way to get a representative sample was to include all households who had children in the right age group.

3.10.3 Recording age

According to the research protocol, the plan was to ask the mothers about the child's age, and cross-check their answer by looking at the birth certificate. This turned out to be difficult. Many children did not have a birth certificate. Also, few of the mothers who said they had a birth certificate for the child, could show it to us. Most of the childrens recorded age is therefore based on the mother/caretakers memory.

3.10.4 Anthropometric measurements

According to the research protocol, the plan was that the anthropometric measurements of each mother and child would be measured twice by to different persons. This was to check reliability of measures. If the two measurements were vastly different from each other, they would be disregarded and a new pair of measurements would be taken. However, this procedure turned out to be difficult. Measuring children was many times a struggle and they needed to be persuaded into doing the measurements. Many times the mothers explained that the children had trauma from being vaccinated and that they probably associated the measuring with being vaccinated. Measuring height and length sometimes made the children very agitated. Double sets of measurements were for this reason disregarded. But, if some of the results were questionable or if there were reason to believe that the measurements were taken incorrectly, we repeated the measurements.

4. Results

4.1 Nutritional status of children aged 6-59 months

Table4.1. Stunting, wasting and underweight according to area

	Area 9	Area 10	Area 11	Area 14	Total	
	n (%)	n (%)	n (%)	n (%)	n (%)	95%CI
HAZ						
Severly stunted <-3SD	4 (5.6)	8 (5.4)	6 (4.2)	0 (0.0)	**18 (4.4)**	**±2.0**
Stunted <-2SD	15 (21.1)	28 (18.9)	23 (16.1)	4 (9.3)	**70 (17.3)**	**±3.7**
Normal height ≥-2SD	52 (73.2)	112 (75.7)	114 (79.7)	39 (90.7)	**317 (78.3)**	**±3.4**
WHZ						
Severly wasted <-3SD	3 (4.2)	4 (2.7)	4 (2.8)	0 (0.0)	**11 (2.7)**	**±1.6**
Wasted <-2SD	8 (11.3)	17 (11.5)	10 (7.0)	5 (11.6)	**40 (9.9)**	**±2.9**
Normal ≥-2SD	59 (83.1)	123 (83.1)	126 (88.1)	36 (83.7)	**344 (84.9)**	**±3.5**
Overweight ≥2SD	1 (1.4)	4 (2.7)	3 (2.1)	2 (4.7)	**10 (2.5)**	**±1.5**
WAZ						
Severely underweight<-3SD	2 (2.8)	8 (5.4)	4 (2.8)	0 (0.0)	**14 (3.5)**	**±1.8**
Underweight <-2SD	14 (19.7)	34 (23.0)	20 (14.0)	6 (14.0)	**74 (18.3)**	**±3.8**
Normal ≥-2SD – 2SD	55 (77.5)	106 (71.6)	119 (83.2)	37 (86.0)	**317 (78.3)**	**±3.4**
Total number	**71 (17.5)**	**148 (36.5)**	**143 (35.3)**	**43 (10.6)**	**405 (100.0)**	

Nutritional status Anthropometric measurements were taken from a total of 405 children in the age group 6 – 59 months. The mean HAZ was -1.13 (SD ± 1.16). Twenty-two percent of the children had HAZ <-2SD and were defined as stunted. The mean WHZ was - 0.77 (SD ±1.23). Thirteen percent of the children had a WHZ <-2SD and were defined as wasted. The mean WAZ was – 1.19 (SD ± 1.12). Twenty-two percent of the

children had a WAZ <-2SD and was defined as underweight. Of the children who was underweight, 8% were both stunted and wasted, 40% were stunted, 34% were wasted and 18% were neither wasted nor stunted

4.2 Characteristics of focus child

Table 4.2. Stunting, wasting and underweight according to characteristics of child

	Stunting			Wasting			Underweight			
	HAZ n(%)			WHZ n (%)			WAZ n (%)			Total
	<-2SD	>-2SD	p-value	<-2SD	>-2SD	p-value	<-2SD	>-2SD	p-value	n (%)
Age										
6 – 11 months	5 (10.2)	44 (89.8)		9 (18.4)	40 (81.6)		9 (18.4)	40 (81.6)		**49 (12.1)**
12 – 23 months	14 (13.9)	87 (86.1)		20 (19.8)	81 (80.2)		22 (21.8)	79 (78.2)		**101 (24.9)**
24 – 35 months	25 (27.5)	66 (72.5)		14 (15.4)	77 (84.6)		22 (24.2)	69 (75.8)		**91 (22.5)**
36 – 47 months	24 (25.3)	71 (74.7)		5 (5.3)	90 (94.7)		24 (25.3)	71 (74.7)		**95 (23.5)**
48 – 59 months	20 (29.0)	49 (71.0)	**0.017**	3 (4.3)	66 (95.7)	**0.003**	11 (15.9)	58 (84.1)	0.609	**69 (17.0)**
Sex										
Boy	47 (23.4)	154 (48.6)		32 (15.9)	169 (84.1)		40 (19.9)	161 (80.1)		**201 (49.6)**
Girl	41 (20.1)	163 (51.4)	0.423	19 (9.3)	185 (90.7)	**0.045**	48 (23.5)	156 (76.5)	0.376	**204 (50.4)**
Birth weight										
≥ 2500 grams	77 (20.3)	302 (96.8)		48 (12.7)	331 (87.3)		77 (20.3)	302 (79.7)		**379 (95.2)**
< 2500 grams	9 (47.4)	10 (52.6)	**0.009***	2 (10.5)	17 (89.5)	1.000*	9 (47.4)	10 (52.6)	**0.009***	**19 (4.8)**

*** Fishers exact test Total sample size: n = 405** Childs age: n = 405 Childs sex: n= 405 Childs birth weight: n = 398

Age The mean age of the children was 30.5 months (SD± 15.0). There was a significant association between childrens age and nutritional status. The prevalence of HAZ <-2 SD increased with increased age of the children, while the prevalence of WHZ <-2SD decreased with increased age of the children.

Sex The distribution of children was equal in both gender groups. However, boys had a significantly higher prevalence of WHZ <-2SD compared to the girls.

Birth weight Children with a birth weight below 2500g were defined as having low birth weight (LBW), and those with birth weight of 2500g or higher were defined as having normal birth weight. The mean birth weight was 3243g (SD± 503.1 Children with LBW had a significantly higher prevalence of HAZ- and WAZ- <-2SD compared to children with normal birthweight. The mean HAZ for children with LBW was -1.91 (SD± 1.1) compared to -1.09 (SD± 1.1) for children with normal birth weight. (p0.002) As much as 72% of the children with LBW was introduced to fluids other than breastmilk

during the first 0 – 2 months of life, compared to 51% of the children with normal birthweight. However, this finding was not statistically significant.

4.3 Socio – economic characteristics

Table 4.3. Stunting, wasting and underweight according to socio-economic factors

	Stunting n(%)			Wasting n(%)			Underweight n(%)			
	HAZ			WHZ			WAZ			Total
	<-2SD	>-2SD	p-value	<-2SD	>-2SD	p-value	<-2SD	>-2SD	p-value	n (%)
Maternal education										
Not finished	4 (80.0)	1 (20.0)					3 (60.0)	2 (40.0)		**5 (1.2)**
Primary school	13 (36.1)	23 (63.9)					11 (30.6)	25 (69.4)		**36 (8.9)**
Secondary school	24 (28.9)	59 (71.1)					15 (18.1)	68 (81.9)		**83 (20.5)**
High school	37 (19.0)	158 (81.0)					49 (25.1)	146 (74.9)		**195 (48.3)**
Grad.stud/university	10 (11.8)	75 (88.2)	**0.000**				9 (10.6)	76 (89.4)	**0.007**	**85 (21.0)**
Paternal education										
Not finished	1 (50.0)	1 (50.0)		0 (0.0)	2 (100.0)		0 (0.0)	2 (100.0)		**2 (0.5)**
Primary school	14 (43.8)	18 (56.3)		7 (21.9)	25 (78.1)		15 (46.9)	17 (53.1)		**32 (8.0)**
Secondary school	20 (26.0)	57 (74.0)		16 (20.8)	61 (79.2)		25 (32.5)	52 (67.5)		**77 (19.2)**
High school	47 (22.4)	163 (77.6)		25 (11.9)	185(88.1)		40 (19.0)	170 (81.0)		**210 (52.2)**
Grad. stud/university	5 (6.2)	76 (93.8)	**0.000**	3 (3.7)	78 (96.3)	**0.010**	7 (8.6)	74 (91.4)	**0.000**	**82 (20.1)**
Maternal occupation										
Housewife	68 (23.2)	225 (76.8)								**293 (72.9)**
Informal work	17 (29.3)	41(70.7)								**58 (14.4)**
Formal work	3 (5.9)	48 (94.1)	**0.007**							**51 (12.7)**
Nr of children										
1 – 2 children	45 (17.5)	212 (82.5)								**257 (63.5)**
3 – 4 children	30 (24.6)	92 (75.4)								**122 (30.1)**
≥ 5 children	13 (50.0)	13 (50.0)	**0.000**							**26 (6.4)**
Monthly income										
< 200$	68 (24.5)	209 (75.5)		45 (16.2)	232(83.8)		71 (25.6)	206 (74.4)		**277 (68.9)**
> 200$	19 (15.2)	106 (84.4)	**0.035**	6 (4.8)	119(95.2)	**0.001**	17 (13.6)	108 (86.4)	**0.007**	**125 (31.1)**
Observation of wall										
Bamboo	8 (57.1)	6 (42.9)					7 (50.0)	7 (50.0)		**14 (3.7)**
Wood	29 (26.9)	79 (73.1)					25 (23.1)	83 (76.9)		**108 (28.3)**
Bricks	45 (17.3)	215 (82.7)	**0.001**				50 (19.2)	210 (80.8)	**0.021**	**260 (68.1)**

Total sample size: n = 405 Maternal education: n=404 Paternal education: n =402 Maternal occupation: n =402 Nr of children: n = 405 Income: n =402 Observations of wall material: n = 382

4.3.1 Status of participant

Most of the participants (94.3%) were the focus childs biological mother. Within the group of caretakers, 5 (1.2%) were the childs grandmother and 8 (2.0%) was the childs father. The majority of the mothers (98%) were married or living together. Only 3 (0.7%) of the mothers were single and 2 (0.5%) were widowed.

4.3.2 Parental education

Maternal education Maternal education was significantly associated with income and housing. Of the mothers with high school or higher education, 37% had an income above 200$ the previous month, compared to 18% of the mothers with secondary or lower education (p.0.000). When comparing mothers with high school or higher with those having secondary school or lower, 74% versus 53% lived in brick houses, 23% versus 41% lived in wood houses and 3% versus 5% lived in bamboo houses (p0.000). Mothers with higher education were also more likely to be married to med with higher education. In the group of mothers with high school or higher education, 86% were married to men with high school or higher education compared to 42% of the mothers with secondary school or lower (p0.000).

Paternal education Paternal education was also significantly associated with income and housing. Thirty-nine percent of the fathers with high school or higher education had a household income above 200$ the previous month, compared to 11% of the fathers with only secondary school or lower (p.0.000). When comparing fathers with high school or higher education with those with secondary school or lower, 76% versus 49% lived in brick houses, 22% versus 43% lived in wooden houses and 2% versus 8% lived in bamboo houses (p0.000).

4.3.3 Parental occupation

Maternal occupation There was no significant association between maternal education and occupation and the majority of the mothers (73%) were housewives. Informal work encompassed, 2.5% garbage collectors, 1.5% seamstresses, 0.5% farmers and 10% shop owners. The formal work encompassed 3% governmental employees and 10% who worked in the private sector. Two of the mothers (0.5%) were students and 1 mother (0.2%) had passed away.

Paternal occupation There was a significant association between paternal education and occupation. When comparing fathers with high school or higher education with those with secondary school or lower, 14% compared to 27% were drivers, 79% compared to 66% were private or governmental employees and 7% had informal work

in both groups (p0.007). In general, the majority of the fathers (75%) were private or governmental employees and 18% were drivers. The group of fathers with informal work encompassed 17% drivers, 2.5% garbage collectors, 1% farmers and 3.5% shop owners. Three of the fathers (1%) were unemployed and 4 (1%) had passed away.

4.3.4 Household size

The mean number of living children pr mother was 2.3(SD± 1.29). The majority of the mothers (65%) had one only one child below the age of five. Thirty percent of the mothers had 2 children and 4% had 3 – 4 children under the age of five. The prevalence of children with HAZ <-2SD increased by increased number of children, see table 3. The mean nr of people per household was 4.54, SD± 1.49. In the households consisting of 2 – 3 people, 18% of the children had HAZ <-2SD compared to 19% in the households with 4-5 people and 31% in the households consisting of 6 or more people (p0.049).

4.3.5 Income

In general, the median income the previous month was $167.9 (Range: $16 – $1.120). In households where the child had HAZ <-2SD the median income was $134 (Range: $17 - $1120) compared to $168 (Range: $17 – $1.120) in households where the child had HAZ > -2SD (p 0.048) In households where the child had WHZ <-2SD the median income was $112 (Range: $17 - $336) compared to $168 (Range: $17 – $1.120) in households where the child had WHZ > -2SD (p 0.002) In households where the child had WAZ <-2SD the median income per month was $134 (Range: $17 – $896) compared to $168 (Range: $45 – $1120) in the household where the child had WAZ >-2SD. (p0.010)

4.3.6 Environmental characteristics

Only 14 families (4%) lived in bamboo houses, 108 (27%) lived in houses made of wood, while as much as 260 (64%) lived in brick houses. All households with bamboo walls had a monthly income below $200 compared to 89% of the houses with wood walls and 59% of the houses with brick walls (p0.000).Twelve percent of the households had a private tap as their main source of drinking water, 16% used an open well in the yard and 73% purchased bottle water. Of the households who had a private tap, 98% boiled the drinking water before use, while in the households with open well, 94% reported that they boiled the drinking water. The majority of the households used pour flushed

toilet and 93% had a private one in their home while 5% shared with other households. Only 6 households (2%) used pit latrine and half of them had a shared latrine with other households.

4.4 Dietary practices

4.4.1 Breastfeeding

Ninety-two percent of the mothers reported that they had ever breastfed their children. Fourty-six percent stated that they had initiated breastfeeding immediately or within one hour after birth and 70% had initiated it within the first day. Five percent of the mothers said that they disposed the colostrum. Seventy-six (21.5%) of the children were currently breastfeeding.

Table 4.4. Breastfeeding practices

	Mean ± SD	Total n (%)
Age initiating fluids	**3.0 ± 2.7**	
0 – 2 months		197 (52.5)
3 – 5 months		106 (28.3)
≥ 6 months		72 (19.2)
Age initiating food	**4.5 ± 2.3**	
0 – 5 months		209 (54.7)
6 months		136 (35.6)
≥ 7 months		37 (9.7)
Exclusively breastfed	**2.6 ± 2.2**	
6 months		56 (14.9)
4 months		54 (14.4)
< 4months		265 (70.7)
Age stop breastfeeding	**13.8 ± 8.7**	
0 – 5 months		61 (22.0)
6 – 11 months		47 (17.0)
12 – 23 months		101 (36.5)
≥ 24 months		68 (24.5)

Reason for ceasing breastfeeding The main reasons mothers gave for ceasing breastfeeding before the children were 6 months were: Had problems with breastfeeding (44%), the child did not want to breastfeed any more (33%), breastfeeding was inconvenient (13%) and mother or child was sick (9%).

