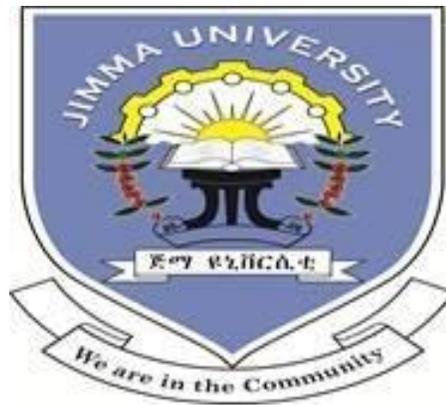


**DIETARY DIVERSITY AND ASSOCIATED FACTORS AMONG HIGH  
SCHOOL ADOLESCENT GIRLS IN JIMMA TOWN, SOUTH WEST  
ETHIOPIA, 2015**



**BY: YABSRA MELAKU (BSC)**

**THESIS SUBMITTED TO JIMMA UNIVERSITY, COLLEGE OF HEALTH SCIENCE,  
DEPARTMENT OF POPULATION AND FAMILY HEALTH IN PARTIAL  
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF  
SCIENCE IN HUMAN NUTRITION (MSC).**

**JUNE 2015**

**JIMMA ETHIOPIA**

Dietary Diversity and associated factors among  
High School adolescent girls in Jimma town, South West Ethiopia

By: Yabsra Melaku (BSc)

Advisors

Dessalegn Tamiru (BSc, MSc, PhD candidate)

Antenehe Dirar (BSc, MSc)

June 2015

Jimma Ethiopia



## **ABSTRACT**

**Background:** Dietary diversity is an aspect of dietary quality that indicates general nutritional adequacy. Lack of dietary diversity is a severe problem among poor people in the developing countries. Studies showed that monotonous diet and low meal frequency consumption has great contribution to adolescent malnutrition. There is limited knowledge in the area of dietary diversity and factors' affecting it among adolescent girls .It is also critically important to focus on the nutritional wellbeing of adolescent girls to break the vicious cycle of inter-generational malnutrition.

**Objective:** To assess the dietary diversity and associated factors among high school adolescent girls in Jimma town 2015.

**Methods:** Institution based cross sectional study was conducted from 15 March 2015 to 15 April 2015.Multistages sampling procedure was used to collect data from 455 school adolescents in Jimma town. A pre-tested interviewer administered questionnaire was used to collect data. The data were analyzed using SPSS version 20.0. Frequency distributions of the socio-demographic characteristics and outcome variables were portrayed. Bivariate and multivariable logistic regression was used to measure the strength of associations between the independent and the outcome variables. The cutoff for statistical significance was set at p-value  $\leq 0.05$ .

**Result:** Two hundred seventy nine (61.3%) students had dietary diversity score DDS score less than five food groups. The Mean ( $\pm$ SD) dietary diversity score of school adolescent girls was 4.34( $\pm$ 1.41). The low dietary diversity of school adolescent girls were positively associated with the students attending in government school [AOR =5.21 (95%CI=2.90, 9.36)], maternal educational status [AOR=7.65(95%CI: 3.41, 17.19)] families in low economic status [AOR=1.87 (95%CI: 1.04, 3.37)] and father occupation [AOR=0.28 (95%CI: (0.08, 0.95)].

**Conclusion and recommendation:** The results of this study indicated that Low socio-economic status, attending government school and lack of maternal education have significant contribution to low dietary diversity score among school adolescent girls. Therefore both government and non-government organization need to focus on school-based adolescent-friendly health and nutrition education services and family economic developments.

**Key words:** dietary diversity score, Adolescent girls, High school, FAO's guideline

## ACKNOWLEDGEMENTS

First and foremost, I thank the Almighty God for giving me strength and wisdom to successfully complete this thesis.

My deepest gratitude goes to my advisors, Mr. Dessalegn Tamiru and Mr. Antenehe Dirar for their unlimited support and their constructive comment throughout the preparation of my research paper.

