NUTRITIONAL STATUS OF ADOLESCENT GIRLS AGED 14-19 YEARS OLD
IN SECONADARY HIGH SCHOOLS OF MANATUTO DISTRICT
TIMOR LESTE

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A Thesis Submitted in Partial Fulfilment of the Requirements

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ภาวะโภชนาการของนักเรียนมัธยมหญิงวัยรุ่นอายุ 14-19 ปี ในเขตมานาตูโต ประเทศติมอ เลสเต

นางเดเรส มาเรีย ซอร์เรส

Thesis Title   NUTRITIONAL STATUS OF ADOLESCENT GIRLS

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                            SCHOOLS OF MANATUTO DISTRIT TIMOR

                           LESTE

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Field of Study   Public Health

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เดเรส มาเรีย ซอร์เรส: ภาวะโภชนาการของนักเรียนมัธยมหญิงวัยรุ่นอายุ 14-19 ปี ในเขตมานาตู โต ประเทศติมอ เลสเต. (NUTRITIONAL STATUS OF ADOLESCENT GIRLS AGED 14-19 YEARS OLD IN SECONDARY HIGH SCHOOL OF MANATUTUO DISTRICT TIMOR -LESTE) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ.ดร. เขมิกา ยามะรัต, 101 หน้า.

วัตถุประสงค์ของการศึกษานี้เพื่อศึกษาปัจจัยพื้นฐาน (host factor) ปัจจัยที่ส่งผลกระทบ (agent factor) และปัจจัยแวดล้อมที่มีความสัมพันธ์กับภาวะโภชนาการของนักเรียนหญิงอายุ 14-19 ปีในโรงเรียน มัธยมศึกษาตอนปลาย เขตมานาตูโต ประเทศติมอ เลสเต้ 3 โรงเรียน การวิจัยนี้เป็นการศึกษาแบบตัดขวาง โดย การสุ่มตัวอย่างอย่างง่ายจำนวน 244 คน โดยการเลือกอำเภออย่างเจาะจง จำนวน 2 อำเภอ ในช่วงเดือน กุมภาพันธ์ ปีค.ศ. 2013 การเก็บข้อมูลใช้การเขียนตอบแบบสอบถามด้วยตนเอง การวัดขนาดของร่างกายโดย การใช้ส่วนสูงและน้ำหนักเพื่อการคำนวณดัชนีมวลกาย การคำนวณความแคระแกร็นจากส่วนสูงต่ออายุ การ วิเคราะห์ข้อมูลใช้โปรแกรมสำเร็จรูป SPSS รุ่น 17 และ คำนวณองค์ประกอบของอาหารที่บริโภคด้วย โปรแกรม nutrisurvey.

ผลการศึกษาพบว่าเด็กหญิงวัยรุ่น 50.8% ในเขต Manatuto มีดัชนีมวลกายปกติ (ค่าระหว่าง18.6- 25 kg./m2) 49.2% มีดัชนีมวลกายต่ำหรือน้อยกว่า 18.5 kg./m2 วัยรุ่นหญิง 75.4 % มีดัชนีความสูงต่อ อายุอยู่ในเกณฑ์ปกติ (ค่าระหว่าง - 2 Z score และ + 2 Z score) 24.6% อยู่ในเกณฑ์ต่ำหรือแคระแกร็น (ค่า เท่ากับหรือต่ำกว่า - 2 Z score) 43.4% มีระดับความรู้ด้านโภชนาการต่ำ 39.3% กินอาหารที่ให้พลังงานอยู่ ในเกณฑ์ต่ำ 31.2% ได้รับในระดับปานกลาง 24.2% อยู่ในระดับขาดสารอาหาร ซึ่งมีเพียง 5.3% ที่อยู่ใน เกณฑ์ได้รับอาหารดี 95.9% ของนักเรียนทั้งหมดได้รับประทานอาหารต่อวันน้อยกว่า 2,200 kcal และ 61.8% ได้รับโปรตีนต่ำกว่า 50 กรัมต่อวัน การศึกษานี้พบความสัมพันธ์ระหว่าง ความรู้ด้านโภชนาการ อาหาร ที่บริโภค ระดับการศึกษาของแม่ และดัชนีมวลกาย อย่างมีนัยสำคัญทางสถิติที่ 0.05 นอกจากนั้นพบ ความสัมพันธ์ระหว่างความถี่ในการบริโภคเนื้อปลาและความแคระแกร็น (ดัชนีความสูงต่ออายุ) อย่างมีนัยสำคัญ ทางสถิติ ใ การศึกษานี้เสนอแนะในมีการสร้างสื่อแก่วัยรุ่นและครอบครัว เกี่ยวกับความสำคัญของการ รับประทานอาหารที่สมดุลย์ เพื่อตอบสนองความต้องการสารอาหารของร่างกายในวัยรุ่นตอนต้น ตอนกลางและ ตอนปลาย ซึ่งมีความต้องการอาหารสูงประเภทโปรตีน และความหลากหลายของธัญพืช ผัก ถั่วและผลไม้ ให้มี การแนะนำเสริมธาตุอาหารที่หลากหลาย โดยเฉพาะธาตุเหล็ก เพื่อตอบสนองความต้องการของร่างกาย และลด การเกิดภาวะโลหิตจาง ควรมีนโยบายระดับชาติที่นำกลยุทธ์ทางโภชนาการและอนามัยเจริญพันธุ์เพื่อลดการเกิด ภาวะโลหิตจาง เพิ่มแผนปฏิบัติการณ์เพื่อแก้ไขปัญหาสุขภาพวัยรุ่น โดยเฉพาะวัยรุ่นหญิง ให้สอดแทรกอยู่ใน กลุ่มโครงการที่เกี่ยวกับสุขภาพแม่และเด็กในทุก ๆ ส่วนของประเทศ

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต...

ปีการศึกษา 2555 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก.……….....….…......

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KEYWORDS: NUTRITIONAL STATUS, BMI, STUNTING, ENERGY CONSUMPTION, ADOLESCENT GIRLS IN TIMOR LESTE

DIRCE MARIA SOARES: NUTRITIONAL STATUS OF ADOLESCENT GIRLS AGED 14-19 YEARS OLD IN SECONDARY HIGH SCHOOL OF MANATUTUO DISTRICT TIMOR -LESTE. ADVISOR. ASST.PROF. KHEMIKA YAMARAT, Ph.D.,95 pp

The objective of the study was to determine the Host, Agent, and Environment factors associate with nutritional status of adolescent girls aged 14-19 years old in three secondary high schools of Manatuto district, Timor-Leste. This research was a cross-sectional study with simple random sampling was used for 244 participants, with purposive selected at two sub-district. This research was conducted on February 2013. Data collection was done by self administrated questionnaire. Anthropometric measurement for calculation of BMI, and height for age (stunting). Data analyzed using SPSS version 17.0 and or food consumption using nutrisurvey window program. The result show that 50.8% of adolescent girls in Manatuto district had BMI with the normal healthy weight range (18.6-25 kg/m^2). 49.2% had low BMIs score $\leq$18.5 kg/m^2. 75.4% had height comparing into age a normal (-2Zscore-+2Zscore), 24.6% stunting ($\leq$ -2Z score). Nearly half of respondents (43.3%) had low knowledge level. 39.3% had low energy consumption, 31.2% had moderate consumption, 24.2% of them had deficit and only 5.3% good consumption, 95.9% had calorie intake <2200 kcal per person per day and 61.8% had daily protein intake of less than 50 gram/day.This study examined statistically significant (p value <0.05) association between, nutrition knowledge, energy consumption, mother level of education with nutritional of BMI. Also found the association between fish consumption and nutritional status of height for age statistically significant (p value <0.05). The study recommend: Create more nutrition promotion materials and provide advice to families and adolescents about the importance of eating a balanced diet to meet the nutrient requirements of early adolescents, middle adolescent and late adolescent with more consumption of animal sources and a variety of cereals, vegetable, legumes, and fruit. Consider the introduction of multi-micronutrient supplementation specific on iron folic acid to meet the nutrition requirements in reduction anemia deficiency. Policy implication of national nutrition strategy and reproductive health strategy, more in action plan to address the adolescent issues in particular of adolescent girls to be included as a target group in all Maternal and child health program in across sectors.

Field of Study : Public Health   Student's Signature…………………..………...

Academic Year : 2012   Advisor's Signature…………………….....

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LIST OF ABBREVIATIONS

BMI   Body Mass Index

ECCU   Ethics Committee Chulalongkorn University

FAO   Food Agriculture Organization

H/A   Height for Age

IDD   Iodine Deficiency Disorder

IDA   Iron Deficiency Anemia

MoH   Ministry of Health

NCHS   National Center for Health Statistic

NHD   National Health Development

PEM   Protein energy Malnutrition

RDA   Recommendation Dietary Allowance

RICI   Respiratory Infection Acute

SES   Social Economic Status

SD   Standard Deviation

SPSS   Statistical Package for Social Science

TL-NNS   Timor-Leste National Nutrition Strategy

TL-DHS   Timor-Leste Demographic Health Survey

UNICEF   United Nations International Children's Emergency Fund

VAD   Vitamin A Deficiency

WHO   World Health Organization

CHAPTER I

INTRODUCTION

1.1   Background and Rationale

The World Health Organization (WHO) defines adolescents as young people aged 10-19 years. There are approximately 1.2 billion adolescents in world and make up roughly 20% of the total world population and their numbers are increasing (WHO, 2005). Four in five of adolescents live-in developing countries and because of they often grow up in deprived situations where resources are limited they will enter to undernourished, making them more vulnerable to disease and early death. Conversely, in developed countries and in situations where poverty and deprivation are not issues overweight and obesity are more common issues in adolescents also making them vulnerable to diseases and early death later in life. Adequate nutrition, healthy eating and adequate physical exercise at this age are the foundations for good health in adulthood (WHO, 2002).

Good nutritional status is a precondition for healthy and active lives and has direct implications on growth and intellectual ability, which ultimately impacts positively on the socio economic development of the individual, their community and their country. Nutrition throughout the lifecycle from conception until adulthood impacts on human growth and development, and builds the foundation of good health now and into the next generation.

Nutritional deficiencies have far reaching consequences, especially in adolescent girls. If their nutritional needs are not met, they are likely to give birth to undernourished children, thus repeating the intergenerational cycle of under nutrition in future generations. If not broken the vicious cycle of under nutrition will result in more and more severe consequences including Protein Energy Malnutrition (PEM), Iodine Deficiency Disorder (IDD), Iron Deficiency Anemia (IDA), Vitamin A Deficiency (VAD), Folate and Calcium deficiency. In adolescence these deficiencies can result in delayed growth spurt, stunted height, retarded intellectual development, and goiter, increased risk of infection, blindness and anemia.

Poor nutritional status in situation before birth generally continues will be into adolescence and adult life and can span generations. Chronically malnourished girls are more like to delivery low birth weight babies and nutritional challenges will continue throughout the life cycle, particularly for and women (ACC/SCN, 2000). Nutritional status and poor growth in the adolescent years will affect the reproductive role of boy and girls. For example stunting and underweight among adolescent girls will continue into adulthood, and coupled whit the risk of early pregnancies result in and increased of obstetric complications, premature births and low birth weight babies and risk also for women (Gopalan, 1989). Severe under nutrition during adolescence even for short periods can have severe consequences later in life. According to one studies from University Medical Centre Utrecht, in the Netherlands. One way to break the intergenerational cycle of under nutrition is to improve the nutritional health of adolescent girl's leading up to conception. In developing countries, under nutrition in adolescents is common and is often the immediate result of inadequate dietary intakes to meet the demands of growth and development, Meals may be low in quantity, nutrient density or variety or eaten infrequently. Adolescence in developing countries are also more at risk of being exposed to communicable and non communicable disease such HIV/AIDS, diarrhoea, respiratory tract or ear infections, measles, hookworms and other gut parasites witch all contributed to the burden of under nutrition. In addition, family food insecurity, inadequate care of vulnerable household members (e.g. 'unfair' sharing of food within families), uunhygienic living conditions (e.g. poor water supplies and poor sanitation) Inadequate health services poverty, lack of information, political and economic insecurity, lack of resources at all levels, unequal status of women, and/or natural disasters, are all common underlying causes of under nutrition in many developing countries and place adolescents at greater risk of deprivations, illness and under nutrition(TL-NNS, 2004).

Timor–Leste is presently one of the countries in the Asia-Pacific region and in the world with alarming nutrition indicators. Utilising data from the Timor-Leste Demography Health Surveys (TL-DHS) in 2003 and 2009-2010, trend analysis indicates that under nutrient rates have not decreased during the last eight years and

the prevalence of the stunting, wasting, and underweight have all been on the rise. According to the TL-DHS 2009-2010, more than half (58%) children under five years of age are stunted or, too short for their age, 19 percents are wasted (a sign of acute under nutrition) and 45 percent are underweight with is a combination of stunting and wasting. According to WHO standards these rates depict a severe public health problem. Certainly, these are worrisome trends given the devastating consequences of malnutrition on physical, mental and economic development.

Under nutrition in woman can resulting increased susceptibility to infection delayed recovery from illness, and heightened risk of adverse pregnancy outcome such as preterm birth, anemia or other micronutrient deficiencies has a greater risk of obstructive labour, . According to the data from TL-DHS, 2009-2010, Twenty-seven percent (27%) of woman were found to be malnourished with a Body Mass index (BMI) of less than≤ 18,5 indicating that under nutrition among women is a serious public health concern in Timor Leste. In addition 33 percent of women age 15-19 age had a BMI of less than ≤ 18,5. In rural areas this was 28 percent and in urban areas 24 percent. If a woman is malnourished she is more likely to give birth to a preterm or small baby and this is reflected in the high rates of low birth weight babies (LBW), producing lower quality breast milk, dying from postpartum hemorrhage, and experiencing illness for herself and her baby. In Timor-Leste with 26 percent of babies born with birth weight less than 2500g and twenty one (21%) of woman an anemic (TL-DHS, 2010).

The causes of under nutrition in Timor-Leste are multi factorial and often a combination of basic, underlying and immediate causes. Food intake and health status of an individual are the most immediate causes of under nutrition In many areas of Timor-Leste food intake is often insufficient and rates of illness especially malaria, diarrhoea and acute respiratory infection, (ARI) among the under-five was 16% and 2,1% respectively. One of the main underlying causes of under nutrition in Timor-Leste is household food insecurity, including the availability, accessibility, stability and utilization of food. According to FAO, 20% of the population in Timor-Leste is considered foods insecure, with 23% are at risk of becoming food –insecure (TL-

DHS, 2010). Other issues include limited market access, poor roads and public transport systems coupled with high costs of transportation. The agriculture system is dictated by the seasons and highly dependent on rain, thus contributing to seasonality patterns in food availability. There is a hungry season in Timor during the dry season which often results in inadequate food availability and composition. Families living in the remote mountainous areas experience food shortages for the majority of the year. Many of these families consume purely monotonous staples such as rice and maize, cassava, and taro. Such consumption patterns result in inadequate dietary diversification. The quality and quantity of food consumed has far reaching implications on the nutritional status of the vulnerable population group. Other underlying causes in Timor-Leste include poor health services, lack of access toa safe water supplied, poor sanitation and the unhygienic handling of food resulting in the spread of infectious diseases. According to TL-DHS, 2009-2010, 14 percent of urban and 45 percent of rural households have no toilet facilities, and less than half of households reported hand washing after defecation.

The basic causes of under nutrition in Timo-Leste are complex and include among other things, the political economic, socio-cultural perspectives, institutional arrangements and limited human resource capacity to address under nutrition. In addition poverty, inadequate and inappropriate nutrition knowledge and skills, unemployment, inadequate distribution and utilization of services and other resources, high food prices especially for imported food commodities all contribute to the burden of under nutrition in woman, new-borns, infants and young children and adolescents in Timor-Leste. A significant determinant of health is women's education. The more educated a woman is the more knowledgeable and able she is to provide appropriate health/nutrition care for herself and her family. According to the TL-DHS, 2009-2010, 32 percent of women still are illiterate. In addition to the health risk associated with early pregnancy often result in girls dropping out of school and not complete their educations have to drop out for school. On average in Timor-Leste 7 percent of women aged between 15 and 19 are pregnant with their first child while this is highest in Manatuto district at 9 percent. This figure when compared to

countries in South Asia is quite low where about 34.2 percent women are married by the age of 18 years old, general maternal mortality are 42 percent in across all of age 15-49, but 20 percent in age 15-19 years old. The adolescent girls are the future mother of the nation. Well nourished educated girls will grow into woman facing fewer risks during pregnancy and childbearing supporting the slogan of nutrition department Timor-Leste which states "The strong children of today will be the intelligent young adolescence, the productive adults and healthy elderly of tomorrow". Why adolescent girls so important because they in second period of life and increased growth and developed, commencement of menstruation and possibility of pregnancy, they will be mother and will span generation, if they are under nutrition, will continue into adulthood, and early pregnancies will increases the obstetric risk. One way to break the intergenerational cycle of malnutrition is to improve the nutrition of adolescent girls prior to conception.

Manatuto is one of the 13 districts of Timor-Leste, located in central part of the country. It reaches both the south and north coasts of the island and it one of the most geographical divers district in Timor-Leste.It has a population of 41,527 (Timor-Leste Census, 2010) across six sub-district and 29 villages covering an area of 1,706 km^2. The capital of the district is also named Manatuto. To date there is limited data on the nutritional status of adolescent girls in this district. The findings of this study will assist health policy marker and planner prioritize nutrition programs for this area. The study aim is determine the nutritional status and factors that contribute to the nutritional status of adolescent girls in Manatuto. This study will provide base line data in to make informed decisions about appropriate nutrition interventions for adolescent girls in Timor-Leste.

1.2 Research Questions

- What is the nutritional status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste
- What are the factors contributed to nutritional status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste

1.3 Hypothesis

- There is any association between agent factors and nutritional status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor -Leste

- There is any association between host factors and nutrition status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste

- There is any association between environmental factors and nutrition status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto District, Timor-Leste

1.4 Objective

1.4.1 General Objective

- To understand the factors associated with the nutritional status of adolescent aged14-19 years old in secondary high schools of Manatuto district, Timor-Leste

1.4.2 Specific Objective

- To determine the nutritional status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste

- To determine the knowledge about nutrition of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste

- To determine the agent factor associated with nutritional status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste

- To determine the host factor associated with nutritional status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste

▪ To determine the environmental factor associated with nutritional status of adolescent girls aged 14-19 years old in secondary high schools of Manatuto district, Timor-Leste

1.5 Conceptual Framework

Figure 1: Conceptual Framework

Host factors

- age
- birth order
- living with whom
- diseases
    - malaria
    - parasite
    - dental problem
    - chronic cough
    - diarrhea
- knowledge of nutrition

Agent factors

- Food consumption
- Eating habit

Environmental factors

- Income of parents
- Occupation of parents
- Education of parents
- Number of family members
- Food affordable
- Living site
    o Urban
    o Rural

Nutritional status

- BMI (weight for height)

1.6 Operational Definition:

Host factors:

- A adolescent girl aged 14-19 years is defined as any girl born between 1 January 1994 and December 31 1999, is enrolled in secondary school in class one, two or three

- Age: refers to a respondent's age at the time of interview in 14- 19 years old. The age will be categorized into: (1). 14-15 age, (2). 16-17 years old and (3) 18-19 years old

- Birth order: refers to the respondent live birth order and classified as (1) first child,(2) second child, (3),third child, (4) fourth, (5) fifth etc

- Living with who refers to the respondent situation of living and categorize as (1). Living with parents: father and or mother in the same home, (2). living with aunt, uncle and grandparent in the same home and (3). Living in dormitory and no relative or other

- Diseases; refers to the respondents diseases status by self report if they have any malaria, diarrhea, parasite, dental problems, chronic cough in the one month prior of interview

- Knowledge: refers to the basic nutrition knowledge of respondent using a questionnaire consisting of 18 questions, if the correct answer scores 1, if either score 0. Total score is between 0-18, base on quartiles percentiles and categorized into three groups: score (1) ≤10, poor knowledge, score (2) 11-12, moderate knowledge and score (3) > 12 good knowledge

Agent factor:

- Food consumption refers to the type of food consumed respondents in the 24 hours prior to the survey and converted into units of energy (calories), protein (g), fat (g) carbohydrate (g), to determine the amount of energy consumption, protein, fat and carbohydrates. Macro nutrient intake will be calculated by using a list of food composition table and compared with

Indonesia Recommendation Dietary Allowances (RDA). The total amount of each nutrient averaged will obtain the amount of the average consumption per person per day. The nutrition level will be compared with Indonesian Widyakarya Nasional PangandanGizi (WNPG, 1998) or Depkes RI (1990). The level of consumption will categorized into four with cut of points: (1) >100% of RDA, good consumption, (2) 80-100% of RDA, adequate consumption, (3) 70% 80% of RDA, less consumption, (4) < 70% of RDA ,deficit.