Exclusive breastfeeding The mothers were not asked directly about exclusively breastfeeding, but asked at what time they initiated fluids and food besides breast milk. The highest combination of months that the child had not been introduced to fluids or

food was defined as the duration of exclusive breastfeeding. There was found no significant differences in childrens nutritional status associated with the practice of exclusive breastfeeding.

4.4.2 Complementary feeding

Initiation of fluids The most commonly fluids initially introduced to the children were water (99.5%) and formula milk (76.5%). Only 5% introduced animal milk to the child, 41% introduced tea, 25% juice and 26% sugar water. In the group of children who were introduced to tea, 18% had a WHZ <-2SD compared to 10% in the group who was not given tea (p0.025). Also, in the group of children who was introduced to tea, 29% had WAZ <-2SD compared to 18% in the group of children who was not given tea (p0.014).

Initiation of food In the group of children who received food before the age of 6 months, 23 % had HAZ <-2SD, compared to 16% in the group of children who received food at 6 months, and 38% in the group of children who did not receive food until they were 7 months or older 38% (p0.016).

Number of meals per day The majority of the children (77%) had 3 meals per day. Eighteen percent had 1-2 meals and only 5% had 4 or more meals per day. The mean number of meals per day was 2.9 (SD± 0.5). We did not identify any significant association between number of meals pr day and children's nutritional status.

Table 4.5. Number of meals per day according to breastfeeding status

	Currently breastfeeding n= 76 (21. 5) n (%)				Are not currently breastfeeding n= 277 (78.5) n (%)			
Childs age	1-2 meals	3 meals	≥ 4 meals	Mean ± SD	1-2 meals	3 meals	≥ 4 meals	Mean ± SD
6 – 8 months	11 (84.6)	2 (15.4)	0 (0.0)	2.1 ± 0.4	1 (50.0)	1 (50.0)	0 (0.0)	2.5 ± 0.7
9 – 11 months	9 (52.9)	8 (47.1)	0 (0.0)	2.4 ± 0.6	4 (36.4)	6 (54.5)	1 (9.1)	2.8 ± 0.9
12 – 23 months	11 (29.7)	25 (59.5)	1 (2.7)	2.7 ± 0.5	3 (6.0)	45 (90.0)	2 (4.0)	3.0 ± 0.3
24 – 59 months	1 (11.1)	7 (77.8)	1 (11.1)	3.0 ± 0.5	29 (13.0)	171 (79.9)	14 (6.5)	2.9 ± 0.5
Total	**32 (42.1)**	**42 (55.3)**	**2 (2.6)**		**37 (13.4)**	**223 (80.5)**	**17 (6.1)**	

Number of snacks per day The majority of the children (61%) had 2-3 snacks per day. Twenty-one percent had 0-1 snacks and 18% had 4 or more snacks per day. The mean number of snacks per child per day was 2.6 (SD± 1.3) There was a significant association between the number of snacks consumed per day and children's nutritional status. In

the group of children who had 0-1 snacks pr day 12% had HAZ <-2SD compared to 21% in the group who had 2-3 snacks and 38% in the group who had 4 or more snacks (p0.000). There was also a significant association between maternal educational level and number of snacks consumed by the children per day. When comparing mothers with high school or higher education with those having secondary school or lower, 24% versus 14% fed 1-2 snacks, 61% versus 60% fed 2-3 snacks and 14% versus 26% fed 4 or more snacks to their children every day (p0.006).

Table 4.6. Number of snacks per day according to breastfeeding status

	Currently breastfeeding n (%)				Are not currently breastfed n (%)			
Childs age	**0-1 snacks**	**2-3 snacks**	**≥ 4 snacks**	**Mean ± SD**	**0-1 snacks**	**2-3 snacks**	**≥ 4 snacks**	**Mean ± SD**
6 – 8 months	7 (53.8)	5 (38.5)	1 (7.7)	1.7 ± 1.4	2 (100.0)	0 (0.0)	0 (0.0)	1.0 ± 0.0
9 – 11 months	8 (47.1)	9 (52.9)	0 (0.0)	1.6 ± 0.6	3 (27.3)	6 (54.5)	2 (18.2)	2.3 ± 1.3
12 – 23 months	9 (24.3)	21 (56.8)	7 (18.9)	2.5 ± 1.2	11 (22.0)	34 (68.0)	5 (10.0)	2.3 ± 1.0
24 – 59 months	2 (22.2)	4 (44.4)	3 (33.3)	2.7 ± 1.6	30 (14.0)	142 (66.4)	42 (19.6)	2.8 ± 1.3
Total n (%)	**26 (34.2)**	**39 (51.3)**	**11 (14.5)**		**46 (16.6)**	**182 (65.7)**	**49 (17.7)**	

4.4.3 Food frequency

Food consumed during the last 24 hours The mothers were asked if the focus child within the last 24 hours had eaten any of the items from the food-groups described in table 7. Of the group of children that had consumed milk or milk products within the last 24 hours 17% had HAZ<-2SD compared 27% in the group of children who had not consumed any milk or milk products (p0.036). Of the children who had consumed carrot, pumpkin or other items from that group, 15% had WHZ<-2SD compared to 6% in the group that did not eat any of those foods (p0.009). In the group of children who had eaten other fruit or vegetables besides those listed in table 5, eight percent had WHZ <-2SD compared to 19% in the group of children who had not eaten any other fruit or vegetables (p0.001). Of the children who had consumed items from the group with sugary food, 10% had WHZ <-2SD compared to 21% in the group of children who hat not eaten any items from that group (p0.023).

Table 4.7. Food frequency table of children aged 6 – 59 months

Children 6 – 59 months	Eaten within last 24 hours	Eat every day	Eat every week	Eat monthly or never
	n (%)	n (%)	n (%)	n (%)
Food made of grains: Rice, noodles, porridge				
6 – 8 months	16 (100.0)	16 (100.0)	0 (0.0)	0 (0.0)
9 – 11 months	28 (100.0)	33 (100.0)	3 (0.7)	0 (0.0)
12 – 23 months	91 (100.0)	100 (99.0)	1 (1.0)	0 (0.0)
24 – 59 months	220 (100.0)	253 (99.2)	2 (0.8)	0 (0.0)
Total 6 – 59 months	355 (100.0)	402 (99.3)	3 (0.7)	0 (0.0)
Carrot, pumpkin, yellow/orange sweet potato				
6 – 8 months	9 (56.3)	9 (56.3)	4 (25.0)	3 (18.8)
9 – 11 months	22 (78.6)	20 (60.6)	11 (33.3)	2 (6.1)
12 – 23 months	61 (67.8)	55 (54.5)	42 (41.6)	4 (4.0)
24 – 59 months	127 (57.7)	100 (39.2)	135 (52.9)	20 (7.8)
Total 6 – 59 months	219 (61.9)	184 (45.4)	192 (47.4)	29 (7.2)
Mango, papaya, tomato, paprika				
6 – 8 months	2 (12.5)	1 (6.3)	7 (43.8)	8 (50.0)
9 – 11 months	14 (50.0)	10 (30.3)	12 (36.4)	11 (33.3)
12 – 23 months	49 (53.8)	25 (24.8)	43 (42.6)	33 (32.7)
24 – 59 months	101 (45.9)	72 (28.2)	127 (49.8)	56 (22.0)
Total 6 – 59 months	166 (46.8)	108 (26.7)	189 (46.7)	108 (26.7)
Food from roots: Cassava, white potato/yam				
6 – 8 months	0 (0.0)	0 (0.0)	0 (0.0)	16 (100.0)
9 – 11 months	2 (7.1)	0 (0.0)	9 (27.3)	24 (72.7)
12 – 23 months	12 (13.2)	1 (1.0)	24 (23.8)	76 (75.2)
24 – 59 months	27 (12.3)	6 (2.4)	73 (28.6)	176 (69.0)
Total 6 – 59 months	41 (11.5)	7 (1.7)	106 (26.2)	292 (72.1)
Dark green vegetables: broccoli, spinach, cassava leafs				
6 – 8 months	6 (37.5)	4 (25.0)	7 (43.8)	5 (31.3)
9 – 11 months	17 (60.7)	17 (51.5)	9 (27.3)	7 (21.2)
12 – 23 months	59 (64.8)	46 (45.5)	44 (43.6)	11 (10.9)
24 – 59 months	148 (67.3)	120 (47.1)	91 (35.7)	44 (17.3)
Total 6 – 59 months	230 (64.8)	187 (46.2)	151 (37.3)	67 (16.5)
Other fruits or vegetables				
6 – 8 months	11 (68.8)	3 (18.8)	10 (62.5)	3 (18.8)
9 – 11 months	12 (44.4)	2 (6.3)	27 (84.4)	3 (9.4)
12 – 23 months	59 (64.8)	28 (27.7)	63 (63.6)	8 (8.1)
24 – 59 months	145 (66.2)	78 (30.7)	159 (62.6)	17 (6.7)
Total 6 – 59 months	227 (64.3)	111 (27.7)	259 (64.6)	31 (7.7)
Organ/blood based food: Liver, kidney, heart				
6 – 8 months	1 (6.3)	0 (0.0)	1 (6.3)	15 (93.8)
9 – 11 months	2 (7.1)	0 (0.0)	8 (24.2)	25 (75.8)
12 – 23 months	6 (6.6)	0 (0.0)	22 (21.8)	79 (78.2)
24 – 59 months	13 (5.9)	2 (0.8)	41 (16.1)	212 (83.1)
Total 6 – 59 months	22 (6.2)	2 (0.5)	72 (17.8)	331 (81.7)

Table 4.7. Cont. Food frequency of children aged 6 – 59 months

Children 6 – 59 months	Eaten within last 24 hours	Eat every day	Eat every week	Eat monthly or never
	n (%)	n (%)	n (%)	n (%)
Any meat: Beef, lamb, goat, chicken, (pork)				
6 – 8 months	0 (0.0)	0 (0.0)	3 (18.8)	13 (81.3)
9 – 11 months	8 (28.6)	0 (0.0)	13 (39.4)	20 (60.6)
12 – 23 months	21 (23.3)	6 (6.0)	36 (36.0)	58 (58.0)
24 – 59 months	70 (31.8)	13 (5.1)	159 (62.4)	83 (32.5)
Total 6 – 59 months	99 (28.0)	19 (4.7)	211 (52.2)	174 (43.1)
Eggs				
6 – 8 months	8 (50.0)	2 (12.5)	10 (62.5)	4 (25.0)
9 – 11 months	13 (46.4)	8 (24.2)	21 (63.6)	4 (12.1)
12 – 23 months	61 (67.0)	43 (42.6)	51 (50.5)	7 (6.9)
24 – 59 months	172 (78.2)	135 (52.9)	108 (42.4)	12 (4.7)
Total 6 – 59 months	254 (71.5)	188 (46.4)	190 (46.9)	27 (6.7)
Seafood: Fresh or dried fish, shellfish				
6 – 8 months	4 (25.0)	3 (18.8)	5 (31.3)	8 (50.0)
9 – 11 months	18 (64.3)	12 (36.4)	15 (45.5)	6 (18.2)
12 – 23 months	71 (78.0)	63 (62.4)	30 (29.7)	8 (7.9)
24 – 59 months	189 (85.9)	181 (71.0)	65 (25.5)	9 (3.5)
Total 6 – 59 months	282 (79.4)	259 (64.0)	115 (28.4)	31 (7.7)
Food made from beans, peas, lentils, nuts, seeds				
6 – 8 months	4 (25.0)	1 (6.3)	6 (37.5)	9 (56.3)
9 – 11 months	13 (46.4)	10 (30.3)	10 (30.3)	13 (39.4)
12 – 23 months	51 (56.0)	33 (32.7)	53 (52.5)	15 (14.9)
24 – 59 months	150 (68.2)	105 (41.2)	117 (45.9)	33 (12.9)
Total 6 – 59 months	218 (61.4)	149 (36.8)	186 (45.9)	70 (17.3)
Milk, cheese, yoghurt or other milk products				
6 – 8 months	11 (68.8)	0 (0.0)	11 (68.8)	5 (31.3)
9 – 11 months	23 (82.1)	25 (75.8)	1 (3.0)	7 (21.2)
12 – 23 months	71 (78.0)	76 (75.2)	2 (2.0)	23 (22.8)
24 – 59 months	143 (65.0)	145 (56.9)	32 (12.5)	78 (30.6)
Total 6 – 59 months	248 (69.9)	257 (63.5)	35 (8.6)	113 (27.9)
Any oils, fats, butter				
6 – 8 months	16 (100.0)	16 (100.0)	0 (0.0)	0 (0.0)
9 – 11 months	28 (100.0)	33 (100.0)	0 (0.0)	0 (0.0)
12 – 23 months	89 (97.8)	97 (96.0)	4 (4.0)	0 (0.0)
24 – 59 months	219 (99.5)	252 (98.8)	3 (1.2)	0 (0.0)
Total 6 – 59 months	352 (99.2)	398 (98.3)	7 (1.7)	0 (0.0)
Sugary food: Chocolates, sweets, cakes, biscuits				
6 – 8 months	12 (75.0)	8 (50.0)	6 (37.5)	2 (12.5)
9 – 11 months	23 (82.1)	23 (69.7)	7 (21.2)	3 (9.1)
12 – 23 months	69 (75.8)	192 (75.3)	54 (21.2)	9 (3.5)
24 – 59 months	198 (90.0)	192 (75.3)	54 (21.2)	9 (3.5)
Total 6 – 59 months	302 (85.1)	283 (69.9)	101 (24.9)	21 (5.2)

Food frequency In the group of children who consumed milk or milk products daily, 16% had HAZ <-2SD compared to 37% in the group of children who consumed it every week and 29% in the group of children who consumed it monthly or never (p0.002). A similar association was found when looking at weight-for age z-scores. In the group of children who consumed milk or milk products daily, 18% had WAZ <-2SD compared to

31% in the group who consumed it every week and 28% in the group who consumed it every month or never. In the group of children who consumed sweets or sugary food daily, 11% had WHZ <-2SD compared to 20% in the group of children who consumed it every week and 5% in the group of children who consumed it every month or never (p0.031). In the group of children who consumed other fruit or vegetables daily, 23% had WAZ<-2SD compared to 19% in the group of children who consumed it every week and 42% in the group of children who consumed it every month or never (p0.010).