I would like to thank Jimma University College health science, department of population and family health for giving me this opportunity to do my research paper.

I would also like to thank ENGINE project for its financial support.

I would like to thank Jimma zone educational office staffs for their excellent cooperation in the achievement of this study.

I would like to thank my husband, my family and my friends who support me financial and morally from the inception of proposal till the end this paper.

Finally I wish to thank all the respondents who agreed to participate in the study and all the people whose names I am not able to mention .May god bless you.

## TABLE OF CONTENT

### Contents

ABSTRACT.....	I
ACKNOWLEDGEMENTS.....	II
<b>TABLE OF CONTENT</b> .....	III
LIST OF TABLE.....	VII
LIST OF FIGURE.....	VIII
ACRONYMS AND ABBREVIATIONS.....	IX
CHAPTER ONE.....	1
1. Introduction.....	1
1.1 Background.....	1
1.2. Statement of the problem.....	4
CHAPTER TWO.....	6
2. Review of Literature.....	6
2.1 Socio demographic factors related to dietary diversity of adolescent girls.....	6
2.2 Personal factors related to adolescent girls’ dietary diversity.....	9
2.3 Significance of study.....	11
Conceptual framework.....	12
CHAPTER THREE.....	13
3. Objective.....	13
3.1 General Objective.....	13
3.2 specific objectives.....	13
CHAPTER FOUR.....	14
4. Methods and materials.....	14
4.1 Study area and period.....	14
4.2 Study design.....	14
4.3 Source Population.....	14
4.3.1 Study population.....	14
4.4. Sample size determination and sampling technique.....	14

4.4.1 Sample size determination .....	14
4.4.2 Sampling technique.....	15
4.5 Study variables.....	17
4.5.1. Dependent variable .....	17
4.5.2 Independent variables .....	17
4.6 Inclusion and Exclusion criteria.....	17
4.6.1 Inclusion criteria .....	17
4.6.2 Exclusion criteria .....	17
4.7. Data collection tools and techniques.....	17
4.7.1 Data collectors .....	18
4.8 Data quality control.....	18
4.9 Data analysis and presentation .....	18
4.10 Ethical consideration.....	19
4.11 Dissemination plan.....	19
4.12 Operational Definition .....	20
Chapter Five; Result .....	22
5.1. Socio-demographic characteristics of study participants.....	22
5.2 Dietary intake practice .....	24
5.3. Dietary diversity score of adolescent girls .....	25
5.4 Nutrition related Knowledge.....	26
5.5 Source of nutrition related information.....	27
5.6 Food preference of Adolescent girls .....	28
5.7 Factors associated with low dietary diversity score.....	28
CHAPTER SIX: DISCUSSION .....	32
Limitation of the study.....	34
Chapter seven.....	35
7. Conclusion and Recommendation .....	35
7.1 Conclusion .....	35
7.2 Recommendation .....	35
References.....	37
Annex I .....	40
<b>Consent form</b> .....	40

Annex II .....	41
<b>Questionnaire .....</b>	<b>41</b>



## LIST OF TABLE

Table 1: Socio-demographic characteristics of high school adolescent girls in Jimma Town	
Table 2: Types of food groups consumed among school adolescent girls in Jimma town, South west Ethiopia, 2015.....	24
Table 3: Distribution of school adolescent girls' dietary diversity score in Jimma town 2015....	25
Table 4: Distribution of the responses given by school adolescent girls, Jimma town,2015 .....	26
Table 5 :Multi variable logistic regression model predicting the likely hood of low dietary diversity score of adolescent girls.....	30

## LIST OF FIGURE

Figure 1: Conceptual framework for factors associated with dietary diversity score among school adolescent girls in Jimma town 2015. Source: adapted after review of different literature .....	12
Figure 2: Schematic presentation of sampling technique. ....	16
Figure 3: Distribution of adolescent girls response of reason for food preference in Jimma town, 2015.....	28