Eating habits refers to the type and frequency of food that consumed by the respondent in the week prior survey including the type of food sources such cereals, animal sources, plant sources legumes, vegetable, fruit including drink and classify by:1-2 times per weeks, (2) 3-5 times per weeks, (3) 6-7 times per weeks (4) none

Environmental Factors:

- Income: refers to the father and mother income per month and will be classified as: (1) < USD$ 200, 00 (low income), (2) USD$ 200-500, 00 (middle income), (3)   USD$ > 500, 00 (high income), (4) Do not know

- Education: refers to the respondent parents (Mother and father) education level that is the highest formal education level, achieved by the mother or father by the time of interview, categorized as: No education/illiterate, elementary school, junior, senior school and diploma/bachelor degree, and categorized into: (0) = no education, (1)= elementary school, (2)= primary school, (3), secondary school,(4) = diploma /bachelor degree
- Occupation: refers to the respondent parents occupation by the time interview that categorize into (1) Employed, (2) unemployed, (3) housewife, (4) retired and (5) military and other

- Number of family members: refers to number of live family members residing in the homes at the time of interview and categorized into: (1) <6 small family (2) 6-10 middle family (3) > 10 large /big family

  Food affordable; refers to perception of respondent about family affordable to some important food such as animal sources, milk and oil, it will be categorized as: (1) Highly affordable, (2) moderately affordable and (3) poor affordable .

- Living site; refers to the respondent living area categorized as (1) urban areas and (2) Rural area

- Nutritional status: refers to the anthropometric measurement including weight and height (weight for age)which will be used to determine body mass index against WHO/CDC growth standard and classified as: (1).Thin (BMI≤18.5kg/m^2),(2) Normal weight (BMI18.6 to 25kg/m^2) and (3) overweight (BMI>25.0kg/m^2).Height will be measured using a microtiocestadiometer to the nearest 0.1 cm and weight will be measured using a seca digital, scale accurate to 0, 1 kg. Height for age classify will follow WHO Growth Standard 2007 for age 5-19 years old. The classification cut of point of Height for age are: (1) short ≤-2ZScore, (2) normal -2ZScoare to +2ZScore, (3) tall ≥+2ZScore.

CHAPTER II

LITERATURE REVIEW

2.1 Definition of Host, Agent and Environment Factor

Agent, host, and environmental factors interrelate in a variety of complex ways to produce disease. Different diseases require different balances and interactions of these three components. Development of appropriate, practical, and effective public health measures to control or prevent disease usually requires assessment of all three components and their interactions. (Scientific, 1978)

Host refers to the human who can get the disease. A variety of factors intrinsic to the host, sometimes called risk factors, can influence an individual's exposure, susceptibility, or response to a causative agent. Opportunities for exposure are often influenced by behavior such as sexual practices, hygiene, and other personal choices as well as by age and sex. Susceptibility and response to an agent are influenced by factors such as genetic composition, nutritional and immunologic status, and anatomic structure, presence of disease or medications, and psychological makeup. (Scientific, 1978)

Agent originally referred to an infectious microorganism or pathogen: a virus, bacterium, parasite, or other microbe. Generally, the agent must be present for disease to occur; however, presence of that agent alone is not always sufficient to cause disease. A variety of factors influence whether exposure to an organism will result in disease, including the organism's pathogen city (ability to cause disease) and dose. Over time, the concept of agent has been broadened to include chemical and physical causes of disease or injury. While the epidemiologic triad serves as a useful model for many diseases, it has proven inadequate for cardiovascular disease, cancer, and other diseases that appear to have multiple contributing causes without a single necessary one. (Scientific, 1978)

Environment refers to extrinsic factors that affect the agent and the opportunity for exposure. Environmental factors include physical factors such as geology and climate, biologic factors such as insects that transmit the agent, and

socioeconomic factors such as crowding, sanitation, and the availability of health services (Scientific, 1978).

2.1.1 Definition of Adolescent girls

Adolescence is the second period of life and the period of transition from childhood to adulthood. It is one of the most crucial stages of life for individuals since between the ages of 10 and 19 years, rapid physical, physiological and psychosocial changes occur. Secondary sexual characteristics begin to develop for girls with the development of breast buds as early as eight years old. Breasts develop fully between ages 12 and 18. Pubic hair, armpit and leg hair usually begin to grow at about age 9 or 10, and reach adult patterns at about 13 to 14 years. Menarche (the beginning of menstrual periods) typically occurs about two years after early breast and pubic hairs appear. It may occur as early as age 10, or as late as age 15. The average age of menstruation in the United States is about 12.5 years. Girls have a rapid growth in height between the age of nine and 14 a half, peaking at around age 12.

The World Health Organization (WHO) defines adolescents as individuals in the 10-19 years age group. Adolescence is a phase rather than a fixed time period in an individual's life. Adolescence can be divided into three periods; early (10-14 years of age), middle (15-17 year of age) and late (18-19 years of age). These periods roughly correspond with the phases in physical, social and psychological development in the transition from childhood to adulthood. While these stages are not universally accepted, and vary across different cultures and socio-economic settings, they provide a basic framework to understand adolescent development (WHO, 1993). Approximately 1200 million people or about 19% of the total population of adolescents in the world face serious nutritional problems related to the growth and development during adolescents and their lives as adults. Adolescences a critical period in the human life cycle, because during this period adolescent experience rapid physical, psychosocial and cognitive growth and development. Adolescent have increased nutrient requirements to accommodate and optimise the accelerated growth resulting in increased body weight and height accompanied by an increase in the number and size of tissue (WHO, 2002).

Nutritional intake has to meet the demands of physical and cognitive growth and development. Poor nutrition starts early in life and can span generations. Chronically malnourished young girls are more likely to remain undernourished placing them at risk of pregnancy and birth complications when they reach child bearing age. Adolescences considered a critical period of life for good nutrition because:

- Of the dramatic increase in physical growth and development demanding more macro and micro nutrients. During this period they will weight gain from 65% of the beginning of period and 40% of their final weight and their height gain will be 15% of their adult height (Brasel,1982)

- There may be socio-cultural or of lifestyle changes including and food habits of adolescents that can affect both nutrient intake and needs (Spear,2002)

- The period of adolescent can be the second opportunity to catch up growth if environmental conditions especially in terms of nutrient intake are favourable (Gopalan, 1989).

- Psychological changes and development of their own personality can impact on their dietary habits during a phase when they a very influence-able

- Growing adolescent have increased nutrient requirement when there are pregnant or ill (Scholl et al, Story et al.,1999)

    Inappropriate or inadequate dietary intake during adolescence can have several consequence including; retardation of physical growth, intellectual capacity and delayed sexual maturation (Story M, 1992). Increased risk of iron deficiency stunted, bone growth, eating disorder and obesity (CDC, 1996).Poor concentration delayed learning affecting school performance. Poor diet can also affect bone growth and density and increase the risk osteoporosis later in life. If an adolescent is overweight they are at increased risk of diabetes and heart diseases as an adult (CDC, 1996).

    There are two main factors contributing to an individual's nutritional status; first is the consumption of an adequately diverse diet that meets nutritional requirements, this is often dependent on a range of factors including socioeconomic status, food practices, culture, tradition, availability of adequate food sources. Poverty is one of the main contributing factors that

determine food consumption. According to Sendorwitz (1995) Cultural factors also can also play a strong role in determining intake of food. Hamilton at all, 1984 resources available to obtain food determine whether the calorie intakes of family and individuals are adequate. The second factor is the ability of the body to digest absorbs and utilizes the food (Chen, 1979). The ability can be delayed by infection and metabolic disorders.

2.1.2 Nutrient Requirements for Adolescents

Food is a basic human need. The human body requires nutrients contained in food for survival. Nutrients are required by the body for various purposes such as growth, maintenances and repair of tissues and to regulate metabolic processes in the body. Nutrients contained in the daily diet are used to maintain healthy body. Nutrients consist of macronutrient and micronutrients. The macronutrient consists of protein, fat and carbohydrate and micronutrient consists of vitamins and minerals. Water is also an essential part of an adequate nutrition (Fardiaz, 1990). Adolescence requires sufficient nutrients to meet the bodies' demands muscles and bone growth developing fat stores to protect the body and its organs, and to ensure healthy skin shiny hair, and hard teeth free from decay (Harper, at,al, 1986).

Adolescence is a period of intense physical and psychosocial and cognitive development. Adolescents gain up to 50% of their adult weight, 50% of their adult skeletal mass and more than 20% of their adult height during this period. Energy and protein requirements are increased because of the rapid growth and development experienced during adolescence. In addition increased physical activity combined with poor eating habits and other factors (e.g. menstruation and early pregnancy) accentuate the risk of poor adolescent nutrition (NHD, 2000). A Recommended Dietary Allowance (RDA) is the amount of each nutrient that is required from food to meet the needs of the body (Karyadi,Muhilal, 1985). A nutritional intake is affected by age, gender activity level, height, weight, genetics and health status including pregnant and lactating.

Table 1: Recommendation Dietary Allowances (RDA) for adolescent girls aged 13-19 year old (per person per day)

Age group (years)	Height (cm)	Weight (kg)	Energy (KKal)	Protein (g)	Iron µg	Calcium µg	Vitamin A re	Vitamin C µg	Iodine µg
13-15	153	48	2350	57	26	1000	600	65	150
16-19	154	50	2200	50	26	1000	600	75	150

Sources: Widyakarya National Pangan dan Gizi VII, 2004

2.1.3 Factors Affecting the Nutritional Status of Adolescent Girls

Adolescent eating habits

Eating is the behaviour of the people or group to meet their needs for food and nutrients, their attitudes beliefs and food choice. Eating habits of adolescents influenced by individual choice as well some environmental factors. Individual or interpersonal factors are: psychosocial, biological; social environmental or interpersonal e.g. family and peers. Physical environmental or community factors include school, other societal influence such as mass media, marketing and advertising and social and cultural norms (Story, 2002). The search for an identity the struggle for independence and acceptance, and concern about appearance tend to have a great impact on lifestyle, eating patterns and food intake among adolescents (Spear, 2002). Adolescent becomes more disorganized and may tend to miss their meals at home as they get order, often skipping breakfast. Adolescents spend a good deal of time away from home and many consume fast foods, which are convenient, but are often high in calories and fat. It is common for adolescents to skip meals and snack frequently.

The eating habits adolescents are greatly influenced by peers, mass media, social and cultural norms. They often lack nutrition knowledge, while the influence of the family tends to decline (Forthing, 1991; Johnston and Haddad, 1996; Spear 1996). Adolescence is a time of high vulnerability to societal and peer pressure, often reinforced by the media, as may be evidenced by conformity, among other things, in behaviors, attitudes and dietary practices (Johnston and Haddad, ibid.). While being under possible considerable pressure from the outside world to conform to current trends, in foods as in other behaviors, adolescents are in the process of adopting eating

patterns that may well form the basis of their dietary habits for much of their lives (Bull et al, 1992). Easily available, low-cost, high-fat and/or high-sugar, low-nutrient foods, such as french fries, candy, chips, or soda a commonly consumed by adolescent when they away from home and specially where limited access to healthy foods that appeal to adolescents. There is often perception that healthy, low fat, unprocessed, nutrient-dense foods (high in nutrients compared with their caloric content) are inconvenient and lack taste. Some examples of healthy snacks include fresh fruit, whole grain bread, or low fat yogurt. Adolescents often lack the knowledge regarding appropriate nutrition and the health impact of poor nutrition. Poor parental role modeling also plays a role in the food choice made by adolescents. Another factors affecting food choices for adolescent is the fear of getting fat, the desire to appear more muscular and emphasis of body image often resulting in disordered eating patterns (CDPH, 2012). Consequences of poor eating habits or inappropriate dietary habits increase the risk and/or incidence of chronic disease among adolescents. Of great concern is the increasing rate of obesity and obesity-related health risks, such as diabetes and cardiovascular disease in developing countries and more recently some less developed counties.

Cultural factors often influence one's food choices and preferences. People from different cultures may also view body weight differently. For example, some cultures may see excess weight as a sign of social status and health. Culture and traditional practices also create food taboos affecting diet especially during pregnancy and infancy. For example some cultures traditionally use herbal supplements and teas during pregnancy. These are not regulated and are not routinely recommended for use.Some cultures may also practice "good/bad" and/or "hot/cold" labeling of foods. According to this belief, certain foods cannot be eaten at certain times of the day or during a specific life stage. Cultural influences are not limited to one's ethnic background. They can include religion, social and economic status, and where one was raised or currently lives (urban, rural, or sub-urban lifestyle). Adolescents also have their own culture that can strongly influence their food choices, especially away from home.

2.1.4 Nutritional Consumption

Food consumption is the amount of food eating by person or group with a particular n propose. There are three factors that influence food consumptions; type and amount of food production and availability, level of income and nutrition knowledge

Food consumption method used to defend nutritional status of individual or grouped. In general food consumption is way to know the eating habits, describe level of nutrition intake, individual, group, household level and factors that affected of food consumption. Food consumption assessment can be accessed quantitatively and qualitatively. Qualitative assessment to determine the aspect related to food habits of then person or public included food frequency (Riyadi 1995). The assessment of qualitative methods including as: food frequency method, dietary history method, phone methods and food list methods (Supariasa, 2002). Quantitative assessment can be complete using a various method to determine the amount of food consumption can be calculated nutrient used foods list in food composition table and compared to a Recommendation Dietary Allowances (RDA).The quantitative method is include: 24 hours food recall, estimated food recall methods, food weighing methods etc (Supariasa,2002). A person condition will influence

The level of consumed; the level of consumption will be influenced by the qualities and quantities of food consumed. The quality of meals will determine the diversity of meals. Quantity of the meals will show the amount of each nutrient in the composition of the meals. If meals can meet optimal quantity and quality according to a person needs state of good nutrition will be reached (Sedieotama, 1987).

To classify the level of food consumption in groups, household and individual can be categories based on the cut of point guidelines Dep-Kes RI, 1990 as follow: good level of consumption > 100% nutritional adequate rate, middle level of consumption in between 80-90% nutritional adequate rate, moderate level of consumption 70-80% and <70% deficit.

The manual calculate individual nutrient requirement using 24 hours form recall, list type and quantity of all food that consumed and calculate the amount of food gram and calorie and compared with recommended dietary allowance (RDA) by follow calculation formula:

RDA= Actual body weight

_____ x Energy (calorie)

Standard weight

Where:

Actual weight =Actual weight based on the results of the weighing (kg)

Standard weight   = Weight reference standard (kg)

RDA   =Recommended Dietary Allowance

Energy (calories)   =Energy standard based of RDA (Supariasa, 2001)

Human body need food for survival, food consumed consisted of essential nutrients and provides energy to the body. The energy production consistent calorie, energy that enters the body must unit's kcal. Carbohydrate, protein and fat is sources of energy, Carbohydrates are needed as much as 60-75% of total caloric needs. Proteins needed as builder substances much as 10-15%, while fat is needed as much as 10-20% of total caloric needs. In addition, the vitamins and minerals that are found mainly in vegetables and fruits are also needed in the growth and development (Almatsier, 2001).

2.2 Malnutrition or Under Nutrition

Malnutrition is a condition that results from an imbalance of nutrients. Malnutrition is a medical condition caused by an improper or an insufficient diet (Nikolaus K, 2001). Malnutrition is technically a category of diseases that includes: under nutrition, obesity and overweight and micronutrient deficiency among others (WHO, 2012). People who are under nutrition or protein–energy malnutrition (PEM) consume too many calories resulting in over nutrition (Waterlow, 1972), or have abnormal nutrient loss (due to diarrhoea or chronic illness), (Zubin at.al, 2009). In

many parts of the word especially developing countries malnutrition is present in the form of under nutrition which is caused by a diet lacking adequate calories, protein and micronutrients. While malnutrition resulting in under nutrition is more common in developing countries. Malnutrition also presents in industrialized countries. In wealthier countries malnutrition is more likely to be caused by consuming unhealthy diets made up of in excess energy in the form of fats and refined carbohydrates. The emerging issues of obesity is now becoming a major public health concern in low socioeconomic groups' and developing counties as well. Malnutrition resulting in under nutrition occurs when people do not eat or absorb enough nutrients to cover their needs for energy and growth or to maintain a healthy immune system.

Under-nutrition is mainly a consequence of inadequate diet and frequent infection, leading to deficiencies in calories, protein, vitamins and minerals (WHO, 2000). Underweight children are at increased risk of mortality from infectious illnesses such as diarrhoea and pneumonia. The effects of under-nutrition on the immune system are wide-ranging, and infectious illnesses also tend to be more frequent and severe in underweight children. A child's risk of dying from under-nutrition is not limited to those children with the most severe under-nutrition (Australian B.S,2003).There is a continuum of risk such that even mild under-nutrition places a child at increased risk. Mild and moderate under-nutrition are more prevalent than severe under-nutrition and so much of the burden of deaths resulting from under-nutrition is associated with less severe under-nutrition (Australian B.S, 2003).

The World Health Report 2002 concluded that 50–70% of the burden of diarrhoeal diseases, measles, malaria and lower respiratory infections in childhood is attributable to under-nutrition (WHO, 2000). Chronic under-nutrition in the first two to three years of life can also lead to long-term developmental deficits (NHMRC, 2003). Among adolescents and adults, under-nutrition is also associated with adverse pregnancy outcomes and reduced work capacity. Underweight was estimated to cause 1 in 15 deaths globally in 2000 (WHO, 2000). Since almost all deaths from under-nutrition occur among young children, the loss of healthy life years is even more substantial.

2.3 Causes of Malnutrition (Under nutrition)

The causes and consequences of malnutrition are complex and multifactorial. Interventions to address malnutrition need to be targeted to address the specific causes and these may be different from place to place. It is important to understand that malnutrition results from a variety of factors not only luck from food. Based on the UNICEF Conceptual Framework, 1990, the causes of malnutrition are divided into immediate, underlying, and basic causes.