4.4.4 Maternal knowledge about infant and child feeding

Knowledge about breastfeeding The mothers were given some statements about breastfeeding and asked if they agreed or disagreed. The first statement was: *"Children need other food or drinks besides breast milk the first 6 months of life"*. Only 15% of the mothers disagreed with the statement, and in that group 5% of the children had WHZ <-2SD compared to 15% in the group of mothers who agreed with the statement (p0.047). There was a significant association between knowledge and practice of exclusive breastfeeding. Twenty-nine percent of the mothers who disagreed with the statement, practiced exclusive breastfeeding compared to 13% of the mothers who agreed (p0.002). The second statement was: *"Formula milk is better than breast milk"* and 79% of the mothers disagreed with this statement. The third statement was: *"Breastfeeding protects the child against infections"* and 95% of the mothers agreed with this statement and 0.5% were unsure. The final statement was: "Children should breastfeed on demand until 2 years or beyond". Ninety-tree percent of the mothers agreed with this statement. However, the reported practice was that merely 25% of the mothers who agreed with this statement had practiced breastfeeding for 2 years or beyond and in the group of mothers who disagreed 16% had practiced breastfeeding for 2 years or longer. In the group of mothers who agreed with the statement, 21% of the children had HAZ <-2SD, compared to 39% in the group of mothers who disagreed (p0.040).

The overall knowledge score was: 26% had poor knowledge, 61% had adequate knowledge and 13% had good knowledge. There was a significant association between knowledge of breastfeeding and the practice of exclusive breastfeeding. Only 9% of the mothers with poor knowledge practiced exclusive breastfeeding compared to 15% in the group with adequate knowledge and 30% in the group with good knowledge

(p0.004). The knowledge score was found to be significantly different in areas, between mothers' educational level and in different socio-economic groups, see table 4.

Table 4.8 - Knowledge score about breastfeeding and associated factors

	Poor	Adequate	Good	Total	
	n %	n %	n %	n %	p-value
Area (n=405)					
9	28 (40.6)	33 (47.8)	8 (11.6)	**69 (18.1)**	
10	23 (16.7)	94 (68.1)	21 (15.2)	**138 (36.1)**	
11	44 (32.4)	78 (57.4)	14 (10.3)	**136(35.6)**	
14	6 (15.4)	28 (71.8)	5 (12.8)	**39 (10.2)**	**0.004**
Mothers education (n=404)					
Not completed	4 (100.0)	0 (0.0)	0 (0.0)	**4 (1.0)**	
Primary/secondary school	34 (29.6)	71 (61.7)	10 (8.7)	**115 (30.2)**	
High school/university	63 (24.0)	161 (61.5)	38 (14.5)	**262 (68.8)**	**0.006**
Monthly income (n=402)					
<200$	79 (29.8)	161 (60.8)	25 (9.4)	**265 (69.4)**	
>200$	22 (18.8)	72 (61.5)	23 (19.7)	**117 (30.6)**	**0.005**

Knowledge about complementary feeding The others were asked if they agreed or disagreed with some statements about complementary feeding. The first statement was: *"Children should not eat meat until they are 2-3 years."* Sixteen percent of the mothers agreed with this statement. Of the mothers who agreed with the statement 32% of the children had WAZ <-2SD compared to 20% in the group of mothers who disagreed with the statement (p0.026). The mothers opinion about the statement, were associated with their age and socio-economic status. In the group of mothers below 30 years 20% agreed with the statement compared to 11% of the mothers above 30 years (p0.019). Of the mothers who had not completed any education, 60% agreed with the statement compared to 19% of those who had completed primary and secondary school and 14% of those with completed high school or university studies (p0.016). In the group of mothers with income below 200$ a month, 19% agreed with the statement compared to 10% in the group with income above 200$ (p0.023). The next two statement was: *"Children have small stomachs and therefore need smaller servings with food rich in energy", and "Children should not start with food in addition to breast milk before they are 6 months".* Forty-four percent and 55% of the mothers agreed with these statements, but there was found no association between their answers and the children's nutritional status. The last statements was: *"By 12 months most children can eat the same types of food as consumed by the rest of the family"*. Seventy-four percent of the mothers agreed with this statement, but among those 25% of the children had HAZ<-2SD compared to

13% in the group of mothers who disagreed with the statement (p0.011). Overall, 47% of the mothers had poor knowledge about complementary feeding, 40% had adequate knowledge and 14% had good knowledge. There was found no significant association between the mothers overall knowledge score on complementary feeding and their children's nutritional status.

4.5 Disease

4.5.1 Acute watery diarrhea

General management Acute watery diarrhea was defined as a passage of 3 or more abnormally loose or watery stools without blood in 24 hours. The mothers were asked general questions about how they usually treated acute watery diarrhea in their children. None of the mothers stopped giving fluids, 11% said they gave less fluid, 9% gave the same amount and 80% gave more fluids than usual during episodes of diarrhea. None of the mothers stopped giving food, 55% said that they gave less food than usual, 18% gave same amount and 27% gave more food than usual during episodes of diarrhea. Of the mothers who gave more food than usual during episodes of diarrhea 35% of their children had HAZ <-2SD compared to 18% in the group who gave same amount of food and 17% in the group who gave less food than usual (p0.001). As much as 83% of the mothers reported that they used antibiotics to treat acute watery diarrhea in their children, 41% used herbal/traditional medicine, 51% gave food based fluids like rice water or soup, 68% used ORS and 3% said that they used zinc supplements. Ten of the mothers (2.5%) reported that their children had never had diarrhea, 4 mothers (1%) said that they used a drug called Entronstop and one of the mothers (0.2%) used massage to treat diarrhea. In the group of mothers who used herbal medicine to treat diarrhea, 19% of the children had WHZ <-2SD compared to 8% in the group of mothers who did not use this treatment (p0.002).

Oral-rehydration-solutions (ORS) Fifty percent of the mothers reported that they had used ORS package to treat diarrhea, 19% had used homemade ORS and 31% had never used ORS. Of the 70% who had used ORS 2% had never used it on the focus child. The most common reason for not using ORS was that the child had never had diarrhea or diarrhea had never been so severe, and as much 72% listed this as the most important reason. Eleven percent stated that they did not think it will help, 5% said they used herbal/traditional medicine instead and 3% had never heard about ORS. Nine percent of

the mothers mentioned other reasons for not using ORS: It was not available in the community, they used "Entronstop" or antibiotics instead, they were worried about the effect or the child did not want to drink it. The mothers who had used ORS were asked how they administered it. Fifty-six percent said that they gave frequent sips from onset of diarrhea until diarrhea stopped, 41% gave it once in a while the first day of diarrhea, 2% gave a couple of tea spoons a day and 1% said they tried to give small sips at onset of diarrhea but the child did not want to take it. There was found no significant association between the use of ORS and the childrens nutritional status.

Zinc supplements Only 3% of the mothers reported that they had ever used zinc supplements to treat diarrhea and all of them said that they had used it on the focus child. The most common reason mentioned for not using Zinc was that they had never heard about it, which was mentioned by 68% of the mothers. Twenty percent said that the reason for not using it was that their child had never had diarrhea or diarrhea had never been so severe, 8% did not think it would help and 1% said they used herbal medicine instead. Three percent of the mothers mentioned other reasons for not using Zinc. The reasons mentioned was that it was too expensive , not available in the community, they used antibiotics instead or that they were worried about the effect. The mothers who had used Zinc to treat diarrhea were asked how they administered it. Fifty-eight percent said they gave it several times a day from onset of diarrhea until it stopped, 33% gave it once the first day of diarrhea and 8% gave it once a day from onset of diarrhea until it stopped. There was found no significant association between the use of Zinc supplements and children's nutritional status

4.5.2 Symptoms of illness within 2 weeks prior to interview

Table 4.9. Symptoms of illness within 2 weeks prior to or during interview

Symptoms	n (%)
Acute watery diarrhea	93 (23.0)
Diarrhea with bloody stools	5 (1.2)
Vomiting	60 (14.8)
Fever	161 (39.8)
Severe cough	212 (52.3)
Tiredness/fatigue	193 (47.7)
Other symptoms of illness	9 (2.2)
No symptoms of illness	88 (21.7)
Still have symptoms	131 (41.3)
Total number	**405 (100.0)**

Acute watery diarrhea Of the children who had suffered from acute watery diarrhea within the last two weeks, 19% had WHZ <-2SD. In the group of children who had WHZ <-2SD, 33% had suffered from acute watery diarrhea within the last two weeks compared to 20% of the children with WHZ >-2SD (p0.032). Fifty-eight percent of the mothers who had had children with acute watery diarrhea sought help or advice to manage the diarrhea. Eighty percent went to a public health facility, 14% went to the pharmacy, 4% went to a traditional practitioner and 2% went to a local shop for help. None of the children were treated with intravenous fluid and only one (2%) was treated with intravenous antibiotics. However, as much as 88% were treated with antibiotic pill or syrup, 8% were given traditional medicine, 43% were given ORS and 8% were given Zinc. One of the mothers (2%) reported that she used Paracetamol to treat the diarrhea. Fourteen percent of the mothers gave the child less fluid during diarrhea, 31% gave same amount and 51% gave more and 19% gave much more than usual. Two percent of the mothers said that they gave less food during diarrhea, 36% gave somewhat less, 28% gave same amount and 19% gave more food than usual.

Diarrhea with bloody stools Only 5 mothers reported that their children had had diarrhea with bloody stools during the last two weeks prior to interview. Of these mothers all of them (100%) sought help or advice for diarrhea management at a public health facility. None of the children were treated with intravenous fluid or antibiotics. However, all of them were given antibiotic pill or syrup, 80% were given ORS, 40% were given Zinc. None of the children were given traditional medicine. Two of the children (40%) still had the symptoms during the time of interviewing. Forty percent of the mothers said that they gave somewhat less fluid than usual, 20% gave more and 40% gave much more than usual. Eighty percent of the mothers reported that they gave somewhat less food while 20% said that they gave much more food than usual. There was found no significant differences in nutritional status associated with the management of acute watery diarrhea or diarrhea with bloody stools.

Fever Of the children who had had fever within last 2 weeks, 18% had WHZ <-2SD. In the group of children with WHZ <-2SD 57% had had fever compared to 37% in the group of children with WHZ >-2SD (p0.008).

Other symptoms of illness In the category "other symptoms", the symptom mentioned by the 9 mothers was the flu, and when asked about what that meant to them, they explained that it was a cold with a runny nose and sometimes cough but the child did not have fever and the cough was not severe.

Symptoms of illness associated with hygiene and environmental factors Of the children who had suffered from diarrhea with bloody stools, 80% had tap or well as their main source of drinking water while 20% used purchased water bottles. In households who had tap or well as main water source for drinking water, 3.6% of the children had had diarrhea with bloody stools during last two weeks compared to 0.3% in the households with purchased bottle water (p0.021*). In the group of caretakers who did not practice handwashing after preparing food, 42% of the children had had acute watery diarrhea during last two weeks compared to 22% in the group who practiced handwashing (p0.025). In the group of caretakers who did not practice handwashing before preparing food, 86% of the children had had symptoms of illness during last two weeks compared to 76% in the group who practiced handwashing (p0.049). In the group of caretakers who always washed the childs hands before eating, 11% of the children had WHZ <-2SD compared to 19% in the group where caretakers sometimes washed the childs hands before eating (p0.027) *Fishers exact test

4.6 Health care services

4.6.1 Vaccination

The mothers were asked about the vaccination history of their children and the vaccines of interest were: BCG, Polio, DPT and Measles.

Vaccination card Only 22% of the mothers could show us the child's vaccination card, 75% that said they had a vaccination card but could not show it and 3% said they did not have any. In the group where vaccination card was seen, 10% of the children had HAZ <-2SD compared to 25% in the group where vaccination card was not seen (p0.002). More of the mothers (28%) below 30 years had vaccination cards for their children compared to the mothers (19%) over 30 years (p0.024).

Vaccination status Three percent of the children had not been vaccinated, 74% were partly vaccinated and 23% were fully vaccinated. In the group of children who had been fully vaccinated, 14% had HAZ <-2SD compared to 25% in the group of children who had not been fully vaccinated (p0.037). A similar association was found where 14% of the children who vas fully vaccinated had WAZ <-2SD compared to 25% of the children who was not fully vaccinated (p0.042).

4.6.2 Vitamin A supplements

The mothers were also asked it the child had received vitamin A supplements during last 6 months prior to interview. Whether the child had received vitamin A supplements or not, seemed to have a significant association with their nutritional status. In the group of children that had received it, 26% had HAZ <-2SD compared to 16% in the group of children that had not received it (p0.027). Also, in the group of children who had received it, 16% had WHZ <-2SD compared to 8% in the group of children who had not received it (p0.013). In addition 25% of the children who had received it had WAZ <-2SD compared to 16% of the children who had not received it (p0.048).

4.7 Maternal anthropometry

Table 4.10. Maternal anthropometry and nutritional status of children

Anthropometry of mother (n)	Stunting n (%)			Wasting n (%)			Underweight n (%)			Total n %
	HAZ <-2SD	HAZ >-2SD	p-value	WHZ <-2SD	WHZ >-2SD	p-value	WAZ <-2SD	WAZ >-2SD	p-value	
Maternal height (364)										
< 150 cm	42 (31.8)	90 (68.2)					40 (30.3)	92 (69.7)		**132 (36.3)**
≥ 150 cm	38 (16.4)	194 (83.6)	**0.001**				44 (19.0)	188 (81.0)	**0.019**	**232 (63.7)**
Maternal BMI (350)										
< 18.5				8 (32.0)	17 (68.0)		12 (48.0)	13 (52.0)		**25 (7.1)**
18.5 – 24.9				22 (12.5)	154 (87.5)		42 (23.9)	134 (76.1)		**176 (50.3)**
≥ 25.0				16 (10.7)	133 (89.3)	**0.014**	26 (17.4)	123 (82.6)	**0.003**	**149 (42.6)**

4.7.1 Maternal height and weight

The mean height of the mothers was 151.8cm SD±5.3 (range 134.2-166.8). The mean weight of mothers was 56.3 SD±4.3 (range 31.3-88.5). There was a significant association between maternal height and childrens nutritional status, se table 6.

4.7.2 Maternal BMI

The mean BMI according the WHO's international standard was 24.4 SD±4.4 (range 15-38). Seven percent of the mothers had BMI< 18.5 and were defined as underweight, 50% had normal BMI between 18.5-24.9 and as much as 43% of the mothers had BMI above 25 and were defined as overweight. Of the 43% mothers who were overweight 11% had BMI above 30 and were defined as obese. (If the asian standard of BMI is applied 7% of the mothers were underweight, 31% had normal weight and 62% were overweight. Of the 62% overweight 22% were obese). Differences in mothers BMI was associated with age, income and household size and. Differences in BMI was significant in the groups of overweight and underweight, while insignificant in the group with normal weight. In the group of mothers below 30 years 11% were underweight and 38% were overweight compared to 5% and 47% in the group of mothers above 30 years (p0.050). Nine percent of the mothers with a monthly income below 200$ were underweight and 40% overweight compared to 2% and 48% in the group of mothers with income above 200$ (p0.030). In housholds with less than 5 people 11% of the mothers were underweight and 38% overweight compared to 3% and 48% in households with 5 or more people (p0.007). There was also a significant association between mothers BMI and childrens nutritional status, se table 6.