## **ACRONYMS AND ABBREVIATIONS**

AOR:	Adjusted odds ratio
BMI:	Body Mass Index
COR:	Crude odds ratio
CSA:	Central statistical agency
DDS:	Dietary Diversity Score.
FANTA:	Food and nutrition technique assistance.
FAO:	Food and Agriculture organization.
FMOH:	Federal Ministry of Health
MF:	Meal Frequency.
NNP:	National Nutrition Program
PCA;	Principal component analysis
SES:	Socio-Economic Status
SPSS:	Statistical packages for social science
WHO:	World Health Organization

# CHAPTER ONE

## 1. Introduction

### 1.1 Background

Dietary diversity is defined as the consumption of an adequate variety of food groups' Nutrition is a main component of health and development (3) .Healthy growth and development heavily dependent upon intake of adequate quantity and quality of food. which includes a variety of foods from different food groups (vegetables, fruits, grains, and animal source foods) (2) .All people need a variety of foods to meet requirements for essential macro and micro nutrients, and the value of a diverse diet has long been recognized (3).

For an individual level studying dietary diversity uses a proxy indicator of nutrient adequacy, Studies in different age groups have shown that an increase in individual dietary diversity score is related to increased nutrient adequacy of the diet. Dietary diversity scores have been validated for several age/sex groups as proxy measures for macro and/ or micronutrient adequacy of the diet. So it is important to know adolescent's dietary diversity score to evaluate their nutrient adequacy and appropriate method in developing country as it was done previously (4)

Adolescence is an important stage of physical growth and development. They experience dramatic physical growth and development. During adolescence, 20% of final adult height and 50% of adult weight are attained this increases their requirements for energy, protein, and many vitamins and mineral (5).

Current nutritional status of adolescents will decide the well-being of the present as well as the future generations. Adolescent have typically being considered as low risk of poor health and often receive few health care resource and less attention. However, this approach ignores the fact that many health problems later in life can be improved by adapting health life style habit during adolescence (6).

Inadequate Nutrition specially, on adolescent girls, has consequences. If their nutritional need was not meet they are likely to give birth undernourished children, thus transmitting

undernourishment to future generation, there by affecting growth and prosperity of a nation. One way to break integration cycle of malnutrition is to improve nutritional status of adolescent girls prior to conception (6)

The nutritional status and development of adolescent girls are integrately related to their nutritional requirements, dietary intake, dietary practices, cultural traditions and meal patterns (7). Micronutrient malnutrition remains a serious nutritional concern, of which the common are vitamin A, iodine and iron deficiency are highly reported (3). While these deficiencies can have a number of causes not necessarily related to nutrition, a high proportion results from nutritional inadequacies (8). Dietary diversification is one of the four main strategies advocated internationally for the improvement of micronutrient intake and status (9).

Increased dietary diversity helps to ensure adequate intake of essential foods. It is a key element of high quality diet. Dietary diversity is intended as a proxy of access to food, intake of energy and other macronutrients and as well as intake of micronutrients. At individual level it refers to consumption of a particular nutrient inside and outside home. Healthy diets are said to be those that are the most varied in nature. Food diversity is emphasized by the Food Guide Pyramid and the USDA (The United States Department of Agriculture) (5).

The lack of dietary diversity is a severe problem among poor people in the developing countries including Ethiopia, suggested that they feed mostly monotonous diet based on starchy staples without or with minimal use of animal products, fruits and vegetables. A monotonous diet lack essential micronutrients and contributes to the burden of malnutrition and micronutrient deficiencies (10). The problem is particularly critical in Adolescents because they need energy- and nutrient-dense foods to grow and develop both physically and mentally and to live a healthy life.

Dietary diversity score of different age groups is done in different countries for different purpose at household level or at individual level and the mean dietary score is vary from place to place and there is a significant association between dietary diversity and their nutrient adequacy. In developed countries, there are a number of studies linking dietary diversity to nutrient intake, particularly among adults (11).

There is no broad research reports done on dietary diversity of adolescent girls in Ethiopia, we believe that the absence of available data on the dietary diversity and associated factors of adolescent girls have limited the development of intervention strategies aimed at improving the nutritional status of girls. Given the importance of integrating and coordinating interventions to optimize outcomes for adolescents, it is vital to arrive at a set of priority actions to guide program development and the implementation process. .