Figure 2: UNICEF Conceptual Framework on causes of Malnutrition
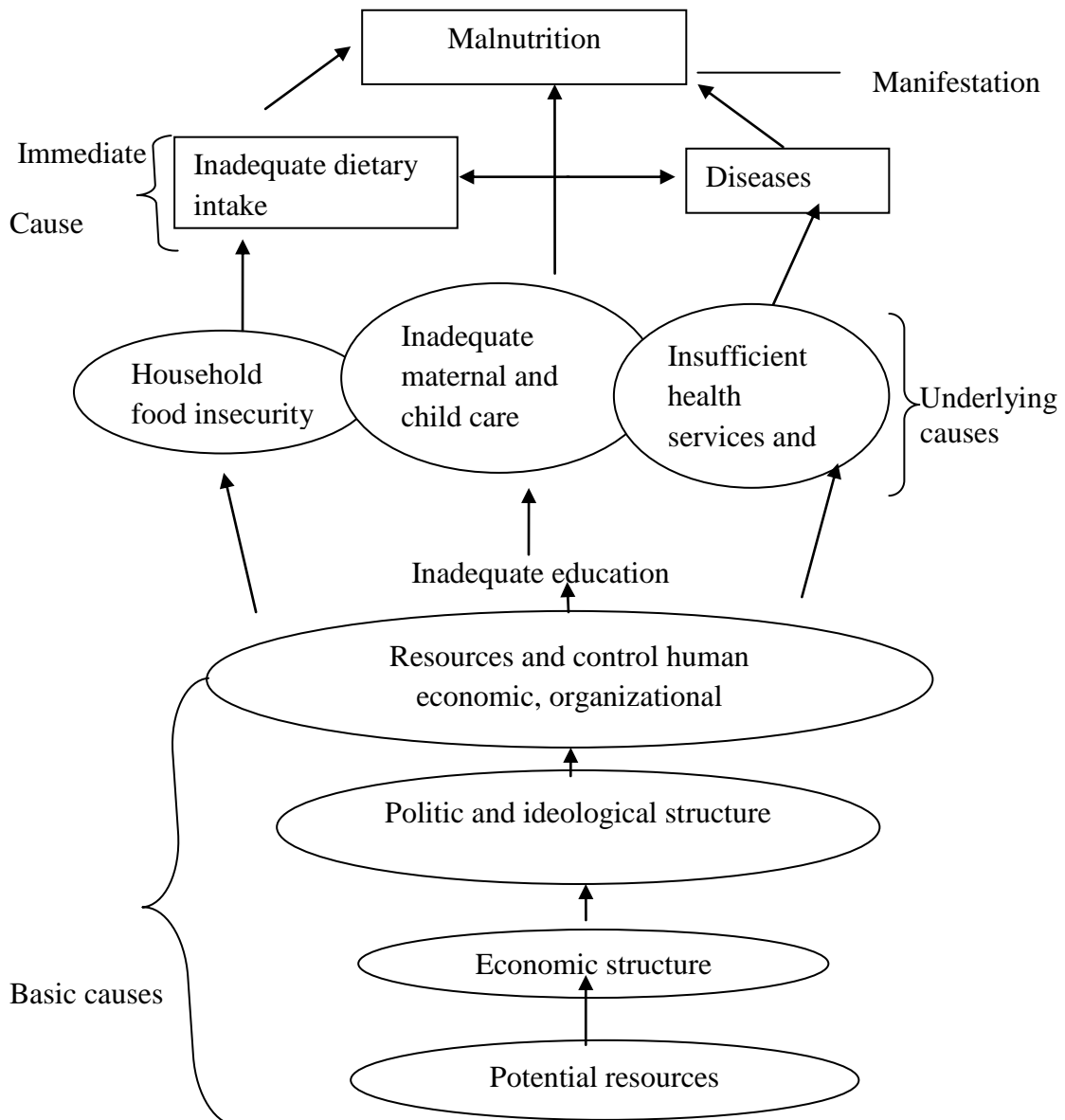
Immediate causes

The immediate causes of under nutrition are a lack of dietary intake or diseases. Inadequate dietary intake as a result of both food availability and access to food at the household or individual level can result inpoor diets. Meals may be low in quantity, nutrient density or variety or eaten infrequently. Inadequate dietary intake includes the following: the quantity of consumed does not provide enough calories or energy. The quality of the diets is adequate in terms of macro or micronutrients (e.g. protein, fat vitamins and minerals). The frequency of food consumptions inadequate for example small children have limited stomach capacity and small thus they have to eat small amounts more frequently.

Disease, particularly HIV/AIDS, diarrhea, respiratory tract or ear infections, measles, hookworms and other gut parasites can affect dietary intake and nutrient absorption. A child who is sick is more likely to become malnourished. For example, measles has the effect of rapidly depleting the bodies stores of vitamin A, thus children with measles are at high risk of developing vitamin A deficiency. On the other hand, children who are Vitamin A deficient are more likely to get infections. Thus it is often a combination of both disease and malnutrition.

Underlying causes

The underlying causes of malnutrition include insufficient access to food, inadequate maternal and child-care practices, poor water/sanitation and inadequate health services like; family food insecurity, inadequate care of vulnerable household members (e.g. 'unfair' sharing of food within families, unhygienic living conditions (e.g. poor water supplies and poor sanitation), and inadequate health services. Underlying cause occur at the level of the household and the community. The food-related underlying cause includes inadequate household food security or access to food. The health-related underlying causes include the household's access to health services and adequate environmental health conditions. Care refers to the social environment, within the household and local community and its impact upon

nutrition, with particular regard to vulnerable groups, such as women, children the elderly, TB or AIDS patients, etc.

Basic causes

The basic causes of malnutrition occur at the national or international level and relate to the quantity and quality of resources available, who controls them and who uses them. There are three main types of resources:

- Human resources, which incorporates people's knowledge, beliefs, skills, physical health and nutritional status etc;
- Economic resources which comprise income, assets, food, time etc,
- Organizational resources which at a community level may include alternate caregivers or community support for care (e.g. crèches). At the national level, the health infrastructure is an organizational resource. Formal and non-formal institutions at all levels are organizational resources.

Political, legal and cultural factors also impact on the nutritional status of any given population. The political ideology of the ruling government and their commitment to preventing malnutrition and its underlying causes affects all people. Famines, for example, are not just related to lack of food but often have underlying political and social elements. It is believed that famines do not occur in democratic countries with a free press, because the elected government has a 'political contract' with the people that prevent famines from occurring. This may be embodied in the laws of that country, which trigger particular actions following a crisis. Internationally there are provisions and principles embodied in international human rights law that uphold fundamental human rights, and international humanitarian law that governs humanitarian action and asserts the right of populations to protection and assistance (TL-NNS,2004).

Situations of war and conflict also impact on the nutritional status of communities. A rapidly changing social and political arena often characterises situations of war and insecurity. New networks may develop based on political

alliances in places of traditional links based on economic and social interdependence. New leaders emerge who may be less accountable than traditional leaders because their power comes from external factors such as wealth or arms rather than from the support of the population they claim to represent. The marginalisation or oppression of particular social or ethnic groups can be the root cause of their nutritional vulnerability. Note that war disrupts state institutions thus civil society breaks down resulting in a much broader effect on health and nutrition.

According to the UNICEF conceptual framework,1990, the three level causes of malnutrition (immediate causes, underlying and basic causes) related with study epidemiology nutrition conceptual framework factors such as, agent, host and environment factors in conceptual framework of this study, the agent and host is an immediate cause such as inadequate dietary intake and disease. Environmental factor are related with underlines and basic causes such as household food insecurity, education, and socioeconomic that will affected nutritional status.

2.4 Consequences of malnutrition (Under nutrition)

The main consequences of malnutrition throughout the   lifecycle include common nutritional disorders like Protein, Energy Malnutrition (PEM), Iodine Deficiency Disorder IDD, Iron Deficiency Anemia (IDA), Vitamin A Deficiency (VAD),folate, calcium deficiency (NHD,WHO)

- In pregnant and   lactating women the main consequence of malnutrition include   insufficient weight gain in pregnancy and maternal anemia placing woman at greater risk of mortality, infection and given birth to premature or low birth weight baby who is at greater risk of dying
- Poor nutrition in pregnancy can damage the fetus causing growth and development retardation and placing the neonate at greater risk of under nutrition and death from low birth weight, brain damage and still birth
- Malnutrition in infants and young children can cause growth and developmental retardation increased risk of infection, high risk of death, goitre, blindness and anemia

- Malnutrition in adolescents can cause a delayed growth spurt, inadequate bone mineralization, stunted height, delayed/ intellectual development and increased risk of infection, death, goitre, blindness, and anemia
- Malnutrition in adults can cause thinness, lethargy, obesity, heart disease, diabetes, cancer hypertension/ stroke and anemia.

2.5 Risk Factors of Malnutrition (Under nutrition)

Malnutrition occurs throughout the world; however a number of geographic and demographic groups are at increased risk of becoming malnourished. Overall, individuals who reside in developing countries are more likely to suffer from malnutrition than those who reside in developed countries, due to the higher prevalence of poverty and infectious disease in developing nations. However, there are a number of factors which may predispose an individual to malnutrition, regardless of their area of residence. These include:

- Poverty individuals from low socio-economic backgrounds and particularly those living in poverty are more likely to be malnourished than individuals from higher socio-economic classes. This is most often primary malnutrition a result of food insecurity (being unable to access adequate sources of nutrition to meet the body's daily demands). Secondary malnutrition (stemming from infectious disease) is also more prevalent in situations of poverty due to overcrowding and poor sanitation which increases the risk of infection and contributes to the increased incidence of malnutrition amongst the poor.

- History of recent infectious and parasitic disease, in particular diarrhoea, malaria, or intestinal worms predisposes an individual to malnutrition and these conditions reduce the proportion of nutrients which the body is able to consume;
- History of recent surgery, particularly surgery involving the gastrointestinal system may increase an individual's risk of malnutrition.

- Medications: A number of medications, for example medications used in chemotherapy, can reduce an individual's appetite or lead to eating difficulties (e.g. difficulty swallowing) and therefore predispose an individual to malnutrition.

- Infectious diseases for example HIV is often associated with reduced appetite and food consumption (usually resulting from toxic medication regimes) which in turn causes malnutrition.

- Tooth decay and periodontal disease may also result from a combination of poor oral hygiene and poor eating habits. Currently dental problems are more widespread in industrialized countries than developing countries. Education on dental hygiene and health and fluoridation of drinking water and toothpastes, and to a certain extent the use of sugar substitutes, are contributing to a reduction in numbers of cavities, filled and missing teeth. However, in developing countries, dental health may deteriorate rapidly as a consequence of dietary changes and will impact also to eating food (WHO 1994). It is also important to note that tooth loss affects general health and is considered to be a risk factor for malnutrition (Musacchio et al, 2007). People without teeth have difficulty in chewing foods with dentures and this can result compromised nutritional status. In turn poor nutritional can affect oral health. A diet high in refined sugar and acid decays teeth which in turn affects nutritional intake.

2.6 Review of previous studies or risk factors

Host factors are personal characteristics that are influenced by the type, intensity, duration and response of one's exposure to an etiology agent. Age, ethnicity sex, socioeconomic status eating patterns exercise, behavior and lifestyle are example of host factors. Some personal characteristic such as age sex and ethnicity are not modifiable. Characteristic that can be changed included nutritional status, leisure time activity, geographic, location and occupation. These modifiable host characteristic can be considered environmental factors. Environmental factors are external factor that

encompasses an agent and a host. Environmental factor may have a multiple levels such as low, middle and high socioeconomic status (SES).

A food consumption pattern survey in Bangladesh and India showed that the diet of adolescents is deficient in all nutrients. In addition to the impact on growth and development, eating practices placed adolescents at greater risk of a number of immediate health problems, such as iron deficiency, under nutrition, obesity and long term bone implications such as poor bone health. The authors reported that low educational level of parents and low family income contributed to the poor nutritional intake of the adolescents

A study examining the nutritional status of adolescent girls from rural communities of Tigray in- Northern Ethiopia found that the prevalence of stunting and thinness were 26.5% and 58.3%, respectively. Lack of latrine facilities were significantly associated with stunting (p = 0.0033) and thinness (p <0.0001).

One study examining in India found that prevalence of under nutrition were common among the girls in the late adolescent group, the higher prevalence was found in Hindus, those who lived joint with family who had low monthly income and in families of seven or more.

According to Stratton (2007) the causes of malnutrition are multifactorial. And factor-factors include geographic location affecting access to shops and increasing frailty contributing to difficulties in preparing and cooking meals (Thomas and Bishop, 2007).Poverty and deprivation both have a significant bearing on the development of malnutrition, particularly in older people (Barker, 2006).

Various studies have shown the correlation of body image and knowledge of balance nutrition toward the nutritional status of students at Jayapura (2012) A significant association variables of knowledge of balance nutrition with nutritional status according to BMI (p =0.005). Lack of knowledge about the kinds and amounts of food needed for good nutrition is one of the main causes of inadequate food intake and consequent under nutrition

Many authors describe two main types of malnutrition of great prevalence in the world:

- low weight-for-height (wasting or thinness) and;
- low height-for-age (stunting or shortness)

Stunting is much more prevalent than wasting. Stunting is associated with limited availability of foods, maternal illiteracy, and low income. Wasting is associated with mainly low immunity, high prevalence of infection, and warfare.

Environmental factors considered in studies on stunting are normally related to family income and maternal schooling and, in some of these studies, paternal schooling, and insertion of the head of the household in the job market, parity, and housing conditions are all environmental factors affecting stunting. The influences of genetic factors in determining final height must be considered when the nutritional factor is not important. In developing countries, studies have shown that environmental factors are important in determining the status of the population, and are mainly related to socioeconomic status of communities.

Availability of household food from self production and market in households, play important role and will influence the nutrient intake of each member of the family (Soekirman, 2000). If the amount of food the family has is not sufficient then the risk of malnutrition is high and malnutrition will increase. This leads to a state deteriorating health and declining productivity (Harper et al, 1986).

According to Suhardjo, 1989 uneven household food distribution, knowledge of nutrition and food educational level including food taboos and superstition are all key determinants of food intake.

The level of education in particular and maternal education and has a significant effect on the quality of the food consumed by a household. Knowledge of nutrition has a effect on attitudes toward meals planning and food preparation. The higher the mother's knowledge the better the consumption of energy, protein and iron by the family is (Birowo, 1989). It has been proposed that the level of education of household head, directly Orin directly determines a domestic economic condition which in turn greatly affects family food consumption and the level of the wife's education affects the family economy and choice and preparation of food.

Kusmadi, 1994 notes that education influences behavior, particular of those responsible for choosing foods. Nutrition knowledge plays an important role in the

use of good food in order to achieve adequate nutritional status. Persons that have higher nutritional knowledge will select type and good food for consumption (Sedioetama, 1999).Families with low educational background are also unable, unwilling, or does not believe the importance of using health facilities will support the growth and development of their children, to achieve optimal nutritional status as well. (Supartini, 2004).

A study and Nepalese school children showed that fast foods (ready to eat snack chips etc) where preferred by more than two-three of adolescent, advertising, probably TV and magazines, influence preferences in 80% of Nepalese students (Sharma,1998).

In Timor-Leste most of nutrition status affected for children under five. TL-DHS 2009-2010 show that 58% of Children under five a stunting, o, to short for the age, 19 percents are wasted and 45 percent are underweight with combination of stunting and wasting. The three levels according to WHO standard depict a severe public health problem. The most cause is inadequate and inappropriate nutrition knowledge, education that impact to feeding practice, diseases , water and sanitation ,utilization of services, food security socio-economic and politic. Stunting, wasting and underweight all most found in rural area compared to urban area. The TL_DHS, 2009-2010 collection information on the height and weight of women in reproductive age group on nutrition status are presented height and BMI. The height of women is associated with past socioeconomic status and nutrition during childhood and adolescent.

Birth order, one's position in the age hierarchy of siblings in the family, is mainly used to explain differences in sibling outcomes. Birth order the impact of a person's birth order is often underestimated as a significant factor in identity formation. The environment at home impacts on child development and birth order can influence how a child is treated by parents and siblings. Our birth order impacts how we are perceived by our families and can relate to the amount of responsibility, independence and support we are given as children. In general, first-born children are typically independent, trailblazers, with the propensity to be anxious or dominant. They have also been shown to be higher achievers, more conscientious and more patient.

Second-born siblings are more open to new experiences and demonstrate more rebellious tendencies (Healey & Ellis, 2007). The 'middle child syndrome' is popularly characterized by children who might be lacking in identity, trying to please others with no defined goals or vying for attention from their older and younger siblings. However there is little truth to this idiom, in Kimberley's opinion. Middle children can be influenced by their elder siblings, and have increased social opportunities with younger and elder peers. One study of 794 adult middle-born revealed no reduction in relationship quality with their family members. They did not preference friendships over family relationships any more than other birth orders (Pollet, Nettle, 2009). Children born last in line typically gain more attention within the family; however they may display more immature and dependent characteristics than their elder siblings. On a positive note, they have been shown to be more agreeable and warm (Saroglou, Flasse, 2003).

2.7 Nutritional Status and Measurement

Nutritional status is state of the body an affected by food intake and nutrient in the food. Nutritional status assessing by using anthropometric. Anthropometric is the size to measure the human body (Jelliffe, 1966). Anthropometric indicator a Weight for age (W/A), Height for Age (H/A) and weight for height W/H and, Upper Arm Circumference by Age, and base on WHO/NCHS standard. Assessment of nutritional status can be related with age:

- Age the important role to determine nutritional status if the age is incorrectly can be effected wrong interpretation of nutrition status.
- Body Weight is the one of the measure scale to describe picture of the body tissues, body weight is very sensitive to sudden changes, either because of illness or decreased food consumption. Body Weight expressed as index weight for age
- Height function is given a view of state of growth and will identified or see condition as a short or stunting, thin or wasting. Height index expressed in terms of height for age(H/A) or weight for height (W/H)

- Weight and height are one of the important parameters determining the health status of the peoples specific in associated with nutritional status

- Body Mass Index (BMI) is statistical measurement that is indicative of fat in the body in correlation with the height and weight of the person. The BMI of a person signifies if he is underweight, normal, overweight, or obese. The Body Mass Index (or BMI) is a way of seeing if weight is appropriate for height. Body mass index is the weight of a child or adult in kg divided by their height in meters squared: Weight (kg) or /(Height in cm)

  The diagnostic criterion for defining stunting in adolescents is a height-for-age less than the third percentile of the reference data or less than -2 Z-score. Under nutrition or thinness in adolescence is indicated by a body mass index (BMI, weight/height 2) less than the fifth percentile of the NCHS/WHO reference data (WHO, 1995). A BMI greater than the 85th percentile in adolescence is indicative of a risk of overweight.

Table 2: BMI classification and cut of point

Classification	Cut of point
Thin	<18,5
Normal	18.5 -25
overweight	>25,0
Pre-obese	25- 29,99
Obese	>30

Source: Adapted from WHO, 1995, WHO, 2000 and WHO 2004

Anthropometric index Height by Age, Used to monitor the linear growth of adolescents, this index allows evaluation of height distribution by age group and gender. The height measurement is compared to the benchmark values for the population by the corresponding age and gender, while the growth diagnosis is given through a percentile and Z score. The cut-off points defined by the World Health Organization (WHO) in 2007 are presented in Table below

Table 3: Classification Height for Age of Adolescent between 10-19 years old and cut of point

Nutritional status	Cut of point	
Short height for age	> percentile 0,1	>-ZScore-3 and >-ZScore-2/ -3 to -2SD
Normal	>-percentile 3	>-Score – 2 / -2 to +2SD
Tall	>+percentile 3	+ 2 Z Score/ >+2SD

Sources: WHO, 2007.