4.8 Logistic regression analysis

Table 4.11. Socio-economic predictors of stunting, wasting and underweight

		Stunting HAZ <-2SD		Wasting WHZ <-2SD		Underweight WAZ <-2SD	
Variables (n)	**n (%)**	**Crude OR (95%CI)**	**Adjusted OR (95% CI)**	**Crude OR (95%CI)**	**Adjusted OR (95% CI)**	**Crude OR (95%CI)**	**Adjusted OR (95% CI)**
Sex of the child (405)							
Boy	201 (49.6)	1		1	1	1	
Girl	204(50.4)	0.8 (0.5-1.3)		0.5 (0.3-1.0)*	0.9 (0.4-2.4)	1.2 (0.8-2.0)	
Childs age (405)							
6 – 11 months	49 (12.1)	1*	1	1**	1*	1	
12 – 23 months	101 (24.9)	1.4 (0.5-4.2)	0.6 (0.1-2.9)	1.1 (0.5-2.6)	2.0 (0.5-7.5)	1.2 (0.5-2.9)	
24 – 35 months	91 (22.5)	3.3 (1.2-9.4)*	1.2 (0.3-5.7)	0.8 (0.3-2.0)	1.5 (0.4-6.2)	1.4 (0.6-3.4)	
36 – 47 months	95 (23.5)	3.0 (1.1-8.4)*	0.8 (0.2-4.1)	0.2 (0.1-0.8)*	0.5 (0.1-2.4)	1.5 (0.6-3.5)	
48 – 59 months	69 (17.0)	3.6 (1.2-10.8)*	0.6 (0.1-3.2)	0.2 (0.1-0.8)*	0.1 (0.0-0.9)*	0.8 (0.3-2.2)	
Education of mother (404)							
High school or higher	280 (69.3)	1	1	1		1	
Secondary school or lower	124 (30.7)	2.5 (1.5-4.0)***	2.5 (1.0-5.8)*	0.9 (0.5-1.8)		1.2 (0.7-1.9)	
Fathers education (402)							
High schoolor higher	291 (72.4)	1	1	1	1	1	1
Secondary school or lower	111 (27.6)	2.1 (1.3-3.5)**	1.1 (0.4-2.6)	2.5 (1.3-4.9)**	1.1 (0.5-2.9)	2.9 (1.8-4.8)***	2.5 (1.3-5.0)**
Occup of mother (402)							
Housewife	293 (72.9)	1	1	1		1	
Informal work	58 (14.4)	1.4 (0.7-2.6)*	1.4 (0.6-3.6)	1.3 (0.6-2.8)		1.3 (0.7-2.5)	
Formal work	51 (15.5)	0.2 (0.1-0.7)**	0.1 (0.0-1.2)	0.8 (0.3-2.0)		0.6 (0.2-1.3)	
Income (402)							
> 200$/month	125 (31.1)	1	1	1	1	1	1
< 200$/month	277 (68.9)	1.8 (1.0-3.2)*	1.6 (0.6-3.9)	3.8 (1.6-9.3)**	6.3(1.5-25.6)**	2.2 (1.3-3.9)**	1.7 (0.7-3.9)
Observation of wall (382)							
Bricks with cement	260 (68.0)	1	1	1		1*	1
Wood	108 (28.3)	1.8 (1.0-3.0)*	0.6 (0.3-1.4)	1.5 (0.8-2.9)		1.3 (0.8-2.2)	0.5 (0.2-1.2)
Bamboo	14 (3.7)	6.4(2.1-19.3)***	1.9 (0.3-14.2)	0.6 (0.1-4.7)		4.2(1.4-12.5)**	2.8 (0.4-19.6)
Nr of children (405)							
1 – 2 children	257 (63.5)	1	1	1		1	1
3 – 4 children	122 (30.1)	1.5 (0.9-2.6)	1.8 (0.8-4.0)	1.0 (0.5-1.9)		1.1 (0.6-1.8)	0.9 (0.4-1.8)
5 or more children	26 (6.4)	4.7(2.1-10.8)***	3.8(1.0-14.3)*	0.6 (0.1-2.5)		2.5 (1.1-5.7)*	1.5 (0.4-5.4)
Total n(%)			**310 (76.5)**		**279 (68.9)**		**274 (67.7)**

*** Sign p <0.05 ** Sign p < 0.01 *** Sign p <0.001**

Stunting: Adjusted for child's age, parental education, maternal occupation, income, observations of wall material, number of children, age child was introduced to food, number of snack per day, frequency milk consumption, feeding during diarrhea, knowledge about complementary feeding, knowledge about breastfeeding, vaccination card, vitamin A supplements during last 6 months, maternal height and child's birth weight.

Wasting : Adjusted for sex and age of the child, paternal education, income, introduced to tea as one of first fluids, consumption of carrot last 24h, consumption of other fruits and vegetables last 24h, handwashing before eating, acute watery diarrhea during last two weeks, fever during last two weeks, traditional medicine to treat diarrhea, maternal BMI and vitamin A supplements during last 6 months.

Underweight: Adjusted for paternal education, income, observation of wall material, number of children, introduced to tea as one of first fluids, frequency other fruits and vegetables consumption, frequency milk consumption, knowledge about complementary feeding, vitamin A supplements during last 6 months maternal height, maternal BMI and child's birth weight.

Table 4.12. Nutritional predictors of stunting, wasting and underweight

		Stunting HAZ <-2SD		Wasting WHZ <-2SD		Underweight WAZ <-2SD	
	n (%)	Crude OR (95%CI)	Adjusted OR (95% CI)	Crude OR (95%CI)	Adjusted OR (95% CI)	Crude OR (95%CI)	Adjusted OR (95% CI)
Fluid introduce(375)							
6 months or older	72 (19.2)	1		1		1	
3-5 months	106 (28.3)	0.9 (0.5-1.9)		1.2 (0.5-3.1)		1.0 (0.5-1.9)	
0-2 months	197 (52.5)	0.9 (0.5-1.7)		1.3 (0.6-3.1)		0.8 (0.4-1.5)	
Food introduce (382)							
0 – 5 months	209 (54.7)	1*	1	1		1	
6 months	136 (35.6)	0.6 (0.4-1.1)	0.7 (0.3-1.5)	1.3 (0.7-2.4)		0.8 (0.5-1.4)	
7 months or older	37 (9.7)	2.0 (1.0-4.2)	1.6 (0.5-5.0)	0.6 (0.2-2.2)		1.1 (0.5-2.4)	
Nr of snacks (405)							
0 – 1 snack	86 (21.2)	1***	1**	1		1	
2 – 3 snack	247 (61.0)	2.0 (1.0-4.1)	3.7 (0.9-15.9)	0.9 (0.4-1.9)		1.0 (0.5-1.8)	
≥ 4 snacks	72 (17.8)	4.6(2.0-10.3)***	11.0(2.3-52.5)**	0.6 (0.2-1.8)		1.4 (0.6-2.8)	
Tea first fluid (374)							
No	219 (58.6)	1		1	1	1	1
Yes	155 (41.4)	1.6 (1.0-2.6)		2.0 (1.1-3.6)*	0.9 (0.4-2.5)	1.8 (1.1-3.0)*	1.4 (0.8-2.9)
Carrot 24h (354)							
No	135 (38.1)	1		1	1	1	
Yes	219 (61.9)	0.8 (0.5-1.3)		2.8 (1.3-6.3)*	3.3 (1.1-9.4)*	1.3 (0.7-2.3)	
Other fruit 24h (353)							
No	126 (35.7)	1		1	1	1	
Yes	227 (64.3)	1.0 (0.6-1.7)		0.3 (0.2-0.7)**	0.2 (0.1-0.5)***	0.8 (0.5-1.4)	
Milk frequency (405)							
Every day	257 (63.5)	1**	1	1		1	1
Every week	35 (8.6)	3.0 (1.4-6.5)**	1.9 (0.6-6.0)	1.2 (0.4-3.4)		2.2 (1.0-4.7)	1.6 (0.5-4.7)
Every month/never	113 (27.9)	2.1 (1.3-3.6)**	1.0 (0.5-2.3)	1.1 (0.6-2.2)		1.9 (1.1-3.1)*	1.6 (0.8-3.3)
BF 2 years † (382)							
Agree	356 (93.2)	1	1	1		1	
Disagree	26 (6.8)	2.3 (1.0-5.4)*	4.9 (1.5-16.4)**	1.2 (0.4-3.7)		1.6 (0.7-3.8)	
Food 12m †† (405)							
Agree	298 (73.6)	1	1	1		1	
Disagree	107 (26.4)	0.5 (0.2-0.8)*	0.6 (0.2-1.4)	0.4 (0.4-1.5)		0.5 (0.3-0.8)	
No meat ††† (403)							
Disagree	338 (83.9)	1		1		1	1
Agree	65 (16.1)	0.9 (0.5-1.7)		0.5 (0.3-1.0)		1.9 (1.1-3.5)*	2.6 (1.2-6.1)*
Total n(%)			**310 (76.5)**		**279 (68.9)**		**274 (67.7)**

*** Sign p<0.05 **Sign p < 0.01 *** Sign p <0.001**

† Opinion about following statement: *"Children should breastfeed on demand until 2 years or beyond"*

†† Opinion about following statement: *"At 12 months most children can eat same type of food as consumed by rest of the family"*

††† Opinion about following statement: *"Children should not eat meat until they are 2-3 years"*

Stunting: Adjusted for child's age, parental education, maternal occupation, income, observations of wall material, number of children, age child was introduced to food, number of snack per day, frequency milk consumption, feeding during diarrhea, knowledge about complementary feeding, knowledge about breastfeeding, vaccination card, vitamin A supplements during last 6 months, maternal height and child's birth weight.

Wasting: Adjusted for sex and age of the child, paternal education, income, introduced to tea as one of first fluids, consumption of carrot last 24h, consumption of other fruits and vegetables last 24h, hand washing before eating, acute watery diarrhea during last two weeks, fever during last two weeks, traditional medicine to treat diarrhea, maternal BMI and vitamin A supplements during last 6 months.

Underweight: Adjusted for paternal education, income, observation of wall material, number of children, introduced to tea as one of first fluids, frequency other fruits and vegetables consumption, frequency milk consumption, knowledge about complementary feeding, vitamin A supplements during last 6 months maternal height, maternal BMI and child's birth weight.

Table 4.13. Health related predictors of stunting, wasting and underweight

		Stunting HAZ <-2SD		Wasting WHZ <-2SD		Underweight WAZ <-2SD	
Variables (n)	**n (%)**	**Crude OR (95%CI)**	**Adjusted OR (95% CI)**	**Crude OR (95%CI)**	**Adjusted OR (95% CI)**	**Crude OR (95%CI)**	**Adjusted OR (95% CI)**
Diarrhea last 2wk (405)							
No	317 (78.3)	1		1	1	1	
Yes	88 (21.7)	0.6 (0.3-1.2)		2.0 (1.1-3.8)*	1.5 (0.5-4.1)	1.1 (0.6-1.9)	
Fever last 2wk (405)							
No	244 (60.2)	1		1	1	1	
Yes	161 (39.8)	0.8 (0.5-1.3)		2.2 (1.2-4.0)**	2.0 (0.8-5.0)	1.1 (0.7-1.8)	
Food diarrhea (395)							
Less food than usual	219 (55.4)	1**	1	1		1	
Same food as usual	72 (17.8)	1.1 (0.5-2.1)	1.0 (0.3-3.1)	0.8 (0.4-1.9)		1.3 (0.7-2.3)	
More food than usual	104 (26.3)	2.5 (1.5-4.3)***	2.4 (1.1-5.2)*	0.5 (0.5-1.9)		1.1 (0.6-1.9)	
Trad.med.diarrhea (395)							
No	229 (58.0)	1		1	1	1	
Yes	166 (42.0)	1.2 (0.8-2.0)		2.5 (1.4-4.7)**	2.6 (1.0-6.4)*	1.4 (0.9-2.2)	
Wash.ch.hands.bf.eat (401)							
Always	304 (75.8)	1		1	1	1	
Sometimes	100 (24.9)	1.0 (0.6-1.8)		2.0 (1.1-3.7)*	2.7 (1.0-7.3)*	1.4 (0.8-2.3)	
Birth weight (398)							
> 2500grams	379 (95.2)	1	1	1		1	1
< 2500grams	19 (4.8)	3.5 (1.4-9.0)**	5.8(1.4-24.9)*	0.8 (0.2-3.6)		3.5 (1.4-9.0)**	4.4 (1.2-16.4)*
Maternal height (364)							
> 150 cm	232 (63.7)	1	1	1		1	1
< 150 cm	132 (36.3)	2.4 (1.4-3.9)***	2.5 (1.2-5.0)*	1.4 (0.8-2.7)		1.9 (1.1-3.0)*	2.4 (1.2-4.5)**
Maternal BMI (350)							
< 18.5	25 (7.1)	1.8 (0.7-4.4)		3.3 (1.3-8.5)*	1.7 (0.4-7.3)	2.9 (1.2-6.9)*	2.4 (0.8-7.4)
18.5 – 24.9	176 (50.3)	1		1 *	1	1**	1
≥ 25.0	149 (42.6)	1.1 (0.6-1.8)		0.8 (0.4-1.7)	0.6 (0.2-1.6)	0.7 (0.4-1.2)	0.9 (0.4-1.7)
Vaccination card (366)							
Seen	89 (22.3)	1	1	1		1	
Not seen	310 (77.7)	3.0 (1.5-6.3)**	2.2 (0.7-6.6)	0.6 (0.3-1.2)		1.2 (0.6-2.1)	
Vitamin A suppl (380)							
No	189 (49.7)	1	1	1	1	1	1
Yes	191 (50.3)	1.8 (1.1-2.9)*	1.9 (0.9-4.0)	2.2 (1.2-4.3)*	4.2(1.6-11.1)**	1.7 (1.0-2.8)*	2.1 (1.1-4.0)*
Total n(%)			**310 (76.5)**		**279 (68.9)**		**274 (67.7)**

*** Sign p<0.05 ** Sign p< 0.01 *** Sign p<0.001**

Stunting: Adjusted for child's age, parental education, maternal occupation, income, observations of wall material, number of children, age child was introduced to food, number of snack per day, frequency milk consumption, feeding during diarrhea, knowledge about complementary feeding, knowledge about breastfeeding, vaccination card, vitamin A supplements during last 6 months, maternal height and child's birth weight.

Wasting: Adjusted for sex and age of the child, paternal education, income, introduced to tea as one of first fluids, consumption of carrot last 24h, consumption of other fruits and vegetables last 24h, handwashing before eating, acute watery diarrhea during last two weeks, fever during last two weeks, traditional medicine to treat diarrhea, maternal BMI and vitamin A supplements during last 6 months.

Underweight: Adjusted for paternal education, income, observation of wall material, number of children, introduced to tea as one of first fluids, frequency other fruits and vegetables consumption, frequency milk consumption, knowledge about complementary feeding, vitamin A supplements during last 6 months maternal height, maternal BMI and child's birth weight.