The process for priority setting should start with the assessment and analysis of the situation that adolescents face in their environment. Therefore, this study aimed at assessing the dietary diversity practice and identifying associated factors of adolescent girls. Information gathered from this study will provide baseline data and will elicit support and promote cooperation among the different stakeholders towards the initiation of a sustainable nutrition and health promotion program for adolescent girls.

## **1.2. Statement of the problem**

Adolescent girls of in all income and racial/ethnic groups are at risk for dietary deficiencies and excesses of both micro and macronutrients. Being in transition, adolescents may no longer benefit from the attention and care that usually go to children, but they may not get the protections associated with adulthood either.

A non-diversified diet can have negative consequences on individuals' health, well-being and development, mainly by reducing physical capacities and resistance to infection. In addition, cognitive development, reproductive and even social capacities may also be impaired (12). 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 transmitting under nutrition to future generations. One way to break the intergenerational cycle of malnutrition is to improve the nutrition of adolescent girls prior to conception. The vicious cycle of malnutrition, if not broken, will go on resulting in more and more severe consequences (13).

Micronutrient deficiency in adolescent is a major public health problem in the world, especially in developing countries including Ethiopia, which is strongly associated with poor quality of dietary intake (14)(9). The high prevalence of chronic energy and micronutrient deficiencies of today's adolescent girls is directly linked to the quality of the next generation. Without addressing these deficiencies, the vicious cycle of inter-generational under nutrition, non-communicable chronic diseases, and poverty perpetuates (16).

Studies from different developing countries showed that lack of dietary diversity which leads to under nutrition among school girls has strong linkage with poor household socio-economic condition, burden of disease and unequal intra-familial distribution of food like specific food taboos and dietary restrictions during menstruation.

Dietary diversity of adolescent girls is influenced by their eating patterns and behaviors of adolescents including peer influences, parental modeling, food availability, food preferences, cost, personal and cultural beliefs, mass media, and body image perception (17).

In general adolescent girls are the worst sufferers of the ravages of various forms of malnutrition like protein energy malnutrition, iron, iodine, calcium, vitamin A and other specific nutrient deficiencies because of their increased nutritional needs but decreased intake. At the same time low literacy level, lack of nutrition related knowledge and lack of awareness about their nutritional requirements further aggravate this dismal situation. (7)

Improving the dietary diversity of adolescent girls' has benefits other than their well being and long-term nutritional health, adolescents are future mothers the key to household food safety and nutrition improving their nutritional status and enhancing their nutrition-related skills is therefore likely to have long-range benefits for themselves and their families (18).

In Ethiopia, child bearing begins at an early age. Forty five percent of the total births in the country occur among adolescent girls and young women (19). Most of the women in parts of sub-Saharan Africa, including Ethiopia, enter pregnancy with a poor nutrition status. It has been found that most of the time, the women may enter pregnancy with iron deficiency anemia and may have other micronutrient deficiencies which adversely affect her health and that of the fetus like low birth weight, neural tube defect and others (20).

Therefore, it is critically important to focus on the nutritional wellbeing of adolescent girls to break the vicious cycle of inter-generational malnutrition by improving the quantity and quality of food and nutrient. On the other hand studying dietary diversity is a good indicator of nutrient adequacy and it has an association to nutritional status as shown in many studies before (13) There is still very little data on Dietary diversity of adolescent girls, particularly in developing countries like Ethiopia. Therefore this study aimed to assess dietary diversity and associated factors among school adolescent girls.

## CHAPTER TWO

### 2. Review of Literature

Adolescent girl malnutrition is a common nutritional problem due to poor quality diet and lack of health care service in the developing world. Mostly household diets are predominantly starchy staples with few animal products and seasonal fruits and vegetables. Addressing the nutritional problems of adolescent girl is important as their nutritional status has negative effect on the future generation (7).