CHAPTER III

METHODOLOGY

3.1 Research Design

The research was cross-sectional study. Use quantitative method to examine anthropometric status (height, weight and BMI). Cross-sectional can help to assess the knowledge, nutrition status of adolescent girls in secondary high school in a specific time

3.2 Study Area

The study areas included one government secondary high school (Secondary high school of Kay-Rala) in Manatuto sub-district and two private secondary high school (Secondary high school of Santo Antonio in Manatuto sub-district and Dom Basilio secondary high school in Laclubar sub-district). In Manatuto district there are six sub-districts but only two sub-districts have secondary high school, hence the study was selected all three secondary high schools in Manatuto district. The secondary high school of Santo Antonio and secondary high school of Kay-Rala in sub-district Manatuto were located in urban areas and the secondary high school of Dom Basilio in Sub-district Laclubar were located in rural area an approximately three hours from Manatuto.

Figure 3: Study area

Sources:www.clicktimormapping.comwhere is-Manatuto(7,th October'2012)

3.3 Study Population

The study was conducted amongst adolescent girls aged 14-19 years old in grade one to three of the three secondary high school of Manatuto districts. The number of population of female students in the three targeted secondary high schools of Manatuto district is based on the information from Education management information system from Ministry of Education by elective year, Manatuto District, 2011-2012) provided in the table below:

Table 4: Data Information student girls in Manatuto

Institutions	Number of student female
1. Secondary high school of Santo Antoni, Private school	195 female from grate 1 to 3
2. Secondary high school of Kay-Rala,Governement school	195 female from grate 1 to 3
3. Secondary high school of Dom Basilio, Private school	109 female from grate 1 to 3
Total	499 of students girls

Sources: EMIS, Ministry of education, 2011-2012

3.4 Sample Size

According to the Manatuto Ministry of Education data, sample for the target study will calculate using the Taro Yamane for appropriate sample size

$$n = \frac{N}{1 + N (e)^2}$$

Where:

n = Sample size

N = Population size

e= Level of precision require, the value of 5%

Therefore;

$$\frac{499}{1 + 499 (0.05)^2} = 222$$

With estimate 10% as the missing data into account, 244 respondents were required for this study, therefore approximately 244 respondents was interviewed in this survey.

3.5 Sampling Technique

Sampling used a purposive selection of two sub-districts, Manatuto sub-district and Laclubar sub-district and divided into three schools. Total of 81 respondents was random and selected from grade one to three with 27 students selected from each grade in the first secondary high school of Santo Antonio. A total 82 respondents was random and selected from the second secondary high school of Kay-Rala, 27 students was selected from grade one, 28 from grade 2 and 27 from grade 3. A total of 81 respondents was random and selected from secondary high school of Dom-Basilio, 27 was selected from grade one, 30 from grade two and 24 from grade three. Per each class was selected random according to the number that was selected from students register book. The participant that was selected, divided into two or three, and star with data collection procedure

The sample respondent follow table 5: below:

	Urban area		Rural area	
Classes	School of Santo Antonio Manatuto	School of Kay-Rala Manatuto	School of Dom BasilioLaclubar	Total
Grade 1 (14-19yrs)	27	27	27	81 students girls
Grade 2 (14-19 yrs)	27	28	30	82 students girls
Grade 3 (14-19 yrs)	27	30	24	81 students girls
Total	81 respondents	82 respondents	81 respondents	244 respondents

Figure 4: Summarizes the sampling methodology:

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                    ┌─────────────────────────┐
                    │   Manatuto District     │
                    └─────────────────────────┘
                       ╱                    ╲
                      ╱                      ╲
            ┌──────────────┐        ┌──────────────┐        Purposive
            │  Manatuto    │        │  Laclubar    │  ──────────────►
            └──────────────┘        └──────────────┘
Selected      ╱         ╲                  │
             ╱           ╲                 │
   ┌──────────────┐ ┌──────────────┐ ┌──────────────┐
   │ School of SA │ │ School of KR │ │ School of DB │
   │    (81)      │ │    (82)      │ │    (81)      │
   └──────────────┘ └──────────────┘ └──────────────┘
          │                │                │     ──────────►   Random
   ┌──────────┐     ┌──────────┐     ┌──────────┐            Sampling
   │ Grade 1  │     │ Grade 1  │     │ Grade 1  │
   │ 27 ┌──────────┐│ 27 ┌──────────┐│ 27 ┌──────────┐
   │    │ Grade 2  ││    │ Grade 2  ││ 30 │ Grade 2  │
        │ 27 ┌──────────┐│ 28 ┌──────────┐│    │ Grate 3  │
             │ Grade 3  │     │ Grade 3  │     │ 24       │
             │ 27       │     │ 27       │
```
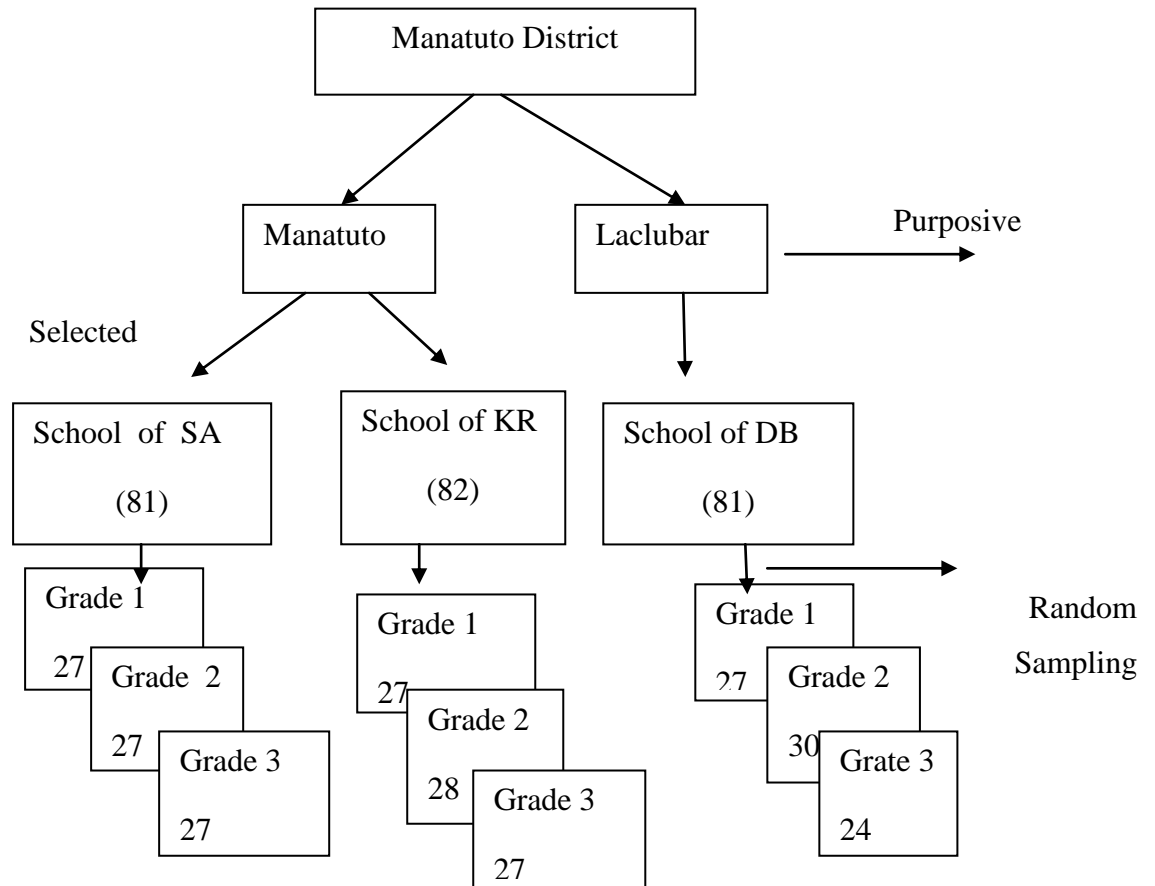
The Inclusion and exclusion criteria as follow.

Inclusion criteria	Exclusion criteria
Female 14 - 19 years old Willingness to participate in study	Those who are not present at the time of data collection

3.6 Measurement Tools

- Structure questionnaire was divided into 6 parts: social economic status, knowledge about nutrition, diseases status, food consumption and eating habit and anthropometric measurement of nutrition status, family income, education, occupation, and number of family member.
- Social economic status information, knowledge about nutrition and status of disease was fill by respondent and the anthropometric measurement and 24 hours food consumption was interview and recorded by researcher team

- Food consumption photo and the cooking equipment (plate, glass, cap spoons) such as scale to know the amount of the food consumption

- Knowledge part was determine 18 questions of true, false and do not know with score for correct answer is 1 and score for incorrect answer is 0. The score are varied from 0-18 point based on quartile and classified into 3 levels as follow: (1) $\leq$ 10 score low knowledge, (2) 11-12 score moderate knowledge and (3) >12 score good knowledge

- The questionnaires was developed in English and translate to tetum, and was check by expert in Ministry of Health in health promotion section

- Food consumption part was recall dietary intake 24 hours using form recall and combined with the suggested amounts of various food groups (food composition table) and compared with Recommendation Dietary Allowance (RDA). All of type and food gram consumed by respondent entry to nutrisurvey window program based on time consumed breakfast, snack, lunch, snack and dinner. After entry all of that data will come out with nutrient requirements of energy calorie, protein, carbohydrate, fat, and vitamins and minerals. The result of consumption compared into level of consumption was categorized into: (1) good consumption > 100%, (2) moderate consumption 80-99% (3) less consumption 70-79% (4) deficit < 70%,

- Using Nutrisurvey windows program for food consumption analyzing. The process of data analysis by was entered all information on food consumed during 24 hour by type the age of respondent, amount food, quantity and the type of the meals and the result automatically come out with result of energy calorie, and all nutrients requirement and the result were entry per each respondents code

- Eating habit part was collected information of type and frequency of food recall during one week and list all of food sources as such cereals, animal sources, plant sources legumes, vegetable, fruit including milk using check

list from and will classify by: 1-2 times per weeks, (2) 3-5 times per weeks, (3) 6-7 times per weeks, (4) none.

- For anthropometric was measure weigh (accuracy 0, 1 kg) using Seca digital and height using microtoice (to the next 0.1 cm) and referred to BMI (Height for weight) calculation.

- Weight for height will classify: Thin if the (BMI<18.5), Normal weight for height if (BMI in between18.6 to 25) and overweight if (BMI>25.0)

- Height for age classify will follow WHO Growth Standard 2007 for age 10-19 years old. The classification cut of point of Height for age are: (1) short <-2ZScore, (2) normal -2ZScoare- +2ZScore, (3) tall >+2ZScore

3.7 Validity and Reliability

3.7.1 Validity test

The content of questionnaires was checked by three nutrition expertise and concerned professionals to ensure content validity

3.7.2 Reliability test

After validation questionnaire was tested for reliability and was trial with 30 students in secondary high schools in Dili, Timor- Leste amongst in different population, of the study subjects interviewed for adjusted to obtain reliability. Kuder-Richarson (KR-20) was use to measure reliability of knowledge part. Reliability re-test again and test by Kuder- Richardson (KR-20) score obtained for knowledge level was 0.78.

3.8 Data collection

This research was conducted on February 2013. The data collection was conducted in school, after gaining approval from Ethics Committee of Timor- Leste. Three people were recruited for data collection including supervisor before starting the data collection. The researcher was requested to Manatuto district public health nutrition officer to initiate an appointment with head of District administrator and director of education institution to get permission and share some secondary data. Researcher was conduct training and standardize equipment with cooking set scale (e.g. 100 grams of rice, 1 glass of tea or milk and 1 spoon sugar or coffee ect), and

the instruction how to fill the questionnaire and anthropometrics measurements to the team research during one and half day. The three researcher team those are nutritionist background and public health working in national hospital and district and Ministry of health. Researcher and team started data collection in the field and explained the objective of the study. Researcher and team discussed with teacher and follow the student register book for random selected respondent and informed consent form for respondent and parents. The respondent and parents requiring reading information sheet before sign in the form consent, before the questionnaire distributed to the target respondent. The process of data collected, based on the data we divided respondent to three classes follow the number the collected one day before, after that researcher team explain the objective of research and how to fill the questionnaire. Respondents fill the questionnaire by them self with team accompanied, and after the completed the questionnaire, research team was measure weight and height of participants. Regarding to 24 hours food recall, respondent fill them self what they are eaten during 24 hours and the quantity and amount of food base of the equipments and the picture that we showed. The research team accompany per each respondent to make sure their complain on food recall.

3.9 Data Analysis

Food consumption was analyzed by computer program nutrisurvey for windows- SEAMEO-Tropmed., by type age of respondent, type and amount of food and automatically the result of consumption come out with RDA percentage. All of data entries in excel sheet and copy to SPSS program. Data were analysed using SPSS version 17.0. Descriptive statistic such as frequency, percentage, mean, maximum, minimum and standard deviation was used and describe all of variables. The analysis was performed based on the following data types: 1. Univariate Analysis: analyze the variables that exist in descriptively by calculating frequency distributions and the proportion to know the characteristics of the study subjects. 2. Bivariate Analysis: Chi square used to determine the relationship between the independent and dependent variables with level of significance 0.05.

3.10 Ethical Consideration

- Researcher was get agreement to follow the guidance of Chula Ethic Consideration Committee of the proposal needs to elaborate revise as follow: state inclusion and exclusion criteria, no provide meal for students at school, state result and validity and reliability testing, and need research assistant and their qualifications 24 hour food recording need elaborate in researcher proposal.

- The study proposal and questionnaire was submitted to Ethical committee of the National Institute of Research, for review and approval before the study start

- Researcher was get an approval letter from National Institute of Research, Ministry of Health Timor-Leste and Local Authority before start the study on 28 of January 2013

- Researcher was get approval consent with respondent, and parent, schools parents association and teacher by follow consent form signed an agreement before data collection.

- The respondents have right withdrawn at any throughout process and none were tracked.

- Guaranteed confidentiality, not linking respondents with any identifying information and consent obtained for any audio taping or photo taking during interview

3.11 Expected Benefit and Application

These researches provide important information on nutritional status and factors contributed of adolescent girl's status. The information gathered from this study will inform the Ministry of Health in Timor about the situation of nutritional status in adolescent girls in a district. This study was the first study examining the nutritional status of adolescent girls. This information will be used to develop standard procedures for the provision of diet advice, and enforce educational and future program intervention for adolescence.

CHAPTER IV

RESULTS OF THE STUDY

A total of 244 students' girls aged 14 – 19 years participated in the study. The study was carried out in three secondary high schools in Manatuto district in Timor-Leste. Two of the three schools involved in this study were based in urban areas, with the third school located in a rural area. The urban based schools included two secondary high schools of Santo Antonio; as a private school, located in a sub-district town comprising 300 male and female from grade one to three. In this school 81 female students were randomly selected from 195 female students. The second urban based school was the secondary high school of Kay-Rala; a government school in Manatuto sub-district located in the border district 2 kilometres from Manatuto city. This school has 320 students male and female students in the age group eligible for this study, .82 female students were randomly selected from a total of 195 female students eligible for the study. The third school participating in the study was the secondary high school of Dom Basilio, a private school located in rural area in Laclubar sub-district town with situated two to three hours' drive from Manatuto town. Dom Basilio School has 218 students' male and female students in the age group eligible for this study. 81 female students' girls were randomly selected from the 109 eligible female students.

4.1 Descriptive Analysis

4.1.1 General Characteristic (Host Factors)

Table 1: Shows the frequency distribution of general characteristics (host factors) information for all the participants (including age, birth order, living with whom, disease status and knowledge of nutrition)

- **Age:**

The age range of the participants was from 14-19 years of age. Ages were divided into three categories (14-15 years of age, 16-17 years of age and 18-19 years of age).The majority of study participants were aged 16-17 years old (50.4%), followed by 18-19 years of age (41%). Only 8.6 % of respondents were aged 14-15 years of age old, the average age of study participants was 17.1 years with a standard

deviation (SD) of 1.1 years. When comparing the three participating secondary schools, the majority (56.4%) of study participants from Santo Antonio secondary school were aged between 16-17 years of age, the majority of study participants (52.4.% from Kay-Rala Secondary School were aged 18-19 years and in there was almost a fifty-fifty split at Dom Basilio Secondary School with half the study participants (in the same age bracket of 16-17 years (46.9%) and 18-19 years old (46.9%). The mean age of study participants at Kay Rala Secondary School was 17 years, and at Dom Basilio Secondary School and Santo Antonio Secondary School the mean age of study participants was 18 years of age. Across the three study schools the majority of the study participants were in grade two 35 %, 33 % in grade one and the remaining study participant's 32 were in grade three

- **Birth Order :**

Nearly half (43.0%) of the total respondent's birth order was found to be first child, 36.5 % were the second child, 13.1% were third child and only 7.4% were the fourth children.

- **Living with whom:**

The majority of the total respondent's reported that they lived with their parents (57.4%), 42.6% reported that they lived with others including their aunt, uncle, grandparent, and non-relatives.

- **Current disease status (by self -reporting)**

The majority of respondents (51.2%) reported being free of disease at the time of interview, 48.8% reported having some disease. Of this 48.8%, 23% reported having oral health problems, 12.3% reported having diarrhea, 2.5% reported malaria, 2.0% reported parasite infection ,0.4% reported having Tuberculosis (TB), 4.9% reported having diarrhea in combination with and oral health problems 2.0% reported having diarrhea in addition to TB and 1.2% reported having diarrhea in addition to malaria.

- **Knowledge of nutrition:**

The basic knowledge of nutrition comprises was assessed using 18 questions in total. Each question was coded 1 for the correct answer (True) and 0 for the incorrect answer (false or I don't know), and divide base on quartile percentiles

In the general assessment of level of nutrition knowledge, it was found that nearly half of the respondents (43.4%) had a low knowledge level, 32.4% had moderate knowledge and only 24.2% of study participants had a good general knowledge of nutrition. The mean score was 11.0 with a SD of 2.2. When examining the responses to each question the results indicate that the majority of respondents had a good understanding that nutrients are substances in the food that give the body energy with 95.9% of respondents answering this question correctly. 38.9% had knowledge in negative answer of food for adolescent should contain only protein and 39.8% of respondents answered the question on culture practices, socioeconomic status, the politic environment and human resources being an underlying cause of malnutrition correctly indicating good knowledge of this issue and 49.2% respondent answer of not having enough food and being affected from diseases are immediate causes of manutrition

Table 1: General Characteristic information (Host factors)

Host Factors	Frequency	Percent
Age		
14-15 years old	21	8.6
16-17 years old	123	50.4
18-19 years old	100	41.0
Total	244	100.0
Mean ±SD	17 ±1.1	
Classes		
Grade I	81	33.0
Grade II	85	35.0
Grade III	78	32.0
Total	244	100.0
Birth order		
First child	105	43.0
Second child	89	36.5
Third child	32	13.1
Fourth child	18	7.4

Host Factors	Frequency	Percent
Living with whom		
Others	104	42.6
Parents	140	57.4
Total	244	100.0
Diseases status by self report		
None diseases	125	51.2
Have diseases	119	48.8
Total	244	100.0
TB	1	0.4
Diarrhea and malaria	3	1.2
Parasite	5	2.0
Diarrhea and TB	5	2.0
Malaria	6	2.6
Diarrhea and oral	12	4.9
Diarrhea	30	12.3
Oral	57	23.4
Total	119	48.8
Nutrition knowledge of 18 items		
Low knowledge (≤10 scores)	106	43.4
Moderate knowledge (11-12 scores)	79	32.4
Good knowledge (>12 scores)	59	24.2
Total	244	100.0
Mean ±SD	11.0 ±2.2	
Minimum	5	
Maximum	17	

Host factors	ST. Antonio n (%)	Kay-rala n (%)	Basilio n (%)
Age			
14-15 years old	9 (11.1)	7 (9.0)	5 (6.2)
16-17 years old	53 (65.4)	32 (39.0)	38 (46.9)
18-19 years old	19 (23.5)	43 (52.0)	38 (46.9)
Total	81 (100.0)	82 (100.0)	81 (100.0)
Mean ±SD	18.8 ±1,0	17 ±1.2	17.3 ±1.1
Minimum	15 years	14 years	14 years
Maximum	19 years	19 years	19 years

Host factors	ST. Antonio	Kay-rala	Basilio
	n (%)	n (%)	n (%)
Classes			
Grade I	27 (33.3)	27 (33.0)	27 (33.0)
Grade II	27 (33.3)	28 (34.0)	30 (37.0)
Grade III	27 (33.3)	27 (33.0)	24 (30.0)
Total	81 (100.0)	82 (100.0)	81 (100.0)
Nutrition Knowledge			
Low knowledge (≤10 scores)	24 (29.6)	34 (41.5)	48 (59.3)
Moderate knowledge (11-12 scores)	33 (40.7)	26 (31.7)	20 (24.7)
Good knowledge (>12 scores)	24 (29.6)	22 (26.8)	13 (16.0)
Total	81 (100.0)	82 (100.0)	81 (100.0)

4.1.2 Agent Factors Characteristics

Table 2: Shows the frequency distribution of agent factor information for all the respondents including food consumed by respondent in the 24 hours prior to the survey against Recommendation Dietary Allowances (RDA) of total energy consumed.

On assessment of 24 hour intake against RDA, of the 244 participants it was found that nearly half of them (39.3%) met 70-79 % of their RDA, 31.2% had moderate consumption, consuming 80-99% of their RDA for energy, 24.2% of study participants consumed less that 70% of their daily energy needs and only 5.3% of study participants respondents consumed enough food to meet their daily energy requirements in the 24 hours prior to the survey. The mean energy consumption was 77.25 (SD 12.71) indicating that the majority of study participants only consumed approximately ¾ of their daily energy requirements and that most of the participants (95%) were in negative energy balance according to their needs. The minimum consumption was less than half (48%) of the recommended daily intake and the maximum consumption was 177% of RDA.

Based on a record of the self-reported food intake consumed in the 24 hours prior to the survey, almost all (95.9%) of respondents had a caloric intake of less than 2200 kcal per person per day, 2.5% of respondents consumed more than 2350 kcal

and only 1.6% consumed 2200-2350 kcal/day. The majority of respondents (61.8%) had a daily protein intake of less than 50 gram/day, 23.0% consumed more than75 grams of protein/day and only 15.2% of respondents consumed 50-75grams of protein/day

In a comparison between the three study schools, the results indicate that Dom Basilio in the rural sub district of Laclubar had the highest number of study participants (48.1%) who did not meet their RDA for energy and had a significant deficit (<70%RDA).In the two urban located school the number of participants consuming <70% of their RDA for energy was much lower. The majority of participants in the two urban located schools of Santo Antonio schools and Kay-rala the majority (35.4 and 40.7% respectively) of study participants had moderate energy consumption (80-99% of RDA). Overall it was found that very few participants across all schools met their RDA for energy.

Table 2: Composite of total energy food consumption (RDA)

Variable agent	Frequency	Percent
Total energy consumption (RDA)		
Good Consumption (>100%)	13	5.3
Moderate consumption (80-99%)	76	31.2
Less consumption (70-79%)	96	39.3
Deficit <70%)	59	24.2
Total	244	100
Mean ±SD	77.25 ± 12.71	
Minimum	48	
Maximum	117	
Calorie intake		
<2200 kcal	234	95.9
2200-2350 kcal	4	1.6
>2350 kcal	6	2.5
Total	244	100
Mean ±SD	1718 ±295.4	
Minimum	2000	
Maximum	2580	

Variable agent	Frequency	Percent
Protein intake		
<50 gram	151	61.8
50-75 gram	37	15.2
>75 gram	56	23
Total	244	100
Mean ±SD	47.5 ±14.5	
Minimum	18	
Maximum	126	

Table 3: Shows the average eating habits of respondents during the week prior to the survey measured by a food frequency questionnaire. The foods were categorised into the following groups, animal sources, vegetables, legumes, cereals, fruits and drinks, with the following frequency categories (1)1-2 times/weeks, (2) 3-5 times/week, (3) 6-7 times /week and (4) none. The majority (84.4%)of respondents reported consuming no liver during the week prior to the survey, 43.9-63.1%   of respondent's reported eating red meat, fish, egg and chicken 1-2 times per week 14.8% and 25% reported eating egg and fish 3-5 times per week only 13.1% ate fish 6-7 times per week. 49.1-54.9%   of respondents reported eating spinach, cassava leaf, pumpkin leaf, mustard, white pumpkin and potato leaf 1-2 times per week. 10.2-34% of respondent's reported eating cabbage, carrot, pumpkin with pumpkin spinach, kangkung, pumpkin leaf, potato leaf and cassava leaf 3-5 times per week and only 7% ate cassava leaf and pumpkin 6-7 times per week. The majority of respondent's (48.8-64.8%) reported eating mango, tomato, pineapple, guava, papaya and avocado 1-2 times per week, 17% reported eating mango 3-5 times per week and only 9% of respondents reported eating banana 6-7 times per week. The majority (57.8%.) of respondents reported eating red bean 1-2 times per week, 11.9% ate red bean 3-5 times per week and only 9.0% ate red bean 6-7 times per week. For the other food categories, 25% of respondent's reported eating green beans, 15% reported eating peanuts, 30% ate Tempe and 19.1% ate tofu 1-2 times per week. Almost 60% of respondents (59.0%) reported eating rice 5-6 times per week; only 31.1% reported eating rice 1-2 time per week. The majority ofrespondants53.3% reported eating corn

1-2 times per week, and only 10.28% ate corn 6-7 times per week. Over 60% (61.3%) of respondent ate cassava 1-2 per week. 49.6-57.8% of respondents reported eating taro, sweet potato, potato and noodles 1-2 times per week. 44.7-65% of respondents reported consuming no coffee, soft drink, milk + coffee and juices/dellos. 31.1-49.5% of respondents reported drinking milk + coffee, coffee, soft drink, tea and milk 1-2 times per week and 13.5-19.7 % reported drinking tea, 3-7 times per week.

Table 3: Composite frequency of eating habits during one week

Eating habits		Frequency		
	None	1-2 times/week	3-5 times/week	6-7 times/week
(n=244)	n/%	n/%	n/%	n/%
Animal sources				
liver	207 (84.4)	36 (15)	1 (0.6)	0
Fish	40 (16.4)	110 (45.1)	62 (25.4)	32 (13.1)
Red meat	121 (49.6)	107 (43.9)	13 (5.3)	3 (1.2)
Chicken	60 (24.6)	154 (63.1)	22 (9.0)	8 (3.3)
Egg	65 (26.6)	132 (54.1)	36 (14.8)	11 (4.5)
Vegetable				
Spinach	70 (28.7)	121 (49.6)	39 (16.0)	14 (5.7)
Cassava leaf	18 (7.4)	124 (50.8)	83 (34.0)	19 (7.8)
Cabbage	126 (51.6)	84 (34.4)	25 (10.2)	9 (3.7)
Potato leaf	50 (20.5)	134 (54.9)	48 (19.7)	12 (4.9)
Kanko	108 (44.3)	86 (35.2)	42 (17.2)	8 (3.3)
Carrot	126 (51.6)	85 (34.8)	25 (10.2)	8 (3.3)
Pumpkin	112 (45.9)	90 (36.9)	28 (11.5)	14 (5.7)
Pumpkin leaf	57 (23.4)	122 (50.0)	46 (18.9)	19 (7.8)
Mustard	56 (23.0)	126 (51.6)	49 (20.1)	13 (5.3)