4.9 Adjusted predictors of stunting

4.9.1 Immediate causes

Number of snack per day Children who had 4 or more snacks per day had 11 times higher chance of having HAZ <-2SD compared to those who had 0-1 snacks per day.

Feeding during diarrhea Mothers who generally gave their children more food during episodes of diarrhea had 2.4 times higher chance of having children with HAZ <-2SD compared to mothers who gave less food than usual.

4.9.2 Underlying causes

Maternal education Mothers who had completed secondary school or lower education had a 2.5 higher chance of having children with HAZ <-2SD compared to mothers with high school or higher education.

Number of children Mothers with 5 or more children had a 3.8 times higher chance of having children with HAZ <-2SD compared to mothers with 1 – 2 children.

Opinion about breastfeeding Mothers were asked about their opinion of the following statement: *"Children should breastfeed for 2 years or beyond".* Mothers who disagreed with this statement had 4.9 times higher chance of having children with HAZ <2SD compared to mothers who agreed with the statement.

Maternal height Mothers shorter than 150cm had 2.5 times higher chance of having children with HAZ <2SD compared to mothers who was 150cm or taller.

Birth weight Children whose birth weight was below 2500g had a 5.8 times higher chance of having HAZ <-2SD compared to children with a birth weight of 2500g or more.

4.10 Adjusted predictors of wasting

4.10.1 Immediate causes

Yellow or orange fruits and vegetables consumed during last 24 hours Children who had eaten carrot, pumpkin or other fruits or vegetables that were yellow or orange inside during last 24h, had 3.3 times higher chance of having children with WHZ <-2SD compared to children who did not eat any of those items.

Other fruits and vegetables consumed during last 24 hours Children who had eaten other fruits and vegetables besides those listed (table 7) during last 24 hours had 0.2 times less chance of having WHZ <-2SD compared to those who had not eaten other fruits and vegetables.

4.10.2 Underlying causes

Age The odds of children being wasted decreased with the increase of age. Children in the age between 48 – 59 months had 0.08 less chance of having WHZ <-2SD compared to children in the age group 6 – 11 months.

Income In households where the monthly income was below 200$ the odds of having children with WHZ <-2SD was 6.3 times higher than in families with a monthly income of 200$ or more.

Washing children's hands before eating Mothers' who sometimes washed their children's hands before eating had 2.7 times higher chance of having children with WHZ <-2SD, compared to the mothers who always washed their children's hands.

Traditional/herbal treatment of diarrhea Mothers who reported that they generally used traditional/herbal medicine to treat diarrhea had 2.6 times higher chance of having children with WHZ <-2SD compared to those who did not use traditional treatment.

Vitamin A supplements Children who had received vitamin A supplements within last 6 months had 4.2 times higher chance of having children with WHZ <-2SD compared to the children who had not received it.

4.11 Adjusted predictors of underweight

4.11.1 Underlying causes

Paternal education Children who had a father with secondary school or lower education had 2.5 times higher chance of having WAZ<-2SD compared to children who had fathers with high school or higher education.

Opinion about complementary feeding Mothers were asked about their opinion about the following statement: *"Children should not eat meat until they are 2 – 3 years".* Mothers who agreed with the statement had 2.6 times higher chance of their children having WAZ <-2SD compared to the mothers who disagreed.

Maternal height Mothers who were shorter than 150cm had 2.4 times higher chance of having children with WAZ <-2SD compared to mothers who were 150cm or taller.

Birth weight Children with a birth weight below 2500g had 4.4 times higher chance of having WAZ<-2SD compared to children with a birth weight of 2500g or more.

Vitamin-A supplements Children who had received vitamin-A supplements within last 6 months had 2.1 times higher chance of having children with WAZ <-2SD compared to children who had not received it.

5. Discussion

5.1 Summary of key findings

The primary objective of this study was to identify the prevalence and risk factors associated with stunting, wasting and underweight in an urban community in Indonesia. The main emphasis was on the immediate causes of malnutrition: insufficient dietary intake and illness. We explored breastfeeding practices, complementary feeding practices and diarrhea prevention and management. In addition we investigated underlying causes that had been identified as risk factors for malnutrition in previous studies.

Our results showed that the underlying causes were more prominent than the immediate causes. We did not identify any significant associations between breastfeeding practices and malnutrition. However, we did identify some associations between certain food intakes and malnutrition. Our findings showed that increased amount of snacks consumed in a day and increased feeding during episodes of acute watery diarrhea, were associated with increased risk of stunting. Regarding wasting, we found that consumption of carrot or other yellow-or orange-colored fruits and vegetables within the last 24 hours was a risk factor for wasting, while consumption of other fruits and vegetables was a protective factor.

We found a significant association between acute watery diarrhea and wasting in the crude analysis, but the effect was diluted after being adjusted for other significant factors. However, our results showed that children who did not always get their hands

washed before eating had increased risk of wasting compared to children who always got their hands washed. We also found that higher income and parental education were protective factors, while low birth weight and maternal short stature were identified as risk factors for malnutrition. The most unexpected finding from our study showed that children who had received vitamin A supplements within the last 6 moths had increased risk of both wasting and underweight.

5.2 Discussion of results

In the first part of this discussion, we will compare the prevalence of stunting, wasting and underweight to other studies and to Indonesia in general. However, in the second part of the discussion we have chosen to discuss the predictors of stunting and wasting only. Underweight is a composite measure of both height and weight and encompass both stunting and wasting. The predictors of underweight are shared by both stunting and wasting and are not specific factors for underweight only. However, stunting and wasting are two different outcomes that represent different biological processes in the body and have different predictors. We therefore find it reasonable to center our discussion around these two outcomes.

5.2.1 Nutritional status of children aged 6-59 months

Stunting Our findings showed that the prevalence of stunting was 21.7%, which is regarded as medium high according to WHO's classification system (64) According to the numbers from the national health survey in 2007, the prevalence of stunting was 37% in Indonesia. (25) This is considerably higher than the findings from our study. There could be several explanations for why our findings could not be compared to Indonesia in general. Indonesia is a country consisting of thousands of islands and there are great disparities among provinces. The national prevalence of stunting only reflects an average of the country and includes both urban and rural populations. It is therefore expected that some areas would have higher or lower rates of stunting. Previous studies done in different parts of Indonesia, has shown that the prevalence of stunting among children under five, could range from 16 – 61%. (9;25;47;65-68) Our study was done in an urban area and that could be a possible explanation for why the prevalence was lower than the national average. Several studies have shown that the prevalence of

stunting is more likely to be lower in urban compared to rural areas. (47;69;70;71) It has been indicated that children living in urban areas are more likely to have mothers with higher education, have available water and sanitation facilities, have access to health services, better socio-economic status and easier access to food. (71)

Wasting The results from our study showed that the prevalence of wasting was 12,6%, which indicates a problem of serious public health significance, according to WHO's classification (64). Our findings are comparable to the national prevalence in 2007, which was 13.6 %. (25) This could indicate that there has been little progress in reducing the burden of acute malnutrition. However, it is important to note that the prevalence of wasting can change rapidly, and it is often influenced by seasonal variations in food availability and disease prevalence. (17) Considering our survey was done during rainy season when disease prevalence was high, it is possible that the prevalence was somewhat higher compared to during dry season. Studies have shown that the risk of wasting increases during rainy season. (69)

Underweight Results from our study showed that 21.8% of the children were underweight. Based on WHO's classification system, this indicates that the magnitude of malnutrition is high in the study area. (64) The latest report from Indonesia in 2010, stated that the prevalence of underweight had decreased to 17,9%. (14) This is not consistent with our findings, which were almost 4% higher. However, as previously mentioned, there are great disparities between geographical areas in Indonesia and one can not generalize based on findings from one area. According to results from he DHS in 2007, the prevalence of underweight in Indonesia ranged from 10.9% in Yogyakarta to 33.6% in Nusa Tenggara Timur. (25)

5.2.2 Predictors of stunting

Consumption of snacks Results from our study indicated that an increased number of snacks eaten per day were associated with an increased risk of stunting. Snacks could mean everything from fruit and nuts to cakes, sweets and biscuits. However, we have reason to believe that the snacks predominantly given to the children were cakes, sweets and biscuits. There was a common tradition in the research area called "Ya Jajan", which means "Yes snack". Every day the children were entitled to get at least

1000Rp ($0.12) to buy sweets or snack for, and even in poor areas this tradition was uphold. The amount of money given to the children was not much, but snack is cheap and easy to access in Indonesia, especially in urban areas. Much of the snacks consumed by the children consisted of high amounts of fat or sugar, which provided energy but little of other important nutrients. From our food frequency questionnaire we could also see that sugary food was given to the children very frequent. In general, almost 70% of the children ate sweets or sugary food every day, and even in the youngest age groups, sugary food was frequently consumed. A study found that consumption of excessive amounts of sugary drinks among children increased the risk of stunting. (72) It is possible that overconsumption of sweets or snacks took the children's appetite away from healthy food, resulting in insufficient quality food intake and impaired growth. Another possible explanation for the association between snacks and stunting could be related to the age of the children. The results from the food frequency questionnaire showed that older children ate more snacks than the younger ones. Considering that the majority of the stunted children were found in the older age groups of children, this could also be a possible explanation for the increased risk of stunting. Our findings also suggested that mothers with lower education were more likely to feed their children more snacks per day. This could indicate that the increased risk of stunting associated with snacks also could be related to caring practices of mothers.

Feeding during diarrhea Another factor that was significantly associated with stunting was feeding practices during diarrhea. Mothers who stated that they generally gave more food to the child during episodes of acute watery diarrhea had increased risk of having stunted children. Based on the guidelines from WHO, it is recommended that feeding during episodes of acute diarrhea is continued as usual and that breastfeeding is increased. However, the guidelines don't say anything about increased feeding of regular food during diarrhea. (73) A possible explanation for why increased feeding during diarrhea increased the risk of stunting could be that more food during diarrhea increased amounts of stool excretion, resulting in additional weight loss and risk of repeated infections. A study in Peru found that children who were fed during episodes of acute diarrhea had increased amounts of stool excretion compared to children who were treated intravenously. However, when feeding was reinstated, the amounts of stool excretion became similar to the group of children who were fed orally. But the children who had been fed orally had significantly improved nutritional status both during and

after recovery compared to the children who were initially treated intravenously. (74) A more likely explanation for the increased risk of stunting, could be that the mothers alleged feeding practices during diarrhea reflected their lack of knowledge about diarrhea management in general. This assumption can be supported by another finding from our study, indicating that mothers with lower education were more likely to increase feeding during diarrhea than mothers with higher education. It is also possible that the answers given to this question was influenced by response bias, and that mothers answered what they thought was the correct answer and not what their actual practices were. However, even though several studies have documented the beneficial effect of early re-feeding and continued feeding during acute diarrhea (75-77), few studies have investigated the effect of giving more food than usual during diarrhea. It is therefore possible that increased amounts of food given during episodes of acute diarrhea, could have had adverse effect on the children's growth.

Maternal education Our results indicated that maternal education was a strong protective factor for stunting in children aged 6 – 59 months. Children born of mothers' that had completed high school or higher education had significantly lower risk of being stunted than children born of mother with completed secondary school or lower education. This finding is consistent with what has been found in several other studies. (46-47;78-79) A cross-sectional study from Indonesia and Bangladesh showed that increased lengths of both maternal and paternal education, was significantly associated with a reduced odds of stunting (47). It is interesting to note that in our study, paternal education was not significantly associated with stunting after the multivariate analysis. A possible explanation for that is that increased paternal education often is linked to increased income, while higher maternal education is associated with better protective childcare practices (80). Our study also found that the significance of income associated with stunting was diluted after regression analysis. This finding may support the assumption that education and care- giving factors have a stronger influence on the level of stunting in the area, than do income. Our results also showed that 70% of the mothers were housewives, suggesting that they most likely spent a lot more time with the children compared to the father. It is therefore reasonable to assume that maternal education would have a stronger influence on the children's growth than paternal education, since mothers were likely to be more involved in the daily care. It has been suggested that mothers with higher education are more likely to have better knowledge

and practices regarding childcare, are likely to utilize resources in a better way, make better use of health services, have better hygienic practices in the household and have a higher status in the family. (47;79-81) These are all factors that directly or indirectly could influence the growth of their children.

Our findings indicated that mothers with higher education had better knowledge about good breastfeeding practices. Also, mothers with better knowledge about breastfeeding were more likely to exclusively breastfeed their children for 6 months compared to those with poor knowledge. However, in general, the prevalence of exclusive breastfeeding the first 6 months was very low. This could be a possible explanation for why we did not find a significant association between breastfeeding practices and stunting, as have been demonstrated in other studies. (80;82) However, we did identify a significant association between knowledge about breastfeeding and stunting. Mothers were asked about their opinion about the following statement: *"After the age of 6 months, children should breastfeed on demand until 2 years or beyond in addition to complementary feeding*". Our findings suggested that mothers who agreed with this statement had significantly reduced odds of having stunted children compared to the mothers who disagreed with the statement. However, when we investigated the mothers practices of prolonged breastfeeding, the difference between the group of mothers who agreed and disagreed with the statement were small and insignificant. That indicates that there was a big disconnect between knowledge and practices, making it difficult to draw any conclusions based on the response to a statement from a small group of mothers.

Number of children An important aspect of good childcare practices is time. Mothers need time to take care of their children. However, the amount of time allocated for a child might be compromised by competition from other siblings. One of the findings from our study suggested that children with many siblings were more likely to be stunted compared to children with few. This association has also been found in other studies. (78;83-84). Increased family size will most likely lead to increased competition for household resources such as food, clothing, money, and care. If there is an inconsistency between the resources available and the number of children sharing them, this could have negative effects on their health and growth, and those under the age of five are most vulnerable. Another important factor to consider regarding households

with many children is how it affects the mothers. Most likely, a large household will increase the workload for the mother in terms of cocking, cleaning, laundry and stimulation of active children. Depending on the mothers´ support and status in the family, this could prey on her strength and health. A possible consequence could be that even though mothers have sufficient knowledge about good childcare, they are incapable of providing it due to lack of time, energy and poor health. Care for mothers are therefore equally important as care for children, in order to reduce the burden of malnutrition. However, the mean number of children per mother in our study was low (2.3%) and the majority of mothers had 1-2 children. This suggests that large families are not a widespread problem in the research area. However, special attention should be given to households with many children.