#### 2.1 Socio demographic factors related to dietary diversity of adolescent girls

Study done in Ahvaz-Iran among school Adolescents girls indicated that the mean dietary diversity score was  $6.81 \pm 1.75$ . All anthropometric measures in this study were slightly higher in participants with high dietary diversity score. Low dietary diversity was significantly associated with weak economic situation. However, age, type of school and ethnicity did not show any significant association with dietary diversity score. Considering the consumption of micronutrient rich diets, only 19.98% of participants used vitamin A rich fruits and 7.3% consumed organ meat (1).

A study done in Kenya showed that women aged 15-49 years old had the mean dietary diversity score  $7.49 \pm 1.43$  where 20% of the women have consumed greater 6 food groups. A significant difference was observed in dietary diversity based on marital status where the married women more likely to have a higher dietary diversity score and the single had a lower dietary diversity. There was also significant differences in the mean macronutrients and micronutrients where respondents with a higher dietary diversity score greater than six food groups were more likely to have a higher macro and micro nutrient intake compared with those who had a lower dietary diversity score (3).

Study done among school adolescents in Iran showed the mean dietary diversity score was  $6.25 \pm 1.08$ , but based on dietary diversity score into three groups, 61.4% of adolescents had dietary diversity score greater than six and 38.3% adolescent girls had dietary diversity score less than 5. School adolescent who had dietary diversity score  $\geq 6$  had greater BMI and better fiber intake than in individuals with scores below six. There was also positive correlation between dietary diversity score and nutrient adequacy ratio (21).

Findings from a rural Burkina Faso showed the mean dietary diversity of young women was  $5.1 \pm 1.7$  and the study indicated a positive relationship between dietary diversity score and nutritional status. Low dietary diversity score was positively associated with underweight (22.8%) and negatively associated with high dietary diversity score (9.8%). Food groups which the majority of women consumed was cereals (98.6%) and leafy vegetables (87.1%) (12).

Studies among European adolescents showed that mean dietary diversity score was significantly different between different study centers. Age and gender had no significant effect on the dietary diversity score. Additionally, the total nutrition knowledge taste scores in the different centers ranged between 50 and 70%. Mean scores were significantly different between centers. Age, BMI and gender had no significant effect on knowledge results. In general, girls had higher values than boys. In girls, there was a tendency for higher scores with increasing age (22).

In rural Bangladesh adolescent girls consumptions of non-staple good-quality food items were positively associated with the household asset quintile. Girls of the highest asset quintile ate fish/meat 2.1 (55%) days more and egg/milk two (91%) days more than the girls in the lowest asset quintile. The overall dietary knowledge adolescents girls were low and more than half them could not name the main food sources of energy and protein and they don't have awareness about the importance of taking extra nutrients during adolescence for growth spurt (16).

In a study conducted in Eastern Kenya within semiarid agro-ecological zones indicated most of the children had low dietary diversity (72.3%) and mostly consuming food less than 4 food groups in a day. However, no significant associations were found with age of child, sex of child, education level of the woman/caregiver, marital status of the woman/caregiver, ecological zones, DDS of child, household size and nutritional status of the children. The result revealed that older age in woman/caregiver and severe food insecurity were strongly associated with stunting among children (23).

Recently the association between dietary diversity and micronutrient adequacy of diets of women in reproductive age was assessed in five countries. Dietary diversity was significantly associated with micronutrient adequacy in all sites (Burkina Faso, Mali, Mozambique, Bangladesh, and the Philippines) (24). Also dietary diversity score was found to be a useful indicator of some specific nutrient adequacy in women from Tehran (25).

The study done among rural India adolescent girls showed the mean intake of micronutrients increased with increase in age. Calcium and iron inadequacy were pronounced in 10-15 years and 16-19 years, respectively. Whereas vitamin A deficiency was significantly more in all age groups with respect to RDA. Vitamin A consumption in the age group 10-12 years was significantly more than the corresponding value in the age groups 13-15 years and 16-19 years. In the latter two groups mean vitamin A intake was statistically not significant (7).