White pumpkin	59 (24.2)	127 (52.0)	40 (16.4)	18 (7.4)
Agriaun	53 (21.7)	144 (59.0)	40 (16.4)	7 (2.9)
Legumes				
Red bean	52 (21.0)	141 (57.8)	29 (11.9)	22 (9.0)
Green bean	164 (67.2)	61 (25.0)	12 (4.9)	7 (2.9)
Peanut	199 (81.6)	37 (15.2)	6 (2.5)	2 (0.8)
Tempe	143 (58.6)	75 (30.7)	15 (6.1)	11 (4.5)
Tofu	158 (64.8)	71 (19.1)	11 (4.5)	4 (1.4)

Eating habits		Frequency		
	None	1-2 times/week	3-5 times/week	6-7 times/week
(n=244)	n/%	n/%	n/%	n/%
Fruits				
Orange	129 (52.9)	96 (39.3)	9 (3.7)	10 (4.1)
Mango	76 (31.1)	119 (48.8)	32 (13.1)	17 (7.0)
Pineapple	77 (31.6)	126 (51.6)	27 (11.1)	14 (5.7)
Avocado	65 (26.6)	133 (54.5)	29 (11.9)	17 (7.0)
Banana	30 (12.3)	158 (64.8)	34 (13.9)	22 (9.0)
Papaya	66 (27.0)	133 (54.5)	29 (11.9)	16 (6.6)
Tomato	65 (26.6)	119 (48.8)	43 (17.6)	17 (7.0)
Apple	158 (64.8)	71 (29.1)	10 (4.1)	5 (2.0)
Guava	87 (35.7)	131 (53.7)	18 (7.4)	8 (3.3)
Mellon	175 (71.0)	57 (23.4)	10 (4.1)	2 (0.8)
Cereals				
Rice	2 (0.8)	76 (31.1)	22 (9.0)	144 (59.0)
Corn	30 (12.3)	131 (53.1)	58 (23.8)	25 (10.2)
Cassava	48 (19.7)	150 (61.5)	35 (14.3)	11 (4.5)
Taro	85 (34.8)	121 (49.6)	30 (12.3)	8 (3.3)
Sweet potato	73 (29.9)	123 (50.4)	34 (13.9)	14 (5.7)
Potato	58 (23.8)	132 (54.1)	42 (17.2)	12 (4.9)
Noodles	35 (14.3)	141 (57.8)	44 (18.0)	24 (9.8)
Drinks				
Coffee	109 (44.7)	78 (32.0)	18 (7.4)	39 (16.0)
Tea	47 (19.3)	116 (47.5)	33 (13.5)	48 (19.7)
Milk	81 (33.2)	121 (49.5)	26 (10.7)	16 (6.6)
Milk + coffee	138 (56.6)	76 (31.1)	17 (7.0)	13 (5.3)
Solf drink	135 (55.3)	85 (34.8)	10 (4.1)	14 (5.7)
Juices/ dellos	160 (65.6)	71 (29.1)	6 (2.5)	7 (2.9)

4.1.3 Environments Factors Characteristics

Table 4 shows the frequency distribution of environmental factors for all study participants. Environmental factors examined include income of parents, occupation of parents, education level of parents, number of family members, the perception of the families' ability to afford food and living location.

- **Monthly income of parents.**

    The majority of respondents (76.2%) could not report on this question as they did not know their parents monthly income. 11.9% of respondents' reported that their parents had a low income (<$200.00/month), 11.1% of their parents had a middle level income ($200-$500/month) and only 0.8% of respondent's reported that their parents had a high income (>$500/month)

- **Parents occupational status**

    The majority (61.1%) of respondents' reported that their father's occupation was a farmer of livestock, 20.9%, reported that their fathers' occupation was a public servants, 11.9% reported that their father was privately employed and 6.1% of respondent's fathers were reported to be retired. Almost all (88.5%) of respondents' reported that their mother's occupation was a housewife, 5.8% reported their mothers occupation as a public servant, 4.1% reported livestock farmer as their mothers occupation and only 1.6% of respondent's reported that their mother was privately employed

- **Parent's educational status**

    Nearly half (34.8%)of the total respondents reported that their fathers had completed secondary high school, 33.6% of respondent's reported that their fathers had no formal education, 18.8% reported that their fathers had only completed primary school, 8.6% of respondent's reported that their fathers had completed elementary school and only 4.0% of respondent's reported that their fathers had diploma or bachelor degree qualifications. When asked about their mothers education, 31.9% of respondent's reported that their mother had no formal education 29.9% reported that their mothers had completed secondary high school, 24.1% reported primary school qualifications, 13.1% reported elementary school qualifications and only

0.8% reported that their mothers had diploma or bachelor degree qualifications.

- **Family size**

    Nearly half (49.6%)of the respondents came from a family of 6-10 members, classified as a medium family size for the purposes of this study, 30,3 % of study participants' came from a large family (>10 people) and the remaining study participants (20.1%) came from a small family (<6 people).

- **Living location**

    The majority of study participants (66.8%) lived in an urban area. The remaining 33.2% participants lived in rural areas.

- **Respondents' perception of families ability to afford food**

    The majority (67.2%) of respondents reported that their family had moderate purchasing power to afford fish/ meat, 24.2%of respondents' reported that their family had high purchasing power to afford of fish/meat and only 8.6% reported poor ability to afford of fish/meat. The majority of respondents (64.7%) reported that their family had moderate ability to afford milk, 27.5% reported that their family high ability to afford to purchase milk and only 7.8% reported poor ability to afford to purchase milk. 62.3% of respondents' reported that their family had high ability to afford to purchase oil, 37.7% had moderate ability to afford to purchase

Table 4: Environment factor characteristic of respondent

Environment factors	Frequency	Percent
Parents income		
Low income (<$200.00)	29	11.9
Middle income($200-500.00)	27	11.1
High income (>$500.00)	2	0.8
Don't know	186	76.2
Total	244	100

Environment factors	Frequency	Percent
Father occupation		
Public servant	51	20.9
Private employed	29	11.9
Farm livestock	149	61.1
Others	15	6.1
Total	244	100
Mother occupation		
Public servant	14	5.8
Private employed	4	1.6
Housewife	216	88.5
Farm livestock	10	4.1
Total	244	100
Father education		
Non education	82	3.6
Elementary school	21	8.6
Primary school	46	19
Secondary high school	85	34.8
Diploma/bachelor degree	10	4
Total	244	100
Mother education		
Non education	78	31.9
Elementary school	32	13.1
Primary school	59	24.2
Secondary high school	73	30
Diploma/bachelor degree	2	0.8
Total	244	100
Family size		
Small family (<6 persons)	49	20.1
Middle family (6-10 persons)	121	49.6
Large family (>10) persons	74	30.3
Total	244	100
Mean ±SD	9.4 ± 3.4	
Minimum	3	
Maximum	4	

Environment factors	Frequency	Percent
Father occupation		
Public servant	51	20.9
Private employed	29	11.9
Farm livestock	149	61.1
Others	15	6.1
Total	244	100
Mother occupation		
Public servant	14	5.8
Private employed	4	1.6
Housewife	216	88.5
Farm livestock	10	4.1
Total	244	100
Father education		
Non education	82	3.6
Elementary school	21	8.6
Primary school	46	19
Secondary high school	85	34.8
Diploma/bachelor degree	10	4
Total	244	100
Mother education		
Non education	78	31.9
Elementary school	32	13.1
Primary school	59	24.2
Secondary high school	73	30
Diploma/bachelor degree	2	0.8
Total	244	100
Family size		
Small family (<6 persons)	49	20.1
Middle family (6-10 persons)	121	49.6
Large family (>10) persons	74	30.3
Total	244	100
Mean ±SD	9.4 ± 3.4	
Minimum	3	
Maximum	4	

Environment factors	Frequency	Percent
Living area		
Urban ares	163	66.8
Rural area	81	33.2
Total	244	100

Environment factors	**Perception of family to afford food**		
(n=244)	high affordable	Moderate	Poor
Fish/meat	59 (24.2)	164 (67.2)	21 (8.6)
milk	67 (27.5)	158 (64.7)	19 (7.8)
oil	152 (62.3)	92 (37.7)	0

Environment factors	ST. Antonio	Kay-rala	Basilio
	n (%)	n (%)	n (%)
Mother education			
No education	18 (22,2)	18 (22.0)	42 (51.9)
Elementary	3 (3.7)	14 (17.1)	15 (18.5)
Primary	15 (18.5)	24 (29.3)	20 (24.7)
Secondary	45 (55.6)	24 (29.3)	4 (4.9)
Diploma/bachelor	0	2 (2.4)	0
Total	81 (100.0)	82 (100.0)	81 (100.0)

4.1.4 Nutritional Status

Table 5 shows the overall nutritional status of respondents measured by Body Mass Index (BMI) (kg/m^2).and height for age (H/A)

- **BMI (kg/m^2)**

The majority (50.8%) of study participants having BMI scores between 18.6-25 kg and indicating a healthy body weight, 49.2% having BMI scores $\leq$ 18.5 kg/m^2 indicating thinness or underweight. The mean height of the study group was 153 cm SD±5.7, the minimum height was 135 cm and the maximum height was 179 cm. The mean weight of the study group was 44.5 kg ±SD 5.6. The minimum weight was 30 kg and the maximum weight was 69 kg. The average BMI of the study group was

19.0 ±SD1.5. With minimum of BMI 19.0 and maximum 25.1 kg/m^2.When comparing the three schools, 56% of study participants (the majority) at Dom Basilio Secondary School were underweight/thin (BMI score ≤18.518 kg/m[2)]. Dom Basilio School had the highest number of adolescent girls who were underweight/thin. In the secondary high school of Santo Antonio and Kay-Rala the majority of study participants (51% and 56% respectively) were in the normal or healthy weight range (BMI18.6-2518 kg/m[2).] The maximum height of study participants was 141 cm. This student attended Santo Antonio School. The lowest height of study participants was 135 cm and this student attended Dom Basilio School. The average height of participants from Kay-Rala Secondary School was the highest and the study participants at Santo Antonio Secondary School had the lowest average heights.

Overall the lowest weight recorded was 30 kg from a study participant in Dom Basilio Secondary School, the highest recorded weight of 69 kg was from a study participant at Santo Antonio Secondary School.(in Kay-rala 35 kg and the maximum of weight 53 kg lower in Kay-rala and higher maximum 69 kg and Santo Antonio school. Average weight across participants at Santo Antonio Secondary School was highest at 44.7kg. The mean weight of study participants at the two schools of Kay-Rala and Dom Basilio secondary Schools was 44.3 kg. The mean height of study participants at Kay-Rala Secondary School was 153 cm and lowest average height was found in study participants' from Santo Antonio school and the average of BMI was highest at Dom Basilio school, (19.218kg/m[2)] and lower in Santo Antonio school and Kay-Rala Secondary Schools where it was (18.9 kg)

- **Height for age**

  Almost 75.4% of study participants' had a height for age classified as normal (-2Zscore-+2Zscore), 24.6% of study participants were classified as stunted (≤ -2HAZ score)

Table 5: Nutritional status

Nutritional status	Frequency	Percent
Mean ±SD of Height	153 ±5.7	
Minimum	153 cm	
Maximum	179 cm	
Mean ±SD of weight	44.5 ±5.6	
Minimum	30.0 kg	
Maximum	69.0 kg	

Nutrition status	Frequency	Percent
BMI		
Thin (BMI≤18.5 kg/m^2)	120	49.2
Normal (BMI 18.6-25 kg/m^2)	124	50.8
Total	244	100
Mean ±SD	19.02 ±1.5	
Minimum	16.4	
Maximum	25.1	

Nutritional status	Frequency	Percent
Height for Age		
Short (≤-2Z score)	60	24.6
Normal (-2Zscore-+2Zscore)	184	75.4
Total	244	100.0

	ST. Antonio n (%)	Kay-rala n (%)	Basilio n (%)
Height for Age			
Short (≤-2Z score)	17 (21.0)	23 (28.0)	20 (24.7
Normal (-2Zscore-+2Zscore)	64 (79.0)	59 (72.0)	61 (75.3)
Total	81 (100.0)	82 (100.0)	81 (100.0)

Nutritional status (BMI ≤18.5kg/m2)	ST. Antonio n (%)	Kay-rala n (%)	Basilio n (%)
Thin (BMI ≤18.5kg/m^2)	35 (43.2)	40 (48.8)	45 (56.0)
Normal (BMI 18.6-25kg/m^2)	46 (56.8)	42 (51.2)	36 (44.0)
Total	81 (100.0)	82 (100.0)	81 (100.0)
Mean ±SD	18.9 ±1.2	18.9 ±1.2	19.2. ±1.9
Minimum	16.6	16.4	16
Maximum	25.1	22.8	24

4.2 Bivariate Analysis

4.2.1 Association Host Factor and nutritional status of BMI

Table 6 shows the relationship between the all host factors characteristics of respondents (including age, birth order, living with whom, diseases status, nutritional knowledge compared with nutritional status of BMI. This association was tested using Chi square test, and the level of significance for the relationship was set at a p value ≤ 0.05.

Age:

The respondent's age were categorized into two groups and compared with nutritional status of (BMI). The results indicated a close to significant association but not significant association (p-values = 0.056), however in between age group 14 -16 years old have potential more likely to have a BMI≤ 18.5kg/m^2 .

Birth order

Birth order was divided into two categories, the first, second third and fourth to facilitate analysis. The result indicated that there was no association between respondents birth order and nutrition status of BMI (p value= 0.814)

Living with whom

Living with whom was divided into two categories including living with parents, and living with others (including, grandparents, uncle, aunt and other

relative). The result shows that there was no significant association between living with whom and nutritional status of BMI (p= 0.183).

Current disease status

The bivariate analysis revealed that there was no relationship between diseases status and nutritional status of BMI (p=0.696).

Nutritional knowledge

The relationship between nutrition knowledge and nutritional status of BMI was found statistically significant (p value= 0.026) with low nutrition knowledge level and low nutrition status

Table 6: Association between host factors and nutritional status

Variables	BMI $\leq 18,5$ n (%)	BMI > 18.5 n (%)	Total	X^2	p-Value
Age					
14-16 years old	37 (59.7)	25 (40.3)	62 (100.0)	3.665	0.056
17-19 years old	83 (45.6)	99 (54.4)	182 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		
Birth order					
First child	55 (52.4)	50 (47.6)	105 (100.0)		
Second Child	41 (46.1)	48 (53.9)	89 (100.0)	0.946	0.814
Third child	16 (50.0)	16 (50.0)	32 (100.0)		
Fourth child	8 (44.4)	10 (55.6)	18 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		
Living with whom					
Parents	74 (52.9)	66 (47.1)	140 (100.0)	1.777	0.183
Others	46 (44.2)	58 (55.8)	104 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		

Variables	BMI ≤18,5	BMI > 18.5	Total	x^2	p-Value
	n (%)	n (%)			
None diseases	63 (50.4)	62 (49.6)	125 (100.0)	0.153	0.696
Diseases	57 (47.9)	62 (52.1)	119 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		
Nutrition knowledge					
Low (≤10) scores	60 (56.6)	46 (43.4)	106 (100.0)	7.328	*0.026
Moderate (11-12) cores	41 (51.9)	38 (48.1)	79 (100.0)		
Good (>12) scores)	19 (32.2)	40 (67.8)	59 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		

Significant at p≤0.05

4.2.2 Association between agent factors and nutrition status of BMI

Table 7 shows the relationship between total energy consumption of (RDA) and nutritional status of BMI. The results indicate that have association between energy consumption and nutrition status of BMI, statistically a highly significant (p value = 0.009) low energy consumption and low nutrition status

Table 7: Association between agent factors with nutrition status

Agent factors and nutritional status	BMI ≤18,5	BMI > 18.5	Total	x^2	p-Value
	n (%)	n (%)			
Energy consumption (RDA)					
Adequate consumption	33 (37.9)	54 (62.1)	87 (100.0)	6.846	*0.009
Less consumption	87 (55.4)	70 (44.6)	157 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		

Significant at p≤0.05

4.2.3 Association between environment factors and nutritional status of BMI

Table 7 shows the relationship between the all of environment factor characteristic including monthly income of parents, Father Occupation, parents level

education, number of family member, living location, families' ability to afford food and living location and nutritional of BMI

Parents' income

The result found there was no association between parents monthly income and nutritional status of BMI (p=0.128). In addition to this figure shows that the higher income of parents have potential to higher nutrition status of BMI

Father occupation

The study revealed that there was no association between fathers occupation and nutritional status of the study participants, (p value = 0.262) respondents how ho have father employee have potential BMI higher than un employed

Mother education

The study results showed that was significant association between mothers level education and nutritional status BMI, statistically significant (p value= 0.028). This result indicates that mother's education have an effect on the nutritional status of the children low education mother with low nutrition status.

Number of family member

The study revealed that there was no association between number of family member and nutrition status of BMI, (p value = 0.824). Family in large size have potential to have lowers BMI than small and medium family

Food affordable

The perception of family ability to afford food like fish/meat, milk and oil. The result was found there was no association between those kind of food and nutrition status of BMI, p value = 0.733, p value = 0.812, P value = 0.442 of both variable.

Living location

The study was found that there was no association between living area with nutritional status of BMI, (p value =0.160).

Table 8: Association between Environment Factors with nutritional status (BMI)

Environment factors and nutrition status	BMI ≤18,5 n (%)	BMI >18.5 n (%)	Total	x²	p-Value
Parents income					
Low (<$200.00)	16 (50.0)	16 (50.0)	32 (100.0)		
High (>$200.00)	10 (32.2)	21 (67.7)	31 (100.0)	4.109	0.128
Do not know	94 (51.9)	87 (48.7)	181 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		
Father occupation					
Employed	36 (45.0)	44 (55.0)	80 (100.0)	0.832	0.362
Un employed	84 (51.2)	80 (48.8)	164 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		
Mother education					
No education	37 (47.4)	41 (52.6)	78 (100.0)	7.142	*0.028
Low education	53 (59.6)	36 (40.4)	89 (100.0)		
High education	30 (39.0)	47 (61.0)	77 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		

Environment factors and nutrition status	BMI ≤18,5 n (%)	BMI >18.5 n (%)	Total	x²	p-value
Family size					
Small family	23 (46.9)	26 (53.1)	49 (100.0)		
Medium family	54 (44.6)	67 (55.4)	121 (100.0)	3.462	0.177
Large family	43 (58.1)	31 (41.9)	74 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		
Living site					
Urban area	75 (46.0)	88 (54.0)	163 (100.0)	1.972	0.16
Rural area	45 (55.6)	36 (44.4)	81 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		
Fish/ meat					
High affordable	32 (53.3)	28 (46.7)	60 (100.0)	0.621	0.733
Moderate affordable	79 (48.2)	85 (51.8)	164 (100.0)		
Poor affordable	9 (45.0)	11 (55.0)	20 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100)		

Milk

	≤ -2HAZ	>-2HAZ	Total		
High affordable	32 (47.1)	36 (52.9)	68 (100.0)	0.417	0.812
Moderate affordable	78 (49.4)	80 (50.6)	158 (100.0)		
Poor affordable	10 (55.6)	8 (44.4)	18 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100)		

Oil

High affordable	72 (47.4)	80 (52.6)	152 (100.0)	1.631	0.442
Moderate affordable	48 (52.2)	44 (47.8)	91 (100.0)		
Total	120 (49.2)	124 (50.8)	244 (100.0)		

4.2.4 Association Host Factor and nutritional status of Height for Age

Table 9 show the relationship between agent factors and nutrition status of Height for Age (H/A). The result indicated that no found any association between host factors; age, birth order, living with whom diseases by self report, nutrition knowledge with nutritional status of H/A. however in related to respondents knowledge of nutrition 25.4% had moderate knowledge a stunting and 27.4% of respondents in aged 14-16 year a stunting

Table 9: Association between host factor and nutrition status (H/A)

Host factor and H/A (n=244)	≤ -2HAZ n (%)	>-2HAZ n (%)	x^2	p-value
Age				
14-16 years old	17 (27.4)	45 (72.6)	0.359	0.549
17-19 years old	43 (23.6)	139 (76.4)		
Total	60 (24.6)	184 (75.4)		

Host factor and H/A (n=244)	≤ -2HAZ n (%)	>-2HAZ n (%)	x²	p-value
Birth order				
First child	28 (26.7)	77 (73.3)		
Second Child	18 (20.2)	71 (79.8)	1.473	0.689
Third child	9 (28.1)	23 (71.9)		
Fourth child	5 (27.8)	13 (72.2)		
Total	60 (24.6)	184 (75.4)		
Living with whom				
Parents	34 (24.3)	106 (75.7)	0.016	0.898
Others	26 (25.0	78 (75.0)		
Total	60 (24.6)	184 (75.4)		
None diseases	30 (25.2)	89 (74.8)	0.048	0.826
Diseases	30 (24.0)	95 (76.0)		
Total	60 (24.6)	184 (75.4)		
Nutrition knowledge				
Low (≤10) scores	26 (24.5)	80 (75.5)	0.272	0.873
Moderate (11-12) scores	18 (22.8)	61 (77.2)		
Good (>12) scores	16(27.1)	43 (72.9)		
Total	60 (24.6)	184 (75.4)		

Significant at p≤0.05

4.2.5 Association between agent factors and nutrition status of H/A

Table 10 shows the relationship between total energy consumption (RDA) and nutritional status of H/A. The results indicate statistically significant (p value = 0.022) between energy consumption and BMI.

In intention to frequency of eating habits of some type of animal sources during a week, the result shows that statistically highly significant (p value = 0.008) between eating fish during 6-7 times per week and nutritional status of H/A

Table 10: Association between agent factors with nutrition status (H/A

Agent Factors and H/A	Short n (%)	Normal n (%)	x^2	p-value
Energy RDA with Stunting				
Adequate consumption	14 (16.1)	73 (83.9)	5.266	*0.022
Less consumption	46 (29.3)	111 (70.7)		
Total	60 (24.6)	184 (75.4)		
Food habit of animal consumption (fish)				
none	4 (10.0)	36 (90.0)		
1-2 times/week	32 (29.1)	78 (70.9)	11.799	*0.008
3-5 times/week	11 (17.7)	51 (82.3)		
6-7 times/week	13 (40.6)	19 (59.4)		
Total	60 (24.6)	184 (75.4)		

4.2.6 Association between environment factors and nutritional status of (H/A)

Table 11 shows the relationship between environment factor characteristic including monthly income of parents, Father Occupation, parents level education, number of family member, living area ,families' ability to afford food and living and nutritional of H/A. According to statistic analysis found that there is no relationship between environment factors of all characteristic and nutrition status of H/A. However intention to some variable shows that respondents who have father employee have potential H/A higher than un- employed, mother higher educations have potential to good nutrition of H/A, respondents with small size family have potential to have good nutrition of H/A

Table 11: Association between environment factors and nutritional status of (H/A)

Environment factors and nutrition status	≤ -2HAZ n (%)	>-2HAZ n (%)	x²	p-value
Parents income				
Low (<$200.00)	5 (15.6)	27 (84.4)		
High (>$200.00)	7 (22.6)	24 (74.4)	1.818	0.403
Do not know	48 (26.5)	133 (73.5)		
Total	60 (24.6)	184 (75.4)		
Father occupation				
Employed	17 (21.2)	63 (78.8)	0.716	0.397
Un employed	43 (26.2)	121 (73.8)		
Total	60 (24.6)	184 (75.4)		
Mother education				
No education	17 (21.8)	61 (78.2)	3.678	0.159
Low education	28 (31.5)	61 (68.5)		
High education	15 (19.5)	62 (80.5)		
Total	60 (24.6)	184 (75.4)		
Family size				
Small family	9 (18.4)	40 (81.6)		
Medium family	34 (28.1)	87 (71.9)	1.931	0.381
Large family	17 (23.0)	57 (77.0)		
Total	60 (24.6)	184 (75.4)		
Living site				
Urban area	40 (24.5)	123 (75.5)	0.001	0.979
Rural area	20 (24.7)	61 (75.3)		
Total	60 (24.6)	184 (75.4)		

Environment factors and nutrition status	≤ -2HAZ n (%)	>-2HAZ n (%)	x²	p-value
Fish/ meat				
High affordable	10 (16.7)	50 (83.3)	2.751	0.253
Moderate affordable	45 (27.4)	119 (72.6)		
Poor affordable	5 (25.0)	15 (75.0)		
Total	60 (24.6)	184 (75.4)		
Milk				
High affordable	10 (14.7)	58 (85.3)	5.381	0.068
Moderate affordable	46 (29.1)	112 (70.9)		
Poor affordable	4 (22.2)	14 (77.8)		
Total	60 (24.6)	184 (75.4)		
Oil				
High affordable	33 (21.7)	117 (78.3)	1.803	0.179