Low birth weight Another finding from our study, showed that low birth weight (LBW) was a strong predictor of stunting. Children with a birth weight below 2500g had significantly higher risk of being stunted compared to children with a birth weight above 2500g. This is consistent with what has been documented in several other studies (47,69,78,85,). One of the studies even claimed that the growth of children in the study area were determined more by prenatal environment than by postnatal factors. (85) However, another study done in the Philippines showed that catch up growth sufficient to bring length-for-height z-scores above -2SD was apparent in 57% of the children with LBW, and many of the children who were stunted at birth were not stunted at 2 months of age. (86) This is consistent with the findings in our study where only half of the children with LBW were identified as stunted. However, our results also showed that the mean HAZ for LBW children was – 1.91 SD, which is very close to the cut off point for stunting (-2SD) and significantly lower than the mean HAZ of children with normal birth weight. This suggests that LBW infants are more likely to have poor growth compared to normal birth weight children. A possible explanation for why LBW infants fail to catch up growth, may be that they are more likely be introduced to food earlier than normal birth weight babies and less likely to be breastfed. (87) This increases the risk of infections and failure to grow. In general, our study showed that LBW infants as well as normal birth weight infants were likely to be introduced to fluids or food before 6 months of age. However, considering the fact that LBW infants are more vulnerable than normal birth weight children, it is likely that early introduction of fluids and food would be more harmful for them compared to normal birth weight children. Research has

shown that, in general, infants thin at birth is likely to remained shorter, thinner and lighter throughout childhood. (80) When that is said, it is important to note that even though LBW was found to be a strong predictor of stunting in our study, the overall prevalence of LBW in the area was low (5%), and only a small percentage of the children identified as stunted had LBW. This indicates that there are other factors more likely to have a stronger influence on the prevalence of stunting in the population studied.

Short maternal stature It has been suggested that short mothers are more likely to get short children, (88) and our findings support this assumption. Our results showed that children born of mothers with a height below 150 cm had significantly higher odds of being stunted compared to children born of mothers with a height above 150 cm. Several other studies has found similar results.(19;47;88;80) The mean height of the mothers participating in our study was 152 cm, which is short. This could indicate that many of the mothers were genetically predestined to become short, or it could indicate that they grew up under unfavorable conditions with repeated infections and/or insufficient intake of nutrients. (88) Studies have shown that there could be an intergenerational cycle of malnutrition. Short women are more likely to deliver infants with LBW, and infants with low birth weight tend to be smaller adults. (64) At the same time it has been suggested that part of the relationship between maternal and child short stature could be explained by the environment. (88) Mothers and their children most often share the same environment. It is therefore natural to assume that environmental exposures impairing a mothers growth potential, most likely would have the same effect on her children if the environment remain unchanged. Our results showed that the predictive effect of maternal height on stunting was slightly attenuated, but remained significant even after controlling for birth weight, environmental, socio-economic and nutritional factors. It is likely the remaining effect is genetic or generational, but there could also be other confounding factors not controlled for in this study.

5.2.3 Predictors of wasting

Consumption of fruits and vegetables Results from our study indicated that children who had eaten carrot or other yellow- or orange-colored fruits or vegetables during the last 24 hours, had a higher risk of being wasted compared to those who had not. This finding was a bit surprising to us considering these food items are regarded as healthy, and recommended to add daily to the staple food of children. Carrot or other yellow- or orange-colored fruits or vegetables are rich in carotene, from which vitamin A is made and also vitamin C. These vitamins are together with other micronutrients essential for the growth of children. (6) A possible explanation for this finding could be that carrot is among the cheapest vegetables you can buy in the study area, and it is easy accessible. However, our results showed that carrot was equally consumed in low and higher income groups. From the food frequency table (table 7) we could see that carrot was more frequently used in the diet of children below 24 months compared to in the older age groups. Considering the fact that children in the age between 6-23 months had higher odds of wasting, this could also be a possible explanation for the significant association between wasting and those who had eaten carrot.

Another finding from our study indicated that children who had eaten other fruits and vegetables compared to those listed (table 7) had a significantly lower risk of being wasted. It is commonly acknowledged that fruits and vegetables are healthy and good sources of important micronutrients. Consequently, a possible explanation for why eating fruits and vegetables was a protective factor could be the fact that it promoted growth and increased the children's health and immune system. This would make the children less susceptible to infections with resulting weight loss. Also, it is possible that mothers who fed their children with extra fruits and vegetables were more health conscious about their children in general. This assumption can be supported by other findings from our study. Our results showed that mothers who had fed their child other fruits and vegetables were less likely to have introduced food before 6 months and more likely to have given their child the measles vaccine, more likely to have higher education compared to the mothers who had not given other fruit and vegetables to their child within the last 24 hours. It is also possible that other fruit and vegetables than those listed, were expensive and that the association between fruit and vegetable consumption was linked to socio-economic status. Our findings also showed that

children living in households with an income above $200 previous month were more likely to have received other fruits and vegetables within the last 24 hours.

Income Results from our study indicated that higher income also was a protective factor for wasting, but not for stunting. Children in households with higher income had significantly decreased odds of being wasted compared to those living in households with lower income. Similar findings have also been documented in other studies. (66;69) Wasting in children indicates acute malnutrition due to recent weight loss or failure to gain weight. This could be due to illness or insufficient intake of food. The association between income and wasting indicates that the current socio-economic status was influencing the nutritional status of the children. Considering that we found no significant association between infections and wasting, it is possible that insufficient intake of food had a stronger influence on the prevalence of wasting in the area than did infections. Low income could mean lack of resources to buy food for, resulting in insufficient diets and failure to gain weight. However, households with lower income are also more likely to live under poor conditions, which increases the risks of hazardous exposures and illness that could lead to illness and weight loss. Results from our study also showed that the majority of the families living in bamboo and wood houses were from the low-income-group, while the majority from the higher income group lived in brick houses.

Childs age Our study found that the odds of being wasted were higher among younger than older children. The prevalence of wasting was significantly higher among the children under the age of two compared to children in the older age groups, and the prevalence peaked between 12-23 months. This is consistent with findings from other studies. (69;17) There could be several possible explanations for the significant association between age and wasting. The age period below 2 years is known as the weaning period where children go from exclusive breastfeeding to introduction of fluids, semi-solid and solid food. Studies have shown that the incidence of diarrhea is particularly high in this period of a child's life. (12;89) Findings from our study showed that the majority of children were introduced to fluids or food before 6 months of age. It is highly unlikely that the replacements for breast milk could match the nutrient dense quality and protective effect of antibodies as is found in breast milk. This would lead to insufficient nutrient intake and impaired growth. In addition, early introduction of food

would make the children more prone to infections with resulting weight loss. Results from our study also showed that children who were introduced to fluids and food before the age of 6 months were more likely to have had symptoms of illness within the two weeks prior to interview, compared to the children who initiated fluids or food at 6 months. The fact that children below 2 years are usually more exploratory of their environments compared to children in older age groups also increases their exposures to harmful bacteria that could cause infections and possibly result in wasting. Clean environments are therefore of utmost importance, especially in households with young children.

Hand washing practices Our results found that hygienic factors were significantly associated with the high prevalence of wasting. Our findings indicated that hand washing was a protective factor, and mothers who always washed their children's hands before eating had significantly lower odds of having wasted children compared to mothers who only washed them sometimes. Also, our results indicated that lack of hand washing in relation to food preparation was significantly associated with increased symptoms of illness, and in particular acute watery diarrhea. This is consistent with other studies indicating that contaminated complementary food is a major risk factor for infectious diseases, especially diarrhea. (89) There could be several explanations for why hand washing seemed to be a protective factor against wasting. It is not unlikely that mothers' who always wash their children's hands before they ate, were more health conscious in general compared to the mothers who didn't. However, it is well established that hand washing with water and soap is one of the most effective preventive measures against infections, and has shown reductions of diarrheal incidences between 21-89%. (90) Based on this knowledge, it is possible that children who got their hands washed every time before eating were more protected against infections, which reduced the odds of wasting. Findings from our study indicated that the prevalence infections within two weeks prior to the study, was high. More than half of the children had severe cough and approximately one in four had acute watery diarrhea. We also found that prevalence of acute watery diarrhea was significantly associated with wasting in the crude analysis. However, to our surprise the association became insignificant after the multivariate analysis. A possible explanation for why we could not identify a significant association between infections and wasting could be due to the limitation of our study design, which could only measure prevalence but not

incidence of infections. This suggests that infections with resulting weight loss that occurred more than two weeks prior to interview, would not be detected. Another possible explanation could be that diarrhea was neither severe nor long lasting and did not cause weight loss or decreased intake of nutrients.

Traditional medicine Even though we did not identify a significant association between acute watery diarrhea and wasting, we did find an association between diarrhea management and wasting. One of our findings indicated that mothers who generally treated acute watery diarrhea with traditional medicine had significantly higher odds of having wasted children. Regretfully, we did not investigate further by asking the mothers what kind of traditional medicine they used. This makes it difficult to say whether it is the actual treatment with traditional medicine that increases the odds of wasting, or if there could be other confounding factors. Further research is needed in order to get a better understanding about the kind of medicine used and how they might affect the children's growth.

Vitamin A supplements The most unexpected finding in our study showed that vitamin A supplements seemed to be a risk factor for wasting. Children who had received vitamin A supplements within last 6 months had significantly higher odds of being wasted compared to those who had not received it, and the odds increased from crude to adjusted analysis. Previous research done on the effects of vitamin A supplements, show conflicting results. Some studies indicate that Vitamin A supplements reduces mortality and morbidity in children less that five years,(91;92) while others have found that vitamin A supplements increased the risk of infections.(93-95) Regarding vitamin A supplements effect on the growth of children, there is also inconsistency among findings. Some studies have found that vitamin A supplements improves the growth of children,(76;96)while others claim that vitamin A supplements cannot be expected to measurably improve growth.(97-98) However, we have found no other studies similar to ours, indicating that there could be an associations between vitamin A supplements and impaired growth. There could be several possible explanations for our unexpected finding. One explanation could be that receiving supplements led to a false sense of security for the mothers. It is possible that the mothers relied too much on the preventive effect of vitamin A and became less focused on basic hygienic measures to prevent infections. However, our results also indicated

that the children who had received vitamin A supplements also were more likely to always get their hands washed before eating compared to the children who had not received vitamin A. Due to the cross sectional design of our study it is difficult to say what is the cause and effect of vitamin A. It is possible that the children who received vitamin A did so because they were already wasted and perceived as deficient in vitamin A. This would indicate that vitamin A was not the cause of wasting, but merely given as a response to the effect of the condition. However, we cannot rule out the possibility of vitamin A supplements contributing to the cause of wasting. A study done in rural Indonesia showed that regular supplements of vitamin A failed to reduce the incidence of acute respiratory illness and diarrhea in preschool children. On the contrary, their results showed that vitamin A supplements increased the incidence of acute lower respiratory illness with 39%, and this effect was found mainly in adequately nourished children. (93) Another study based on animal trials found that both chronic excess and deficiency of vitamin A was associated with depressed immunity. (99) This could indicate that vitamin A supplements given to children without deficiencies may suppress their immune system and make them more susceptible to infections. It is well established that infections increase the risk of wasting, and if vitamin A supplements somehow increased the risk of infections, it could also indirectly increase the risk of wasting.

The Government of Indonesia has implemented a vitamin A capsule distribution program intended to cover all preschool children between 6-59 months. Children between 6-12 months are given 30 mg retinol and children between 12 – 59 months are given 60 mg retinol biannually by the local health post. (76-77) Indonesia is also one of the few countries that have reported fortification of vitamin A in food items such as noodles or fat. (74) As previously discussed, our findings also indicated that children who had eaten carrot or other yellow- or orange-colored fruits or vegetables during the last 24 hours had increased risk of wasting. Carrot or other yellow-or orange-colored fruits and vegetables are known to be rich in carotene, from which vitamin A is made. In addition dark green leafs or vegetables (also known to be rich in vitamin A) were consumed daily by half of the children from 9 months and up. This indicates that children may get vitamin A capsules in addition to vitamin A from fortified food, and food naturally rich in vitamin A. These results could indicate that there may be a need for a revision of the current policy. Perhaps the current strategy of supplementation to

all children under the age of five need to be replaced with a more targeted strategy, focusing on the children who are deficient in vitamin A. However, it is difficult to draw any conclusions due to the limitations of our study design. We don't have any information about whether children in the area had vitamin A deficiency or not, but if they were, it is not unlikely that supplementations in a combination with fortified food and food naturally rich in vitamin A, could result in excessive amounts of vitamin A and impaired immunity. It is also possible that this surprising finding is due to chance. However, considering the fact that there are conflicting results from previous studies about the effect of vitamin A, further research is needed to increase knowledge about whether vitamin A supplements under some conditions could negative effect on children's health.

5.3 Discussion of methodology

5.3.1 Study design

Our study design was quantitative and cross sectional, meaning that all data was gathered at the same point of time. Our main objective was to identify the prevalence of stunting, wasting and underweight in a specific population, and the quantitative approach was most suitable for that purpose. We also wanted to explore the etiology of malnutrition and the ideal design would have been to do a longitudinal study where we could measure disease incidence and nutritional habits over time and how these factors influenced the nutritional status of children. However, due to the increased cost this design would imply, and the limited timeframe of our project, we chose the cross sectional design instead. The cross-sectional design is considered a good proxy for longitudinal data, (101) and based on our time and resources, this was the most suitable design to meat our objective. However, the weakness with the cross-sectional design is that it measures both exposures and outcome at the same, which makes it difficult to establish what is the cause and what is effect. (100)

5.3.2 Limitations and strengths

It has been suggested that all epidemiological studies are subject to bias in one way or another. But this doesn't mean that they are scientifically unacceptable or disregarded. (100) We have identified some potential biases that may have affected the outcome of our study, and these need to be considered before drawing any conclusions.

Selection bias Our study areas were not randomly selected but chosen by a local NGO, aiming to start a project in the area. However, our respondents were systematically recruited and all mothers with children between 6-59 months were asked to participate. We had a high response rate and only nine percent of those invited to participate, declined and 10 percent weren't home. It could be argued those who did not want to participate, might have declined because they had malnourished children. On the other hand, it could also be argued that those who weren't home, most often were working, and most likely had higher income and were less likely to have malnourished children. However, this would only be speculating and we have no reason to believe that the prevalence of malnutrition would have differed significantly if those not included had participated. In some situations, mothers had several children under the age of five. In order to select a focus child, we used random draw. Our objective was to find the prevalence of malnutrition and identify the associated risk factors in a specific population. Considering our objective, we have a strong reason to believe that we have a representative sample of the population studied, which is not likely to be influenced by selection bias.

Recall bias Another potential bias in this study was recall bias. Some of the questions asked relied on the memory of the mother or caretaker. This could have caused them to answer incorrectly. We tried to reduce the potential recall bias by making the recollection period as short as possible, but at the same time long enough to provide sufficient information. E.g. We asked about symptoms of illness within two weeks prior to interview, and about food consumption during last 24 hours which is a reasonable recollection period. However, for some of our variables, like; birth weight, time of initiating breastfeeding, time of introducing fluids and food or vaccination received, it was impossible to reduce the recall period. It is possible that these questions may have been influenced by recall bias, and the results from these variables must therefore be interpreted with caution.