Findings from different studies also indicated that dietary diversity and nutritional status has strong linkage. However, studies from Iran showed an inverse association between dietary diversity and abdominal adiposity among young females (26).

Findings from study done in urban area of Burkina Faso indicated that one of the major reasons for low diversity of diet is poor accessibility of food and also there was a significant relationship between the DDS and economic situations. Poor people often do not have access to a diverse food. Although access is important, but the awareness of food-based dietary guidelines will probably have more effect. Furthermore, it is evident that food diversity needs greater cost (27).

Studies from rural Bangladesh indicated that household dietary diversity and food expenditures have strong relationship. Significant associations were also observed between dietary diversity and other indicators of socioeconomic status, including parental education, area of main dwelling, and amount of cultivable land owned by the household (28).

study done in Jimma showed that age and high household income tertiles were positively associated with having high dietary diversity score, while adolescent food insecurity and residence in the rural area were negatively associated with having high dietary diversity score of adolescent (29).

A comparative cross sectional study conducted in Iran adolescents indicates family education and occupational status has positive contribution to dietary diversity among school adolescent girls. This study showed that poor socio economic status and parents' education were significantly associated with low dietary diversity score (30).

Study done in among South African adults' showed the highest prevalence of poor dietary diversity score (DDS <4) were 61.8% and the lowest one was 15.7%. This study also shows the

majority of South Africans consumed a diet of low in dietary variety were the national level mean DDS was 4.02. The most commonly consumed food groups were cereals/roots; meat/fish; dairy and vegetables (other than vitamin A rich). Eggs, legumes, vitamin A rich fruit and vegetables were the least consumed. Having no toilet; a river water source, living in a traditional type house; and no access to electricity were positively associated with low DDS (31).

Studies conducted in Ethiopia showed that high prevalence of malnutrition in adolescent girls. For instance, the study done in Tigray Ethiopia shows the prevalence of stunting and thinness among school adolescent girls were 26.5% and 58.3%, respectively (13). Similarly recent study done in Bedelle town showed that the prevalence of underweight among adolescent girls was 28% (14)

## **2.2 Personal factors related to adolescent girls' dietary diversity**

Study from Ghana showed that adolescent's knowledge about Diet-Related Chronic Diseases and Dietary Practices were low. Most of them (89.2%) have poor knowledge and 9.3% of the respondents had good knowledge about the disease. The dietary diversity of the respondents was generally poor and there was a significant relationship between knowledge of diet related chronic diseases and the dietary practices of the adolescents. As knowledge of the diseases increased, dietary diversity also improved. A greater proportion of the respondents (87.9%) ate three times or more in a day. This pattern of consumption is in agreement with WHO recommendation of three meals a day the rest ate once (1.6%) or twice (10.5%) in a day (32).

Study done among Indian adolescent girls on nutrition related knowledge was imparted in the school to 53.70%. As much as 48.28% subjects did not remember the content of knowledge imparted in the school and 35.17% were informed about fruits and vegetables. Two third of girls respond that food intake during adolescent age should be less than adult. Access of nutrition related knowledge was poor for adolescent girls. Their nutrition related knowledge was not satisfactory and majority of them were not aware about their nutritional needs. Ignorance about micronutrients and protective foods prevailed in adolescent (7).

A study done in South Korea in elementary school children showed the average score of nutrition knowledge was 6.8. Dietary behavior of male subjects was positively correlated with parents' education levels, monthly household income and nutrition attitude. Dietary behavior of

female students was positively correlated with monthly household income, nutrition knowledge and nutrition attitude (33).

### **2.3 Significance of study**

The major reason for focusing on adolescents is that this period gives a unique opportunity to break a range of vicious cycles of structural problems that are passed from one generation to the next, of those things are, poor health and nutrition. Nutrition intervention in adolescent girls may contribute to breaking the vicious cycle of intergenerational malnutrition.

Adolescence may represent a window of opportunity to prepare nutritionally for a healthy adult life. Some nutritional problems originating earlier in life can potentially be corrected, in addition to addressing current ones. It may also be a timely period to shape and consolidate healthy eating and lifestyle behavior's, thereby preventing or postponing the onset of nutrition-related chronic diseases in adulthood.