Moderate affordable	27 (29.3)	65 (70.3)		
Poor affordable	0			
Total	60 (24.6)	184 (75.4)		

CHAPTER V

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

This was a cross sectional study carried out amongst 244 adolescents' girls of reproductive age (14-19 years old) in the three secondary high schools of Manatuto district, Timor-Leste. The aim of the study was to determine the Host, Agent and Environment factors and their effect on the nutritional status of adolescent girls aged 14-19 years old in three secondary high school of Manatuto districts, Timor-Leste. One of the specific aims of this research was to determine the underlying factors associated with the nutritional status of adolescent girls in order to develop standard procedures and resources to ensure appropriate diet advice and support is provided to adolescent girls to improve their nutritional status and that programs also address underlying issues that impact on the nutritional status of this group of vulnerable women.

5.1.1 Nutritional status of adolescent girls in secondary high school of Manatuto

A woman's nutritional status has important implications for her own short term and long term health as well as for the health of their children. Malnutrition in adolescent can cause delayed growth and development, including inadequate bone mineralization, delayed menarche, poor reproductive health outcomes, stunted height, delayed intellectual development and increased risk of infection, goitre blindness and anemia (NHD, 2000). In the long term poor nutrition in adolescence can result in reduced productivity, poor learning and development outcomes as well as increased health risks during the reproductive years and beyond. A woman with poor nutritional status, as indicated by low Body Mass Index (BMI<18.5 kg/m^2), short stature (<145cm), anaemia or other micronutrient deficiency has a greater risk of obstructed labour, having a baby with a low birth weight as a result of intrauterine growth retardation, giving birth to a preterm baby, producing lower

quality breast milk, dying from postpartum haemorrhage, and experiencing poor health for herself and her baby post-partum and later in life (NHD,2000).

This study showed that the majority of study participants (50.8%) had a BMI within the normal healthy weight range (18.6-25), 49.2% had low BMIs ≤ 18.5 indicating underweight and thinness and placing them at risk of nutritional deficiencies and subsequent illness. Almost 75.4% of study participants' had a normal height and age and 24.6% of study participants were found to be stunted (based on height for age).

The study found that in one school, Don Basilio Secondary, over half (56%) the study participant were underweight/thin (BMI<18.5). Of the three schools involved in the study, amongst the study participants, this prevalence of underweight was the highest. Most of the respondents (over 50 %) in Kay-Rala and Don Basilio secondary schools had normal BMI scores between 18.6-25 indicating that the rates underweight was lower in the study population in these two schools. In addition to stunting status comparing between those schools 28% of respondents was found in secondary high school of Kar-raya.

When comparing the situation for adolescent girls in Manatutu district with neighbouring Bobonaro district, the TL-DHS data 2010 indicates that Bobonaro district has the higher prevalence of undernourished women (39%) across the country ,the TL-DHS data from 2010 indicates that 33.4% of women aged 15-19 years are underweight(BMI less < 18.5) and 22% have a height less than 145 cm, indicating short stature. In addition the TL- DHS found that 21.5% of adolescent girls aged 15-19 years also had anaemia (Hb<120g/l) and of 0.1% had severe anaemia.

5.1.2 Association between Host Factor and Nutritional status

In this study nearly half of the total respondents were the first child (43.0%), 36.5% were second child, 17.1% were the third child and fourth child 7.4%. A current fertility level a woman in Timor-Leste will have an average of 5.7 children in her file time (TL-DHS.2010).

Birth order is a factor that may influence nutritional status and can influence the way a child is treated in the home environment. Birth order can impact on the child's development, roles within the household, and relationships with parents and household food distribution.

In observation context of Timor-Leste generally boys are seen as the most important as they represent the future generation and family leadership in customary culture. Generally girls are more look likely to hold the responsibly of primary care taker of the household and will often be married early to take on this role. This is validated by statistic in Timor-Leste which show that18% of babies born to mothers under 20 years have a low birth weight, compared to 10% of babies born to mothers aged between 20 and 24 years Despite the risks of pregnancy during adolescence, many girls in Timor Leste become pregnant to early, about one in nine (11%) of adolescent girls have had a live birth or are pregnancy by the time they are 18 years old and 20% of adolescent girls (one in five) have had a live birth or are pregnant by the time they are 19 years old. The rate of teenage pregnancy is twice as high in rural areas of Timor Leste than in the urban areas. The data is not available for Manatuto. This rate is not as high as some countries in the region (particularly South Asian countries) but it is still high and this is possibly because due to the fact that in Timor-Leste the dowry system is practiced from the males' families to the females' family and there is an expectation that once married a female child has the potential to bring in income to the family if she is married early. Although the data from this study could not be extrapolate to examine the effect of early marriage and pregnancy on nutritional status it is well documented that early marriage is one of the basic causes of malnutrition and is one of the main factors compounding the intergenerational cycle of under nutrition (UNICEF, 2010).

In this study the majority of respondents lived at home with their parents (57.4%), 42.6% lived with others family members such as their aunt, uncle or grandparents, and 6.7% lived with non-relatives. According to TL-DHS, 2010 the percentage of children not living with a biological parent increases with age from four percent of children aged zero to four years to19 percent of children age 15-17 years.

Disease status can affect nutritional status and nutritional intake. UNICEF conceptual framework (1990), identifies illness as one of the immediate causes of malnutrition. Some diseases such as diarrhoea can affect intake as well as the absorption of essential nutrients. Other diseases such as pneumonia increase the requirements for fluids and essential nutrients such as Vitamin A When asked about current disease status the majority of respondents (51.2%) reported being in good health with no current disease, 48.8 % reported having a disease at the time of survey, with 23% reporting diarrhoea and 12.3 % reporting oral health problems. Surveys conducted in Manatuto district in the rainy season in the past time have revealed that diarrhoea is prevalent and cases are most common in two to 15 year old children. In this study the majority of respondents reporting having diarrhoea.

Knowledge of nutrition can affect food choices. In this study, knowledge of nutrition was measured to ascertain the respondents understanding of some of the basic principles of nutrition. According to Suhardjo, (1989) uneven household food distribution, knowledge on nutrition and food, educational levels, food taboos and food superstitions are all key determinant of food intake and hence nutritional status.. In this study, nearly half of the respondents (43.4%) had a low level of basic nutrition knowledge, 32.4% had moderate knowledge and only 24.2% of them had good knowledge of basic nutrition. These results were based on an 18 question quiz on basic nutrition,

Between the three schools surveyed, the results indicate that the majority (59.3%) of study respondents at the secondary high school of Dom Basilio had low nutrition knowledge, in the secondary high schools of Kay-Rala and Santo Antonio nearly half of respondents had a moderate level nutrition knowledge (between 31-40%). In the context of Timor_Leste it is often recognised that the quality of education is better at private schools than government school with most of the private schools run by catholic missionaries. If nutrition education is part of the curriculum, these results reflect that the level of knowledge is quite good in some private school in urban areas compared to private school in rural areas.

The results from the bivariate analysis of nutritional status against the host factors of birth order, living with whom, diseases status and knowledge indicate

that there was a statistically significant association between knowledge of nutrition and nutritional status (p value = 0.026) with most of respondents who were having a low BMI. Various studies have shown the link between knowledge of nutrition and nutritional status, such as those reported by the Cebu and colleagues (1991), Ruelet al (1992), and Ruelet al (1999). The authors have demonstrated that knowledge through nutrition education can improve nutritional status by improving dietary practices and behaviours. The studies have shown that levels of knowledge will be influences a person's attitudes and behaviour in the selection of food which will then, in turn affect their nutritional status. Inadequate nutrition knowledge, lack of understanding about good eating habits, and lack of understanding of the nutritional contribution of various types of food can result in undernutrition and overweight and obesity and all these conditions can affect learning ability, labour capacity, growth and development and earning capacity. Other studies have shown a significant (p=0.005) correlation between nutritional status (BMI) and knowledge of nutrition and the importance of a eating a balanced diet in Jayapura students (M.Sada, 2012).

5.1.3 Association between Agent Factors and nutritional status

Nutrients contained in the daily diet are used to maintain a healthy body. The macronutrients consist of protein, fat and carbohydrate and although there are many micronutrients, the main ones include various vitamins and minerals (Sunita, 2001). If meals can meet the optimal quantity and quality of nutrient needs according to a person's requirements a state of good nutrition will be reached (Sedieotama, 1987). The results of this study indicate that the well assumed eating habits of the Timorese people, whereby the majority of people consider rice as a staple and often consume large plates of rice with very little vegetables, fish and corn mixes. On average most the respondents of this study ate approximately 300-350 gram of cooked rice at lunchtime and 200-300 of cooked rice at dinner, and a typical breakfast is often bread or porridge with tea or coffee., an overall meal plan that is low in protein and micronutrients. Conclusively this study shows that the majority of study participants consume a poor quality diet. It is well know that diet quality (not just quantity) is

associated with undernutrition (including underweight and micronutrient deficiencies such as anaemia and Vitamin A deficiencies) therefore, it is important to invest ways to improve both the quality and quantity of the diets of children and woman of reproductive age and this would maximize the chances of improving pregnancy outcomes, growth and development, cognitive development and school performance of children and adolescence.

During the period of the data collection for this study it was observed that most of the study participants walked to school, a distance of approximately, 1-2 kilometres for most people. This daily level of physical activity will increase the energy requirements of the adolescents, making it more difficult for the girls to meet their daily energy requirements especially when food security is an issue and food sources are scarce or families cannot afford to buy enough food to sustain the daily nutritional requirements of family members. In the schools involved in this study, school commences at 7.30 am and finishes at 13.00.None of the schools surveyed had a school canteen but all schools had street vendors who sold snack foods to the students during break times and unless students bought their own meal s to school, purchasing food from street vendors was the only option for food and meals at school

In observation the recapitulation amount of food quality inadequate such as animal sources, but more amounts in cereal tuber sources and dependency of the food availability and accessibility, in example Laclubar market open two times per week, it will be implicate to accessibility of food and majority of products sold being vegetables and legumes and limited amounts and of meat products.

It is a well established fact that inadequate energy intake over the short or long term will affect nutritional status (Muhji, 2003). Underweight for age (low BMI) is often a result of short term undernutrition and stunting is a result of long term nutritional deprivation which has affected skeletal growth and development .The bivariate analysis ,comparing agent factors and nutritional status results of this study, showed that there was a statistically significant association between total energy intake and nutritional status including BMI weight (kg)/ height (m)^2 (p=0.005), and stunting (height for age)(p value = 0.022). The food frequency

questionnaire results indicated that the majority of respondent (55.4%) consumed less than their daily recommended energy requirements without energy expenditure taken into account. There was also a statistically significant association between low consumption animal food sources (fish) and stunting (p value = 0.008). Stunting is a more prevalent look like a chronic status is limited associated with limited availability of food, but any way this study result found association between consumption of animal sources (fish) during 6-7 day per time day and nutritional status of Height age, its can not generalise in short period time, it can be related to the country nutrition status was found in Timor demography health survey ,2010 that 58% of children under five a stunting, its like on to going process of span generations.

5.1.4 Association between environmental factors and nutritional status

Studies have shown that parent's occupation can be associated with child under nutrition. Although this is more relevant for children under the age of 5, but parental occupation also determine the potential for income level

When asked about their parent's occupation the majority (61.1%) of the respondents stated that their father's occupation was a livestock farmer.

These results correspond to the 2010 Timor-Leste Demographic Health Survey results which showed that agriculture is the dominant sector of economic in Timor Leste and most of employed persons work in the agriculture sectors, specifically, 61 percent of employed women and 67 percent of employed man are engage in agricultural jobs, and in Manatuto district found 56.9% of agriculture jobs, 20.9 % of respondents reported that their father's occupation was a public servant and 13.1% of respondents reported that their father was privately employed. 87.3% of respondents reported that their mother's occupation was a housewife.

It is well established that poverty is an underlying determinant of under nutrition both within countries and between countries. Recent UNICEF figures show clearly that the poorer you are, the more likely you are to suffer undernutrition. Based on wealth quintiles, the Figure below shows some of these estimates from countries in the world.

Graph showing the percentage of children under 5 years old who are moderately or severely stunted, by household wealth quintile (Source: UNICEF, Tracking progress on child and maternal nutrition, 2009)
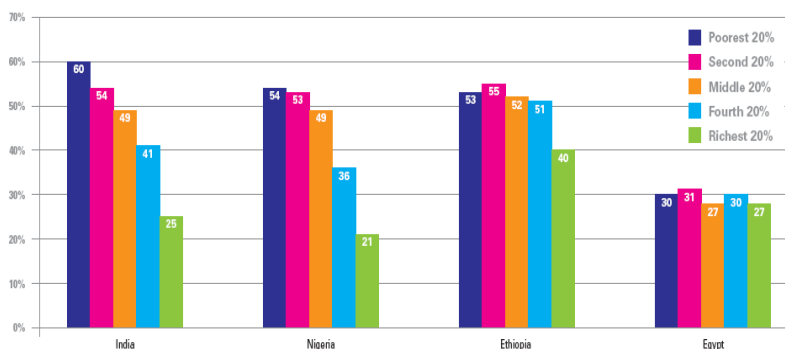
The impact of poverty on nutritional status is obvious not just between countries but also within. In the early 1980s: Blaxter and Waterlow (1985), Blaxter KL, Waterlow JC, eds. Nutritional adaptation in man. London: John Libbey, 1985:13 established that across a number of countries classified as high-income, the children are approximately the same height and all are approximately at 0 z-scores - the average height of the international growth reference. In all low income children in all countries, the children are significantly shorter (by up to 12 cm) than high-income children and have average height z-scores well below zero (refer to table below). They also established that in many countries the dramatic seasonal differences in the availability of foods and incidence of infectious disease have significant effects on growth. Timor would be no exception to this.

Graph showing average heights of 7 year old boys of high and low socio economic status
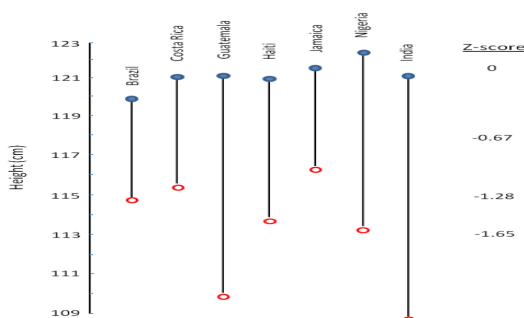
● High socio economic status

○ Low Socioeconomic status

Families cope with poverty and rising food prices (such as those experienced in 2008) by eating less, reducing the number of meals and variety of foods eaten per day which in turn impacts on the nutritional value of their diet and the quantity they eat. Women and older people tend to cut back on meals and food first, followed by other adults in the household and finally children, as poverty worsens It is known that women are more likely than men to spend money on food for their children

In this study an association between monthly income and nutritional status could not be established as the majority (76.2%) of respondents reported that they did not know their parents monthly income, 11.9% of respondents reported that their parents had a low income, 11, 1% reported that their parents have middle incomes and only 0.8% of respondents reported that their parents had a high monthly income.

In low income settings and food insecure settings family size can impact on the nutritional status of family members, with the distribution of food having to reach much further between family members. In this study nearly half (49.6%) of all respondents reported that the number of family household members was between 6 and 10 members (classified for the purposes of this study as a 'medium' family size) 30.3 % of respondents reported that they lived with more than 10 household members (classified as a 'big' family size for the purposes of this study) Only 20.1 % of respondents reported living in a small family of less than 6 household members. These results reflects the 2010 TL-DHS results which showed that the average household size in Timor is 5.8 persons in the urban area and 5.9 persons the in rural area (66.8%) reported that they lived in un urban area which had one private secondary high school located in the town and one government secondary high school located in the urban area. The results indicate that more (56%) study participants from the school in the rural area had BMIs less than (≤18.5), indicating nutritional deprivation

Education level of the family in particular the mother, has potential to affect the level of knowledge and understanding about health and nutrition and affect the

health and eating behaviours of the family. Women who receive even a minimal education are generally more equipped to make better decisions about health and health seeking behaviours and how to utilise available resources for the improvement of the nutritional status of themselves and their family than those who have no education. Education enables women to make independent decisions, to be accepted by other household members, and to have greater access to household resources that are important to nutritional status (ACC/SCN, 1990).

The results of this study showed a statistically significant had association between mothers level educational and nutritional status of adolescent (P value= 0.028). The majority of respondents (59.9%) with a low BMI came from families whose mothers education was low. Similar to the results of this study examining the socio-demographic factors associated with body mass index of female adolescent students aged 14-18 years in Semnan City, Iran, the authors found a significant association between mothers' educational level and BMI status of children (p =0.001), where a higher percentage of underweight (12.5%) adolescents came from families where the mothers education was low (Doust mohammadian A.at, al, 2009).

Education is one of the important underlying factors to good nutrition as it can also determine the level of nutrition knowledge and awareness. Education levels and the status of the mother is one of the most important factors contributing to the health and well-being of children. Improving girls' education, as well as promoting the delay of first pregnancy until at least 20 years of age and implementing laws and programs to prevent under-age marriage, can have important benefits for the health of both the mother and child. Children of educated women are less likely to be underweight, wasted or stunted. Poor nutrition of women and girls contributes to increasing gender inequalities since poor nutritional status in early childhood can impair growth and cognitive development, which impacts educational enrolment, attainment and future work prospects and in turn perpetuates the intergenerational cycle of underweight and poverty (Bread,2012). Interventions which improve girls' and women's education and empowerment may therefore contribute to improving the nutritional status of mothers and children, which in turn has broader implications

for both mortality and morbidity of current and future generations. A study conducted between the 1970s and 1990s, a period of time that saw a rise in women's status and an increase in girls enrolling at school, estimates that improving the education level of women alone can contribute to a 43% reductions in child under nutrition (Smith, L and L. Haddad, 2012), Refer to figure1 below.

As women's status improves (often through access to education), improvements in women's nutritional status, prenatal and birthing care for women, complementary feeding practices for children, treatment of illness, immunisation of children, and the quality of substitute child caretakers takes place as well.

An estimated 12% reduction in child undernutrition between 1975 and 1995 was attributed to improvements in woman's status during this period the education status of woman also increased dramatically. In Timor the average number of years of school attendance is two years and this is very low. Education of mother can determine the level of knowledge and awareness of good nutrition as well as impact on the nutritional outcomes for herself and her family. Improving education, especially for girls in Timor should be a priority.