Response bias During some interviews, women from the neighborhood came to visit the respondent. According to the interpreter it was not culturally accepted to ask them to leave. This was problematic since the interview was supposed to be confidential and we did not want the answers to be influence by others. In these situations, we informed the visitors that they could influence the mother answers in any way. However, even if they did not say anything during the interview, the presence of other people may have caused the mothers to answer differently compared to if they had been alone with us. Another potential bias was that the principal investigator was present during the interviews. Considering that the principal investigator was from a western country, had higher education and most likely were perceived as rich, these factors may have influenced the mothers answers. It is possible that the mothers sometimes gave the answers they thought would "please" the researcher instead of telling the truth. It is also possible that they answered what they thought was the correct answer, instead of telling us what their actual opinion and practices were. Another possibility could be that the mothers avoided telling the truth because it was sensitive to them. This was actually confirmed at one occasion: Mothers were asked how many children they had given birth to and how many living children they had. One of the mothers answered that all the children she had given birth to, were alive. However, when we visited her neighbor, we were told that this woman had lost five children after birth. Another potential bias, could be leading questions. During the development of the questionnaire, we were very conscious about not including any leading questions. However, the original questionnaire was translated and adapted to the local setting, and this might have influenced the wording of some of the questions. In addition, leading questions were commonly used in everyday conversations in the area. E.g. If people wanted to know the sex of a child they usually asked: It's a boy right?, or: It´s a girl right?, even though they had no idea about the sex. This also influenced the way our interpreter performed the interviews, and the principal investigator repeatedly had to remind the interpreter not to ask leading questions. This bias could particularly have influenced the mothers responses to questions about their opinions or practices. Due to the various factors mentioned, it is highly likely that response bias has influenced our findings. This needs to be considered when interpreting the results.

Systematic bias Another potential bias was the use of an interpreter. It is possible that the interpreter systematically asked some of the questions in another way than what was written in the questionnaire. For two questions systematic, errors were discovered and corrected. During the first 30 interviews the interpreter asked the mothers if they had ever received vitamin A supplements, instead of asking if they had received it during the last 6 months. Also during the first 50 interviews the interpreter asked if the children had ever eaten any of the food items listed, instead of asking if they had eaten any of them during the last 24 hours. All cases up until correction of the errors were withdrawn from the analysis and coded as missing numbers. This had an implication on the number of cases included in the regression model. However, the cases included in the regression model were not suspected of systematic bias.

Reliability of measures The questionnaire was constructed by questions from previously conducted studies, and had therefore been tested and proven reliable. However, questions that are reliable in one setting might, not be valid in another. The way people ask, interpret and respond to questions may wary significantly from one population to another. It is therefore important that each question is adapted and tested in the local setting where it will be used. To increase the reliability of measures from our questionnaire, we had it translated to the local language (Bahasa Indonesia)by one person, and back-translated to English again by another person. We also tested the questionnaire in a pilot study and changed or removed questions that failed to measure what they intended to measure. These precautions strengthen the reliability of measures from the questionnaire used in our study. Regarding anthropometric measurements, there will most likely always be variations when independent measures are replicated. (100) The fact that we did not take two separate measurements from each child, could be a threat to the reliability of the measures. However, in situations where the results were questionable, or if there were reason to believe that the measurements were performed incorrectly, a new set of measurements was always obtained. Also, there was only one team performing all measurements, and the team had been trained in standardized measurement techniques. In addition, the weighing scale was validated on a daily basis, before onset to the field. These efforts decreased the likelihood of incorrect measurements, and increased the reliability of measures.

5.3.3 Validity

Internal validity Besides from the potential biases described above, we have identified some other threats to the internal validity of our study. Due to missing numbers in several of the variables used in the multiple regression model, only 68 - 70% of the total sample size were analyzed. This could have influenced the outcome and reduced the effect of significant variables or increased the effect of variables that had weaker associations. Another limitation with multivariate regression is that it only explains the relationship between the exposures entered into the model with the outcomes. However, there could be other confounding factors not controlled for in our study. The study design we used could also be a potential threat to the internal validity. Cross sectional designs measure the exposures and the outcomes at the same time, which makes it difficult to state clearly what is the cause and what is the effect. However, many of the exposures that we identified as significant for the outcomes, are consistent with findings from other studies, which strengthens the internal validity of our results.

External validity The external validity of the magnitude of malnutrition was not very strong. There are a number of reasons for that. Our sample population was from a poor urban community in a large city and we found no other studies done in the same city to confirm or disregard our findings. This means that we cannot generalize our findings to other areas in the same city. Also, when we compared our findings with other recent findings from urban as well as rural areas and to Indonesia in general, the findings were inconsistent. This confirms that there are great disparities in the magnitude of malnutrition in Indonesia related to place and time of study as well as people studied. Our results on the prevalence of stunting, wasting and underweight are therefore representative only in the area studied.

5.4 Implications

Findings from our study will contribute to increased knowledge about the factors associated with stunting, wasting and underweight in the study area. We have not found any other studies investigating the prevalence and risk factors for malnutrition in this part of Indonesia. One of the strengths of this study, is that it is broad and explore the relationship between socio-economic characteristics, nutritional characteristics, health characteristics as well as maternal and child physiologic characteristics with the

nutritional outcomes, stunting, wasting and underweight. We have not found any similar studies done in an Indonesian context. Most other studies explore one or few characteristics in relation to nutritional outcomes, which increases the likelihood of confounding factors. Findings from our study will contribute to increased knowledge about the relationship between different exposures and the prevalence of stunting, wasting and underweight in the area. Our results will be useful for the local government, as well as the local NGO to plan appropriate and targeted interventions aimed at reducing the burden of malnutrition.

5.5 Conclusion

Our results indicated that there were no significant association between breastfeeding practices and malnutrition, as have been found in other studies. However, we found that the rates of exclusive breastfeeding in the area were extremely low, and the rates of infections were high. This could indicate that there is an indirect link between breastfeeding practices and malnutrition. However, we also failed to identify any significant association between acute watery diarrhea and malnutrition. We found some factors related to dietary intake, that were significantly associated with malnutrition. Increased snacks consumption was identified as a risk factor for stunting, while consumption of other fruits and vegetables were identified as a protective factor for wasting. Unexpectedly, vitamin A supplements and consumption of carrot and other yellow- or orange-colored fruits and vegetables were identified as risk factors for wasting. The underlying causes were more prominent in our findings than the immediate causes, which could be attributed to the limitations of our study design. In general we found that maternal education was a protective factor for malnutrition and that higher maternal education was associated with better childcare practices.

Even though the magnitude of malnutrition has decreased during the last decade, it is still prevalent. According to our results, the prevalence of chronic malnutrition was lower in our study area compared to findings from other areas in the country, and to Indonesia in general. However, the prevalence of acute malnutrition was still high and the magnitude of malnutrition was higher in our study area compared to Indonesia in general. We found that one in five children suffered from underweight, and that is unacceptably high. Generalizing progress makes little sense, when there are still great disparities between areas and populations as well as within. Generalizing dilutes the

problem by mixing it up with numbers of progress, covering up the uneven distribution of resources and burdens. It could be tempting to underestimate the severity of the problem based on the fact that, in general the magnitude of malnutrition was not so high in our study are as compared to some other parts of Indonesia. However, having seen the great disparities within the population studied, the temptation diminishes. For those children suffering from malnutrition it is still serious, whether the prevalence is 10% or 60% in the area live. Malnutrition is not about numbers, but about people. As long as malnutrition prevail, attention and commitment is needed to work towards eradicating the problem.

5.6 Recommendations

5.6.1 Focus areas for interventions

Our results showed that there were several factors in the study context significantly associated with the prevalence of stunting and wasting. Based on these findings the study population may benefit from interventions targeted at following focus areas:

• Improvement of exclusive and prolonged breastfeeding practices: Even though we found no direct association between breastfeeding practices and malnutrition, we still recommend that exclusive breastfeeding should be promoted. The alarmingly low rates of exclusive breastfeeding together with the high rates of infections in the area, indicates the need for change. We suggest counselling of mothers about breastfeeding, advocation against the aggressive marketing of formula milk and reassurance to mothers about the quality of their breast milk.

• Improvement of complementary feeding: Counseling mothers about safe and nutritious food as well as appropriate amounts of food and snack intake for children in the various age groups.

• Prevention and management of diarrhea: Counselling mothers about the measures to prevent diarrhea as well as fluid and food intake during diarrhea, and the use of ORS and zinc supplements.

• Reducing environmental exposures: Interventions that promote hand washing and clean environments.

• Improvement of dietary habits during pregnancy: Counselling mothers about safe and nutritious food during pregnancy.

• Family planning: Counselling mothers about birth spacing and methods available for family planning. (This only applies for a small percentage of the mothers in the area)
• Increase socio-economic status: Governmental support for higher education and creation of employment opportunities.

5.6.2 Focus areas for future research

The cross sectional design was not the best option to get sufficient knowledge about dietary practices and the information we gathered in our study was limited. There is a gap in knowledge about dietary habits and growth in Indonesian populations and further research is needed on the subject. Our findings suggested that increased feeding during diarrhea was likely to increase the odds of stunting, however there is a gap in knowledge about dietary practices during diarrhea in Indonesian populations. In addition we found no supportive studies about the effect of increased feeding during diarrhea and linear growth. We therefore recommend further research on nutritional management of diarrhea in Indonesia. We also found that increased number of snacks eaten per day was associated with stunting. Further research is needed on the associations between high consumptions of sweets and stunting in Indonesian populations. The most unexpected finding in our study suggested an adverse effect of vitamin A supplementation on linear growth. This could not be confirmed or disregarded by other findings and further research is needed in order to establish if vitamin A supplementation under some conditions could be harmful. Our results show that Indonesia is suffering from the double burden of malnutrition, where underweight and overweight is coexisting. Our findings revealed that an alarmingly high prevalence of the mothers in the study area were overweight. Overweight was not the focus area for our research and we recommend further research on overweight, obesity and associated factors among women in Indonesia.

APPENDICES

Appendix 1: Informed consent form

Appendix 2: Questionnaire

Appendix 3: Ethical approvals

APPENDIX 1

INFORMED CONSENT

Informed consent form

My name is Målfrid Kolbrek, and I am a Norwegian researcher from the university of Oslo in Norway.I am doing a study on malnutrition among children in North-Sumatera and my objective is to find out how many of the children are malnourished and what are the risk factors for malnutrition.

I will be working in this area from august to December collecting information through interviews with mothers and caretakers, and measuring weight and height of mothers and children under the age of five and down to 6 months.
During the interview I will ask some general questions about socio-economic status, water and sanitation, health and health care services, feeding practices and diarrhea management in children under the age of 5.

I want to inform you that participating in this project is voluntary, and you are free to decline participation. If you decide to participate, you are also free to withdraw from the interview at any time. If you decide after completed the interview to withdraw your answers, your wish will be respected and the answers you have provided will be excluded from the analysis. Everything you say to me will be strictly confidential. The questionnaire will be marked with a number instead of your name, and the answers will not be possible to link back to you by others.

The information gathered from this study will help create awareness of the situation of people living in this area. Information about the risk factors for malnutrition is also very important in order to find out what can be done to prevent and reduce the number of malnourished children.

Yours sincerely Målfrid Kolbrek _____.

Signature of mother/caretaker

APPENDIX 2

QUESTIONNAIRE

Malnutrition and associated risk factors in children 6-59 months in urban Indonesia

QUESTIONNAIRE IDENTIFICATION			
ID01	**Serial number of questionnaire** |__|__|__|		
ID02	**Date of interview** *dd-mm-yy* dd|__|__| mm|__|__| yy|__|__|__|__|	**ID03**	Interview start: Hour|__|__| minute |__|__| Interview finish: Hour|__|__| minute |__|__|

CHARACTERISTICS OF RESPONANT			
CR01	**How old are you?**	|__|__| years	
CR02	**What is your civil status?**	Single Married/living together Divorced Widowed	1 2 3 4
CR03	**What religion do you belong to?**	Buddhism Christianity Catholicism Hinduism Islam Traditional believes	1 2 3 4 5 6
CR04	**What is your highest level of completed education?**	Not finished Primary school Secondary school High school Graduate studies/university Technical education/ vocational training	1 2 3 4 5 6
CR05	**What is the father of the child's highest level of completed education?**	Not finished Primary school Secondary school High school Graduate studies/university Technical education/ vocational training	1 2 3 4 5 6
CR06	**What is your occupation?**	Housewife Garbage collector Seamstress Governmental employee…….. Private employee…….. Farmer Other……	1 2 3 4 5 6 7
CR07	**What is the father of the child's occupation?**	Driver (becak, taxi, bus) Garbage collector Governmental employee…… Private employee…… Farmer Other……	1 2 3 4 5 6

SOCIO-ECONOMIC FACTORS			
SE01	**What was the household's total income last month?**	_____Rupiah = _____US$ 98 DK	
SE02	**How many people are supported by the total household income?**	_____People 98 DK	
SE03	**What was the household's total expenditure last month?**	_____Rupiah = _____US$ 98 DK	
SE04	**If you got unexpected expenditures of 300.000 RP one month, would you be able to raise the money? If yes, how?**	Savings Borrow from family/friends Would not be able to raise the money	1 2 3

ENVIRONMENTAL FACTORS AND HYGIENE			
EC01	**What is the main source of drinking water for the household?**	Public tap Private tap Protected well Open well in yard	1 2 3 4

	Circle only one category	Spring River/stream Lake Purchased bottle water Other……	5 6 7 8 9
EC02	**Do you boil or treat the children's drinking water in any way?**	Don't treat water Boil drinking water Other……	1 2 3
EC03	**How do you store the household drinking water?**	In clean open container In clean closed container Other……..	1 2 3
EC04	**What type of latrine does your household use?**		
	Bucket latrine where excreta is manually removed, private Pit-latrine, private Pit-latrine shared with other households Pour-flushed toilet, private Pour-flushed toilet, shared with other households None, open defecation		1 2 3 4 5 6
EC05	**Do you wash the children's hands before meals?**	Always Sometimes Almost never Never	1 2 3 4

In which of the situations do you practice hand- washing, and in which situations do you not?
1 Yes; 2 No

EC06	Before using the latrine	1 2	**EC07**	After using the latrine	1 2
EC08	Before preparing food	1 2	**EC09**	After preparing food	1 2
EC10	Before eating food	1 2	**EC11**	Before helping children with their latrine visit	1 2
EC12	After helping children with their latrine visit	1 2	**EC13**	Before feeding the children	1 2

CHARACTERISTICS OF THE CHILD			
CC01	**How many children have you given birth to?**	|__|__| children	
CC02	**How many surviving children do you have?**	|__|__| children	
CC03	**How many children below 5 years live in this household?** *If answer is more than one, select one child in the age between 6-59 months randomly*		|__|__| children
CC04	**What is your relation to the child?**	Mother Grandmother Caretaker Father	1 2 3 4
CC05	**Is the child a boy or a girl?**	Boy Girl	1 2
CC06	**Dou you have a birth certificate for this child that I can see?**	Yes, seen Yes, not seen No	1 2 3
CC07	**In what day, month and year was this child born?**	Day: month : year	|__|__|:|__|__|:|__|__|__|__| DK98
CC08	**How old is the child?** *In completed years and months*	Years : months DK	|__|__|:|__|__| 98
CC09	**What was the child's birth weight?**	DK	|__|__|__|__| grams 98

BREAST FEEDING (If respondent is not the child's mother, skip module N/A)				
BF01	**Did you ever breastfeed the child?**	Yes No N/A	1 2 97	→ END MODULE
BF02	**At what time after birth did you first put the child to the breast?**	Immediately/within 1 hour Within|__|__| hours Within |__|__| days N/A DK		97 98