Improving access to appropriate nutrition services for adolescents especially girls is required and is part of the second component of the national nutrition program overall strategy, in addition to strengthening their skills for adopting healthy eating and lifestyle. It is evident from this that adolescent nutrition promotion is lagging and should connect with health services on one side, and food security programs on the other. Nonetheless, schools provide a wealth of opportunities to improve nutrition: formal learning, and in particular, gardening, cooking and feeding.

Despite of the above mentioned facts, in developing countries like Ethiopia there is limited school based studies, assessment and interventions depending on dietary diversity and associated factors on adolescent girls. Therefore the findings of this study have significant input to improve the dietary patterns of school adolescent girls. Besides, policymakers and program managers can use this study as base line information to take action and to fill the gap. It also gives insight for researchers to do more in the dietary diversity in the study area.

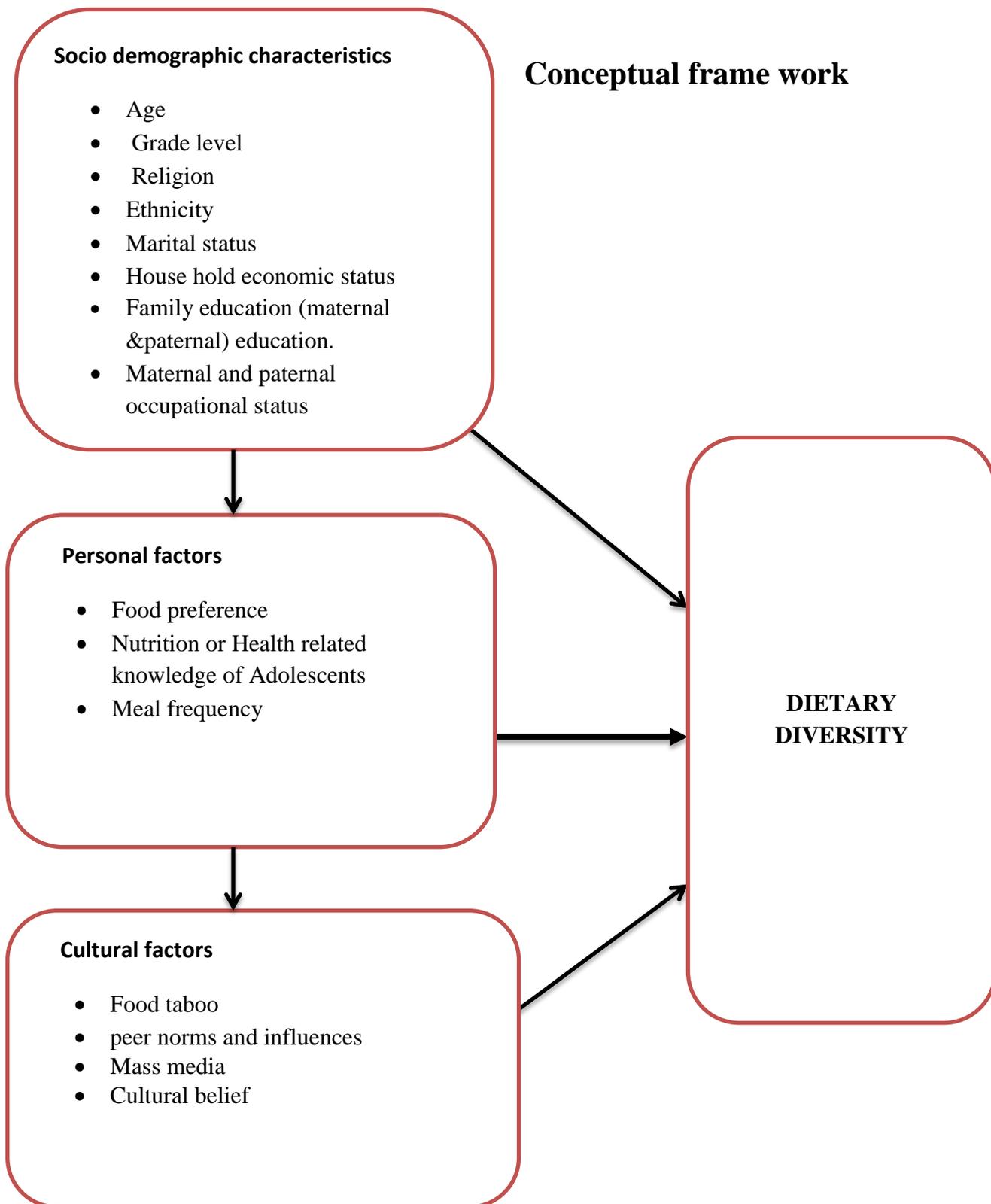


Figure 1: Conceptual framework for factors associated with dietary diversity score among school adolescent girls in Jimma town 2015. Source: adapted after review of different literature

## **CHAPTER THREE**

### **3. Objective**

#### **3.1 General Objective**

- To assess dietary diversity and associated factors among adolescent girls in Government and Private high schools in Jimma town from March to April 2015.

#### **3.2 specific objectives**

- To determine the dietary diversity score of school adolescent girls in Jimma town
- To identify factors associated with dietary diversity of school adolescent girls in Jimma town.

## **CHAPTER FOUR**

### **4. Methods and materials**

#### **4.1 Study area and period**

This study was conducted in Jimma town government and private high schools. Jimma is located at 357 km to south west of Addis Ababa. It is found in Oromia Region of Ethiopia. The town is named after the former Kingdom of Jimma, which was absorbed into the former province of Kaffa in 1932. It is bordered in the south by the Southern Nations, Nationalities and Peoples Region, in the northwest by Illubabor, on the north by Welega town and on the north east by west Shewa. Projecting from 2007 census Jimma town has a total population of 159,009 of whom 80,897 