The 2010 TLDHS showed consistently that a child who was underweight, stunted or wasted was more likely to come from a low income family, live in a rural area and be from a family where the mother's education level is poor. In this study respondents were asked about the education level of their mother 32.2 % of respondents reported that their mothers had no formal education 29.9% reported that their mothers had completed secondary high school, 24.2% of respondents reported that their mothers had completed primary education only, 13.1% of respondents reported that their mothers had completed elementary education and only 0.8% of respondents reported that their mothers had completed tertiary education (diploma or bachelor degree). These results are consistent with the 2010 TLDHS results which indicates that in Manatutodistricts32.2% of women have no formal education and this is a contributing factor to the high rates of undernutrition in children and women in Manatuto district.

Figure:5 Woman education in child under nutrition
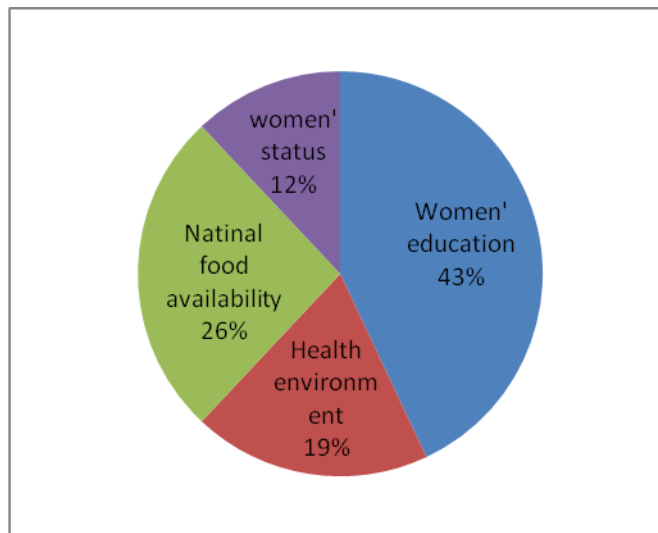
Adapted from Smith and Haddad, 2011

Although these associations have been well established in other studies, the results of this study indicates no statistically significant association between the nutritional status of adolescent girls and their parent's income, their father's occupation, their family size, living location or food affordability. This may be due to sample size and the inability for some many respondents to report accurately on family income.

In reference to any association between parents income and nutritional status, there was no significant association found (P value = 0.128) but the majority of respondents (51.9%) were not able to answer this question accurately or did not know. Family income has the potential to effect buying power and to affect food consumption patterns of a family and will impact to nutritional status a families children, particularly in families where income is low and family size is big. Poverty is one of the basic causes of malnutrition, if you don't have money to purchase a wide variety of foods or have the means to grow enough foods, nutritional status will be affected The results of this study showed no significant relationship between these variables, however this is an area which requires further investigation to examine a greater sample size, cross section and any seasonal variations to the variables examined.

In the context of Timor- Leste the 2009 DHS survey indicate that families who were poor and live in rural areas where the availability and accessibility of food is sometimes poor and where people are more likely to have limited financial, physical and social means to purchase foods were more likely to have children who are wasted and stunted and have adolescent children with low BMIs and pregnant mothers who do not gain enough weight during pregnancy. The 24 hour recall and food frequency data collected in this study also indicated that the girls from poorer families consumed less energy and less variety of foods than girls from wealthier families, they were also less likely to consume meats and dairy products such as milk. In a similar study examining the socio-demographic factors associated with body mass index of female adolescent students aged 14-18 years in Semnan City, Iran, the authors found that there was no association between parents' job and BMI status of the students.

In the same study 65.6% of study participants came from a large family size of 5-10 persons and the mean ± SD family size was 5.1 ± 1.2 persons. Similar to the results found in this study, the Semnan study found no association between family size and BMI status p>0.05.(Doustmohammadian A.at,al,2009).

No significant association was found between nutritional status and birth order, living with whom and reported diseases and parent's income, father occupation, family size, living area but again, with a larger sample size and taking into account seasonality and interviewing parents for some of the details, this is an area that requires further investigation in Timor Letse in order to gain a full understanding of the underlying and basic causes of undernutrition in this group of women.

5.2 Conclusion

This study found that within a cohort of adolescent girls ages 15 -19 year old attending 3 secondary schools in Manatutu district in Timor Leste , the girls who were found to be underweight (BMI<18.5) were more likely to have poor knowledge of nutrition and come from a family where the level of education of the mother was low. In addition those who were found to be stunted (<2HAZ) were

more likely to consume small amounts of fish and meat food sources /week. Although these positive associations were found, more research is required to ascertain the extent to which underlying factors in Timor Leste affect the nutritional status of adolescent girls in Timor Leste and to determine approached to addressing these. The results of this study would indicate that improving nutrition education in schools and improving access to education for women in Timor should be a priority.

5.3 Limitations

The study only assessed a small number of student adolescent girls from a wide range age group from only three secondary high schools in one district of Timor- Leste, therefore the results cannot be generalized for all adolescent girls in Timor- Leste.

There were some limitations with the questionnaire design and the questions asked, for example many respondents were unable to answer accurately the question on family income status. The question related to current disease status was also limited as this was self-reported and not validated with diagnostic clinical measures. In future studies this measurement could be validated against clinical health records if these were available and accurate and if the study participant had attended the health centre for diagnoses and treatment. In future studies, clinical examinations could also be used to determine current disease status.

Time limitations did not allow repeated 24 hour recalls to take place, The recall was based on one day of the week. Ideally 3 recalls should be undertaken to account for variations in eating patterns across the week. Because Timor also experiences a" hungry season" where, particularly in rural areas, food is in short supply, future studies should endeavour to collect diet intake data across a range of seasons.

24 hour recall is also self-reported data and like any self-reported data open to under and over reporting bias, in addition to rough estimates of the amounts of food eaten. In this study the method was supported by conducting a food frequency questionnaire which is also open to reporting bias.

In future studies, it may also useful to validate information obtained from study participants by interviewing the parents of the study participants. This is particularly important for income, education and perceived affordability data collection.

5.4 Recommendations

Recommendations for individuals

- The nutritional health of adolescent girls is important and this information should be provided to the girls and their families in school and through the health community in community program.

- Parents and the adolescent girls themselves should pay attention to ensuring that girls receive the correct quantity and quality of food, in particular more animal food sources, a variety of vegetable and fruits and ensure that there is appropriate household distribution of this food and adolescent girls are provided for appropriately as these girls are a future generation of mothers.

- Nutrition education should be provided at schools through a standardised curriculum.

- This should be supported by canteens and vendors who sell appropriate healthy food choices in specific more in protein contain and the healthy environment.

- For all teacher, in the process of teaching place more attention on nutrition in schools, in the curriculum, in nutrition lesson on theory and practices

For community health centre and health staff

- Create more nutrition promotion materials and provide advice to families and adolescents about the importance of eating a balanced diet to meet the nutrient requirements of early adolescents, middle adolescent and late adolescent with more consumption of animal sources and a variety of cereals, vegetable, legumes, fruit

Recommendation at policy and program level

- The inclusion of adolescent girls as a priority group in relevant nutrition and food security policies and strategies

- Support and encourage multisectors approach to improving the health of adolescent girls e,g involve the ministry of education in nutrition programming and as an access point for programs that target adolescent girls

- Ensure that policies such as the national nutrition strategy, the reproductive health strategy focus, the national education policy and related action plans have strategies and plans in place to address the adolescent health and nutrition issues and to ensure that this vulnerable target group is included as a key target group in all plans and policies

- Develop Timor Leste specific food base guidelines for adolescents and IEC materials to promote basic nutrition and develop nutrition training packages that can be incorporated in the curriculum of Timor-Leste school program

- The country schools feeding program should a ensure that a balanced diet is provided including a range local food products in the correct quality and quantity to meet the needs of adolescent girls.

- Consider the introduction of multi-micronutrient supplementation specific on iron folic acid in pilot are of research base on national nutrition plan with develop a simple guideline

Recommendations for future research in Timor-Leste

This study is the first of its kind in Timor-Leste and to date there is not a lot is known about the nutritional health and wellbeing of adolescent girls. Future studies should be conducted in other districts at community level across urban and rural areas.

If possible parents of the girls should be included on the study to validate the findings, Adequate time should be made available in the data collection phase to ensure that the questionnaire is focus tested before the study and if possible self reported responses are validated with clinical testing, to gain a greater understanding of the nutritional status of all adolescent both female and male, and to assess the immediate and underlying causes of malnutrition in this vulnerable group

This will allow greater targeting of programs to address the causes of malnutrition in this group and ensure that their nutritional status is improved before they become pregnant.

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APPENDICES

Appendix A

Time Schedule

Time Schedule of this research:

Work Plan

Time frame (month)	2012		2013					

Research project activities	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Literature review	xxx	xxx						
Proposal writing / develop tools for data collection (questionnaire)		xxx	xxx					
Thesis proposal exam			xxx					
Ethical approval				xxx				
Field work and data collections				xxx	xxx			
Data analyze and interpretation					xxx	xxx		
Report writing and presentation						xxx	xxx	xxx

Appendix B

Budget

Estimated budget

Item		Description	Unit cost	Total cost
1.		**Research materials**		
	a	Photocopy and print the questionnaire	U$ 200.00	U$ 200.00
	b	Stationary including equipment (scale, height measurement, ect)	U$ 800.00	U$500.00
		Sub- total	**U$ 1000.00**	**U$ 700.00**
2		**Other expenses; accommodation travel, seminar dues, photocopy fee, phone car**		
	a	Fee for research assistants	5 x U$ 40.00 x 6	U$ 720.00
	b	Souvenir for respondent	0,5 x 244	U$122.00
	c	Local help	6 x $ 10.00	U$ 60.00
	d	Transportation fuel		U$ 100.00
	e	Accommodation		U$ 100.00
	f	Meals and allowance for one day training		U$ 100.00
		Sub- total		**U$ 1,202.00**
3		Data entry (processing, analysis & binding)		**U$ 100.00**
		Grand total : 1+2+3		**U$ 2.002.0**

Appendix C

QUESTIONNARE

Nutritional Status of Adolescent Girls in Secondary High school of Manatuto District, Timor- Leste

Questionnaire Instructions:
1. Read these instructions carefully before filling out the questionnaire and please also make sure to read the question carefully
2. Before answering the follow questions, you must first complete the information related to your background and identity.
3. Put a circle on the answer that you think is most appropriate and in accordance with your actual situation.
4. If you have any questions unclear please ask the interviewer directly for clarification
5. Thanks you for your time in filling out the questionnaire

Respondents code to be assigned by the interviewer

Data of the interview   : _____-
Time of interview   :_____
Name of interviewer   :_____

I. Identity of respondents

1.	Age :	
2.	Class/grade	☐ .1 ☐ .2 ☐ .3
3.	Name of school	1. ☐ Secondary high school of Santo Antonio 2. ☐ Secondary high school of Kay-Rala 3. ☐ Secondary high school of Dom Basilio
4.	Sub-district	1. ☐ Manatuto ☐ 2. Laclubar

II. Family Characteristic:
1. Family occupation
    1. Fathers occupation
        1. ☐ Public servant   5. ☐ Private employees
        2. ☐ Labourer   6. ☐ Farmer
        3. ☐ Military   7. ☐ Unemployed
        4. ☐ Retired   8. ☐ Others please
specify……………………………

    2. Mothers occupation
        1. ☐ Public servant   5. ☐ Private employees
        2. ☐ Labourer   6. ☐ Farmer

3. ☐ Military   7. ☐ Others please
specify………………………………
4. ☐ Housewife

2. The number of family member in your household………….
3. How many brother and sister do you have   …………………………………….
4. You are the child number?---------------- for your family
5. With whom do you live:
1. ☐ Mother   2. ☐ Father   .
3. ☐ Mother & Father   4. ☐ Aunt, uncle, grant parent/relatives
4. ☐ other …………………………………………………………….

5. Family income

.   Family income per month

Parents	Income per/month	
Father		☐ do not know
Mother		☐ do not know

6. Family education

Parents	1.No school	2. Elementary school	2.Primary school	3.Secondary school	4.Diploma/Bachelor degree(high education)
Father					
Mother					

7. Family married status (your parents)

1.☐Married	2.☐Widow	3. ☐ Divorced

II. **Basic Knowledge about Nutrition:**

No	Questions	1.True	2.False	3.Do not know
1	Nutrients are substances in the food that give the body energy	☐	☐	☐
2	The function of nutrients in the body is to provide energy, support growth and development and regulate Immune functions	☐	☐	☐
3	The types of nutrients that the body needs are carbohydrates, proteins fats, vitamins and minerals	☐	☐	☐
4	Rice , bread, sweet corn, taro potatoes, and noodles are foods high in vitamin A	☐	☐	☐
5	Butter is a food that contain mostly the nutrients fat	☐	☐	☐
6	Eggs, fish, meat, *tempe* and tofu are all the sources of protein	☐	☐	☐
7	Fresh, fruits such as oranges, mangoes, papaya are all the food sources of vitamins	☐	☐	☐
8	Vegetables such as *kangkung* and spinach are high in minerals	☐	☐	☐
9	Green vegetables is contains more nutrients compared with white vegetable	☐	☐	☐
10	The Function of vitamins and minerals in the body is to lose body fat	☐	☐	☐
11	A balanced diet contains the proper quantity and quality of food	☐	☐	☐
12	Only eating fish frequently is considered a healthy diet	☐	☐	☐
13	Food for adolescent should contain only protein	☐	☐	☐
14	Malnutrition is condition that can result in making people thin, stunted and underweight	☐	☐	☐

15	Not having enough food and being affected from diseases are immediate causes of malnutrition	☐	☐	☐
16	Culture practice , socioeconomic status, the political environmental and human resources can all causes malnutrition	☐	☐	☐
17	Malnutrition will affect growth and development and increase the risk of infection	☐	☐	☐
18	Adolescent have especial nutrition requirement because they still a growing and development	☐	☐	☐

IV. Disease status

1	During the past month did you get any diarrhoea?	1.☐ Yes 2.☐ No 3.☐ Do not know
2	During the past month did you have any malaria	1.☐ Yes 2.☐ No 3.☐ Do not know ☐
3	Have you suffered from continue couching for over 2 weeks or have cough blood?	1.☐ Yes 2.☐ No 3.☐ Do not know
4	Are you have any oral problems	1.☐ Yes 2.☐ No 3. ☐ Do not know
5	Did you have parasite womb?	1.☐ Yes 2. ☐ No 3. ☐ Do not know

V. Nutrition status

1. Results of measurement:

Age:			
Weight:			
Height:			
BMI			

VI. Eating Habit

.Frequency eating during one week

Please put a tick on every line

	Frequency eating during one week

Type of food	(1) 1-2 /week	(2) 3-5/week	(3) 6-7/week	(4) None
ANIMAL SOURCE				
Liver				
Red meat				
Chicken				
Fish				
Egg				
Plant sources/green VEGETABLE				
Spinach				
Cassava leafy				
mustard				
Cabbage				

Sweet potato leafy				
Carrots				
Pumpkin				
(Kabura)				
Agriaun				
White pumpki				
Pumpkin leafy				
Potato leafy				
LEGUMES				
Red beans				
Green beans				
FRUITS				
Orange /tangerine				
Mango				
pineapple				
Tomato				
Banana				
Avocado				
Apple				
Papaya				
CEREAL/TUBER/product				
Rice				
Corn				
Taro				
Cassava				
Potato				
Noodles				
DRINK				
Coffee				
Milk				
Tea				
Coffee + milk				
Juice				
Coca-Cola, etc				

VII. Respondents perception of the family ability to afford important food sources:

Type of food	(1) Highly affordable	(2) moderate affordable	(3) Poor affordable
Fish/meat	▢	▢	▢
Milk	▢	▢	▢
Oil	▢	▢	▢

Filling instructions of 24 hours food consumption
- Ask end recall of food that respondent consuming like food , drinks, fruit snack during 24 hours
- Ask what kind of the food they are cooking to make food (example name of the food like vegetable soup, the food constituents are: potato, carrot cabbage, chicken and the name of drink like the: sugar etc
- Ask and recall how much respondent consuming in household scale like: spoons, plates grain scale cattle, glasses and other (one plate of rice, one piece of tofu and one spoon of sugar)
- Asking clearly and details do not missing

VIII. Food recall record sheet 24 hours
Respondent Code:_____   data:_____
        Gender:_____
Data of birth/age :_____

Time eating	Name of food /drink	Type of food	Quantity	
			Household Size scale	grams
Morning Snack				
Lunch				

Time eating	Name of food /drink	Type of food	Quantity	
			Household size	grams
Afternoon Snack				
Night				

Appendices: Authors biography

Table Result of nutrition knowledge

No	Questions	True n%	False n/%	Don't know n/%
1	Nutrients are substances in the food that give the body energy	234 (95.9)	6 (2.5)	4 (1.6)
2	The function of nutrients in the body is to provide energy, support growth and development and regulate Immune functions	133 (54.5)	71 (29.1)	40 (16.4)
3	The types of nutrients that the body needs are carbohydrates, proteins fats, vitamins and minerals	179 (73.4)	37 (15.2)	28 (11.5)
4	Rice , bread, sweet corn, taro potatoes, and noodles are foods high in vitamin A	104 (42.6)	98 (40.2)	42 (17.2)
5	Butter is a food that contain mostly the nutrients fat	204 (83.6)	23 (9.4)	17 (7.0)
6	Eggs, fish, meat, *tempe* and tofu are all the sources of protein	159 (65.2)	47 (19.3)	38 (15.6)
7	Fresh, fruits such as oranges, mangoes, papaya are all the food sources of vitamins	195 (79.9)	29 (11.9)	20 (8.2)
8	Vegetables such as *kangkung* and spinach are high in minerals	149 (61.1)	66 (27.0)	29 (11.0)
9	Green vegetables is contains more nutrients compared with white vegetable	152 (62.3)	60 (24.6)	32 (13.1)
10	The Function of vitamins and minerals in the body is to lose body fat	128 (52.5)	69 (28.3)	47 (19.3)
11	A balanced diet contains the proper quantity and quality of food	144 (59.0)	54 (22.1)	46 (18.9)
12	Only eating fish frequently is considered a healthy diet	124 (50.8)	81 (33.2)	39 (16.0)
13	Food for adolescent should contain only protein	97 (39.8)	87 (35.7)	60 (24.6)
14	Malnutrition is condition that can result in making people thin, stunted and underweight	173 (70.9)	41 (16.8)	30 (12.3)
15	Not having enough food and being affected from diseases are immediate causes of malnutrition	120 (49.0)	71 (29.1)	53 (21.7)
16	Culture practice , socioeconomic status, the political environmental and human resources can all causes malnutrition	93 (38.1)	80 (32.8)	71 (29.1)
17	Malnutrition will affect growth and development and increase the risk of infection	129 (52.9)	60 (24.6)	55 (22.6)
18	Adolescent have especial nutrition requirement because they still a growing and development	210 (82.4)	27 (11.1)	16 (6.6)

Nutrisurvey window program of analysis food consumption

Al data of food consumption entry to nuttrisurvey window program based on age group, meals time, (breakfast, snack, lunch, snack and dinner)
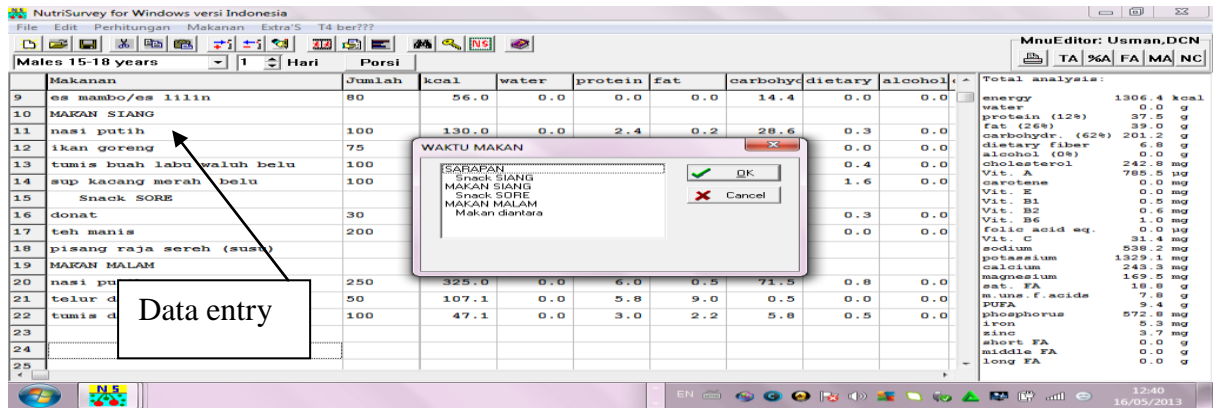
Result of food consumption automatically come out after the data enttry
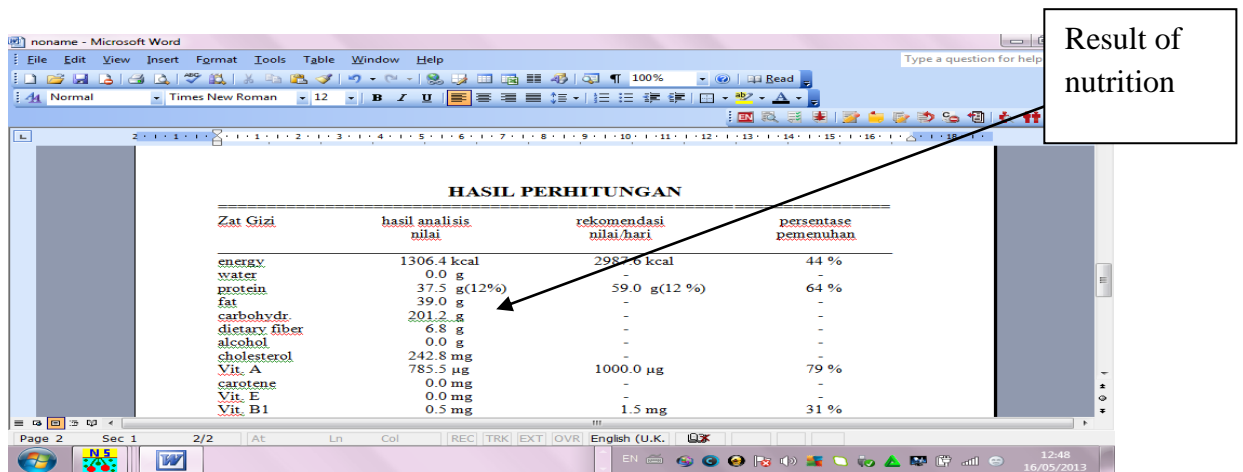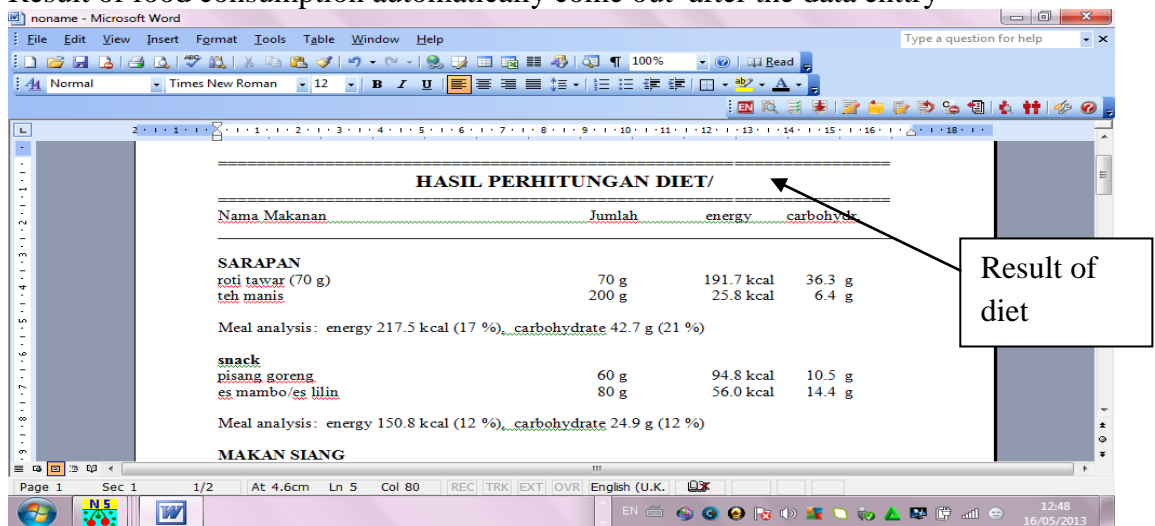
Anthropometric equipment:

Food consumption equipment:

CURRICULUM VITAE

A. PERSONAL IDENTITY

Name   : Dirce Maria Soares
Sex   : Female
Place and date of birth: Dili, 5 September 1971
Nationality   : Timorese
Address   : Lahane Oriental, Dili
Marital status   : Married
E-mail   :dominut_2006@yahoo.com
Phone number   : +670 78072858
Language   : Tetum, Potugues
Qualification   : Public health, 2007

B. WORK EXPERIENCE:

Head of Nutrition Department, Ministry of health Timor-Leste, 2008- 2012

C. TRAINING :

1. Workshop on Food and nutrition promotion of horticulture, CPLP, Potugal Lisboa, October, 2004
2. Food and Nutrition Training Course, by WFP,Dili-Timor leste,April,2006
3. Master Trainer of Infant & Young Child Feeding Counseling The 3-1 Course,WHO,Unicef, IBFAN,MoH, Dili Timor Leste November 2007
4. International training program nutrition for maternal and child health, Faculty of Nursing, Chiangmai, November 2008
5. Essential nutritional actions, prevention first Seminar, USAID,Senegal,April,2009
6. International workshop on IYCF and Management of CMAM,WHO,Manila,2010
7. Reginal knowledge Management workshop on children, food security and nutrition window of MDG- Achievement Fund, UNICEF Dhaka,Bangladesh,2011
8. Nutrition for Infants and young children module to improving the health of woman and children short course by Menzies School of Health Research, Darwin,2011
9. Nutrition for adolescent girls and women throughout t the lifecycle short course, Menzies School of Health Research, Alice Springs, Australia, 2011
10. Nominated by the Timor-Leste Government Ministry of Health of study MPH in Thailand, Jun is a student and study MPH in Chulalongkorn University

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Approval Letter Ethical consideration