BF03	**The breast - milk that is produced the first 1-7 days after birth is different than ordinary breast milk. Did you feed this milk to the child when he/she was newborn, or did you dispose it?**	Fed it to the child Disposed it N/A DK	1 2 97 98
BF04	**Are you currently breastfeeding the child?**	Yes No N/A	1→ BF07 2 97
BF05	**How old was the child when you stopped breastfeeding?**	|__|__|months	
BF06	**Why did you stop breast feeding?**	Child was to old to continue breast feeding Child did not want breast milk anymore Breast feeding was inconvenient I had problems with the breast feeding Other, specify……	1 2 3 4 5
BF07	**How old was the child when you started to give fluids other than breast milk?**	*Answer in completed months* DK N/A	|__|__|months 97 98

BF08	**What kind of drinks was introduced to the child?**	Water Infant formula Animal milk Tea	a b c d	Sugar water Jus Others…….. N/A	e f g 97

Can you tell me if you agree or disagree with the following statements?	1 Agree; 2 Disagree; 98 DK	
BF09	A child need other foods and drinks besides from breast-milk during the first 6 months of life	1 2 98
BF10	Formula milk is better than breast milk	1 2 98
BF11	Breastfeeding protects the child against infections	1 2 98
BF12	After 6 months of age, a child should breast-feed on demand until 2 years or beyond in addition to complementary food	1 2 98

DIETARY PRACTICES

DP01	**How old was the child when you started to give food in addition to breast milk?**	*Answer in completed months* DK N/A	|__|__|months 98 97

A.	**During the day and night yesterday, did the child eat or drink any of the following food/drink items ?**	**1** Yes **2** No **98** DK	**3** Daily **4** Every week **5** Every month **98** DK	
B.	**How often does the child eat the following food items?**		**A**	**B**
DP02	Porridge, bread, rice, noodles, or other foods made from grains		1 2 98	3 4 5 98
DP03	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside,		1 2 98	3 4 5 98
DP04	Ripe mango or papaya, pumpkin, tomato, paprika		1 2 98	3 4 5 98
DP05	Any other fruit and vegetables, specify…… ……			3 4 5 98
DP06	White potatoes, white yams, cassava, or foods made from roots.		1 2 98	3 4 5 98
DP07	Dark green /leafy vegetables; E.g. Spinach, broccoli, cassava leafs, etc		1 2 98	3 4 5 98
DP08	Liver, kidney, heart, or other organ meats or blood based food		1 2 98	3 4 5 98
DP09	Any meat, such as beef, pork, lamb, goat, chicken, or duck or other birds		1 2 98	3 4 5 98
DP10	Eggs		1 2 98	3 4 5 98
DP11	Fresh or dried fish, shellfish, or seafood		1 2 98	3 4 5 98
DP12	Any foods made from beans, peas, lentils, nuts, or seeds		1 2 98	3 4 5 98
DP13	Milk, cheese, yogurt, or other milk products		1 2 98	3 4 5 98
DP14	Any oil, fats, or butter, or foods made with any of these		1 2 98	3 4 5 98
DP15	Any sugary foods such as chocolates, sweets, candies, pastries, cakes, or biscuits		1 2 98	3 4 5 98
DP16	Any other solid or semi solid food, specify……			3 4 5 98

	……		

Can you tell me if you agree or disagree with the following statements about child and infant feeding?
1 Agree; 2 Disagree; 98 DK;

DP17	Children should not eat meat until they are 2-3 years old	1 2 98
DP18	Children have small stomachs and therefore need small servings with food rich in energy	1 2 98
DP19	Children should not start with food in addition to breast milk before the age of 6 months	1 2 98
DP20	By 12 months most children can eat the same types of food as consumed by the rest of the family	1 2 98
DP21	How many meals per day does this child eat?	|__|__| times/day
DP22	How many snacks per day does this child eat?	|__|__| times/day

ACUTE DIARRHEA KNOWLEDGE AND PRACTICES

AD01	**How do you manage acute diarrhea in your children?**	Stop giving fluids until diarrhea stops	a
		Give less fluids than usual	b
		Give same amount of fluids as usual	c
		Give more fluids than usual	d
		Stop feeding the child until diarrhea stops	e
		Continue feeding as usual	f
		Give less food than usual	g
		Give more food than usual	h
		Give antibiotics	i
		Give herbs/traditional medicine	j
		Give food based fluids like rice water, yoghurt drinks, soup, etc	k
		Give ORS solution	l
		Give zinc supplements	m
		Other, specify……	n
AD02	**If your child has diarrhea, when do you seek advice or treatment?**	When child also has a fever	a
		When the child also has repeated vomiting	b
		When the child show signs of dehydration	c
		When there is blood in the stools	d
		If the child is eating and drinking poorly	e
		When diarrhea has lasted for more than |__|__| days	f
		I never seek help or advice to treat diarrhea	g

I will read a list of symptom's, can you please tell me which of them you think are symptoms of dehydration and which are not? 1 Symptoms of dehydration; 2 NOT symptoms of dehydration; 98 DK

AD03	Sunken eyes and fontanel	1 2 98
AD04	Wrinkled and dry skin	1 2 98
AD05	Little and dark urine	1 2 98
AD06	Urinating more than before	1 2 98
AD07	Good appetite	1 2 98
AD08	Thirsty	1 2 98
AD09	Child becomes very active	1 2 98

ORS AND ZINC TREATMENT FOR DIARRHEA

OZ01	**Have you ever used a fluid made from a package called ….(local name for ORS)..or homemade ORS to treat diarrhea in children?**	Yes No DK	1 → OZ03 2 → OZ03 → OZ05 98 → OZ05

OZ02 **Why have you never used ORS to treat diarrhea in any of your children?**

I have never heard about it	1	It is too expensive	6
I don't think it will help	2	It is not available in this community	7
I use herbal medicine instead	3	Other, specify……	8
My child has never had diarrhea	4	N/A	97
The diarrhea has never been so severe	5	DK	98

OZ03	**Have you ever given this child ORS treatment for diarrhea?**	Yes No	1 2	N/A DK	97 98
OZ04	**How did you administer the ORS?**				

	Once in a while the first day of diarrhea Frequent sips from the onset of diarrhea until the diarrhea stopped	1 2	A couple of teaspoons a day for 7 days Other, specify…… N/A	3 4 97

OZ05	**Have you ever used Zinc supplements to treat diarrhea in any of your children?**	Yes No DK	1 → CZ07 2 → OZ06 → END MODULE 98 → END MODULE

OZ06	**Why have you never used zinc-supplements to treat diarrhea?**	I have never heard about it I don't think it will help I use herbal medicine instead The diarrhea has never been so severe	1 2 3 4	It is too expensive It is not available in this community Other, specify…… N/A	5 6 7 97

OZ07	**Have you ever given the child Zinc supplements to treat diarrhea?**	Yes No	1 2	N/A	97

OZ08	**How did you administer the zinc-supplementation?**	Once the first day of diarrhea Several times a day until diarrhea stopped Gave it once a day from onset of diarrhea for 5-6 days Gave it once a day from onset of diarrhea for 10 days Other, specify…… N/A	1 2 3 4 5 97

HEALTH CHARACTERISTICS					
HC01	**How would you describe the child's health?**	Very healthy Healthy	1 2	Poor health Very poor health	3 4

HC02	**Has the child suffered from any of the following symptoms of illness during the last two weeks?**	Watery diarrhea Diarrhea with bloody stools Fever Vomiting Severe cough Tiredness/fatigue Other, specify…… Have had no symptoms of illness	a b c → HC06 d → HC06 e → HC06 f → HC06 g → HC06 h → END

HC03	**Did you seek any advice or treatment for the diarrhea?**	Yes No N/A	1 2 → HC06 97		
HC04	**Where did you first seek help?**	Public health facility Private health facility Pharmacy	1 2 3	Traditional practitioner Relative/mother/mother-in-law N/A	4 5 97
HC05	**Does the child still have these symptoms?**	Yes No	1 2	N/A	97
HC06	**During the time the child had these symptoms, how much was he/she given to drink?**	Much less Somewhat less About the same More	1 2 3 4	Much more Nothing to drink N/A	5 6 97
HC07	**During the time the child had these symptoms, how much was he/she given to eat?**	Much less Somewhat less About the same More	1 2 3 4	Much more Nothing to eat N/A	5 6 97

VACCINATION AND VITAMIN A SUPPLEMENTATION					
VV01	**Do you have a vaccination card where the child's vaccines are registered? Can I see it?**	Yes, vaccination card seen Yes, vaccination card not seen	1 2	No	3
VV02	**Has the child ever been given a BCG vaccine against tuberculosis, that is an injection in the arm or shoulder that usually leave a scar ? (should be given at 1 month)**			Yes No DK	1 2 98
VV03	**Has the child received polio vaccine, that is the drops in the mouth? (birth/1 month, 2 months, 3 months)**			Yes No DK	1 2 → VV05 98 → VV05
VV04	**How many times has he/she received the polio vaccine?**	1 times 2 times 3 times 4 times N/A DK	1 2 3 4 97 98		
VV05	**Has the child received DPT vaccine, that is an injection given in the thigh or buttocks? (2 months, 3 months, 4 months)**			Yes No DK	1 2 → VV07 98 → VV07
VV06	**How many times has he/she received the DPT vaccine?**	1 times 2 times 3 times N/A DK	1 2 3 97 98		
VV07	**Has the child ever been given a measles injection, that is a shot in the arm at the age of 9 months or older to prevent him/her of getting measles?**			Yes No N/A DK	1 2 97 98
VV08	**Has the child received a vitamin A dose within the last 6 months?**			Yes No DK	1 2 98
VV09	**Has the child taken any drugs for intestinal worms during the last 6 months?**			Yes No DK	1 2 98

OB01	**Main materials of wall**				
	Bamboo Poles with mud Bricks with mud Bricks with cement	1 2 3 4	Wood Corrugated plates Other……	5 6 7	

ANTHROPOMETRIC MEASUREMENTS CHILD				
Age in completed months _____months.		Weight (kg) _____Kg.		Height/length (cm) _____cm.
MC01	Stunting	Normal height for age Stunted (z-score < 2 SD from median value) Severely stunted (z-score <3 SD from median value)	1 2 3	
MC02	Wasting	Normal weight for height/length Wasted (z-score < 2 SD from median value) Severely wasted (z-score < 2 SD from median value)	1 2 3	
MC03	Underweight	Normal weight for age Underweight (z-score < 2 SD from median value) Severely underweight (z-score < 3 SD from median value)	1 2 3	

ANTHROPOMETRIC MEASUREMENTS MOTHER (BMI = mass (kg) / (height (m))^2)				
MM01	Weight_____cm Height_____cm	BMI =_____.	BMI less than 16.5 = severely underweight BMI from16.5 - 18.4 = underweight BMI from 18.5 – 24.9 = normal BMI from 25 – 30 = overweight	1 2 3 4

APPENDIX 3

ETHICAL APPROVALS

HEALTH RESEARCH ETHICAL COMMITTEE
Of North Sumatera
c/o MEDICAL SCHOOL, UNIVERSITAS SUMATERA UTARA
Jl. Dr. Mansyur No. 5 Medan, 20155 – INDONESIA
Tel: +62-61-8211045; 8210555 Fax: +62-61-8216264, E-mail: komet_fkusu@yahoo.com

PERSETUJUAN KOMISI ETIK TENTANG
PELAKSANAAN PENELITIAN BIDANG KESEHATAN
Nomor: 122 /KOMET/FK USU/2011

Yang bertanda tangan di bawah ini, Ketua Komisi Etik Penelitian Bidang Kesehatan Fakultas Kedokteran Universitas Sumatera Utara, setelah dilaksanakan pembahasan dan penilaian usulan penelitian yang berjudul:

" Malnutrition And Associated Risk Factors For Children Aged 6-59 Months In Urban Indonesia"

Yang menggunakan manusia ~~dan hewan~~ sebagai subjek penelitian dengan ketua Pelaksana/Peneliti Utama: **Malfrid Kolbrek**
Dari Institusi : **Norwey**

Dapat disetujui pelaksanaannya selama tidak bertentangan dengan nilai-nilai kemanusiaan dan kode etik penelitian biomedik.

Medan, 4 Mei 2011
Komisi Etik Penelitian Bidang Kesehatan
Fakultas Kedokteran Universitas Sumatera Utara

Wakil Ketua,

Prof. dr. Harun R. Damanik, SpPD. SpGK

UNIVERSITETET I OSLO
DET MEDISINSKE FAKULTET

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Dato: 18.06.2010
Deres ref.:
Vår ref.: 2010/1367a

2010/1367a Malnutrition among children aged 6-59 months in a semi-urban community in Indonesia

Vi viser til søknad om forhåndsgodkjenning av ovennevnte forskningsprosjekt. Søknaden ble behandlet av Regional forskningsetisk komité for medisinsk og helsefaglig forskningsetikk i møtet 27. mai 2010. Søknaden er vurdert i henhold til lov av 20. juni 2008 nr. 44, om medisinsk og helsefaglig forskning (helseforskningsloven) kapittel 3, med tilhørende forskrift om organisering av medisinsk og helsefaglig forskning av 1. juli 2009 nr 0955.

Prosjektleder: Professor Akhtar Hussain

Masterstudent: Målfrid Kolbrek

Forskningsansvarlig: Universitetet i Oslo ved øverste ledelse

Prosjektet er et studentprosjekt der formålet er å studere ernæring/underernæring hos indonesiske barn (6-59 måneder) fra et semi-urbant miljø på Nord Sumatra kalt Marelan. Datainnsamlingen i studien er tredelt; spørreskjema, antropometri, observasjoner. Spørreskjema skal innhente opplysninger om forskningsdeltakeres (mor og barn) levekår, kosthold (herunder oppfatninger om kosthold), helsetilstand (herunder diaré og kunnskap om diaré/behandling av diaré, kunnskaper om kvalitet på vann, hygiene, tilberedelse av mat), helsetilstand/helseinformasjon og opplysninger om vaksinasjoner. Antropometriske observasjoner vil vurdere barn for kortvoksthet, feilernæring og lignende. Observasjoner ellers i studien omhandler særlig levekår for den enkelte mor-barn gruppen.

Forskningsdeltakerne i denne studien er barn og deres foresatte/foreldre. Rekruttering til studien skjer ved å oppsøke Det skal innhentes samtykke fra informantene i studien. Resultatene fra studien skal brukes av en lokal NGO til utvikling av helsetilbud til befolkningen i området. Alle personopplysninger i studien blir innsamlet og lagret på prosjektleders PC.

Komiteens vurdering

Dette studentprosjektet skal innhente data om barn i en særlig fattig befolkning i Indonesia med dårlig utviklet helsetilbud. Forskningsdeltakerne må regnes å være særlig sårbare og det er derfor viktig at resultater av prosjektet kommer informantene til fordel. Komiteen regner prosjektets samarbeid med lokal NGO for å ivareta informantenes interesser fordi studien kan bidra til en utvikling av helsetilbud.

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