were males and 78,112 were females. In the town there are about ten high schools out of which six are private and the rest are government schools. The total number of students in four government secondary schools are 6,860 where 3589 are females and 3271 are males, whereas total number of students in six private secondary school are 1783 students where 814 are males and 969 are females.

The study was conducted in Jimma town from March 25, 2015 to April 5, 2015

#### **4.2 Study design**

Institution based cross-sectional study.

#### **4.3 Source Population**

The source populations are all high school adolescent girls attending their education in Jimma town.

##### **4.3.1 Study population**

Government and private adolescent girls 'who are randomly selected from each of sample selected schools.

#### **4.4. Sample size determination and sampling technique**

##### **4.4.1 Sample size determination**

The sample size was determined by using single population proportion formula. Taking 0.05 margins of errors at 95% confidence interval and taking proportion of dietary diversity practice among adolescent girls 16.1% (prevalence of low dietary diversity score of adolescents which was conducted in Jimma zone) (29) then the final sample size was calculated as follows

$$n = \frac{[Z_{\alpha/2}]^2 * P * (1-P)}{d^2}$$

$$n = 1.96 \times 1.96 [0.16 \times 0.839] / 0.05^2 = 207$$

By adding 10% non-response rate the total sample size was 227.7 by considering the design effect the sample size multiplied by two.

$$= 227.7 \times 2 = 455.4 \approx 455. \text{ Therefore, the final sample size was } n=455$$

Where:-

n=minimum sample size.

P= prevalence of poor dietary diversity practice which is 16.1%

Q=1-p

Z<sub>α/2</sub> = critical value at 95% confidence level of certainty (1.96) (a constant).

d= the margin of error (tolerance) between the sample and population= 0.05

#### **4.4.2 Sampling technique**

Multi-stage sampling technique was used to select the study participants. The existing high schools were stratified according to Government and private ownership. A lottery method was used to select two schools from government and three from private schools. A total of 455 female students were included in the study and the number of students from the selected schools was determined using proportional allocation to size sampling technique. Finally female students in each class were selected by simple random sampling technique.

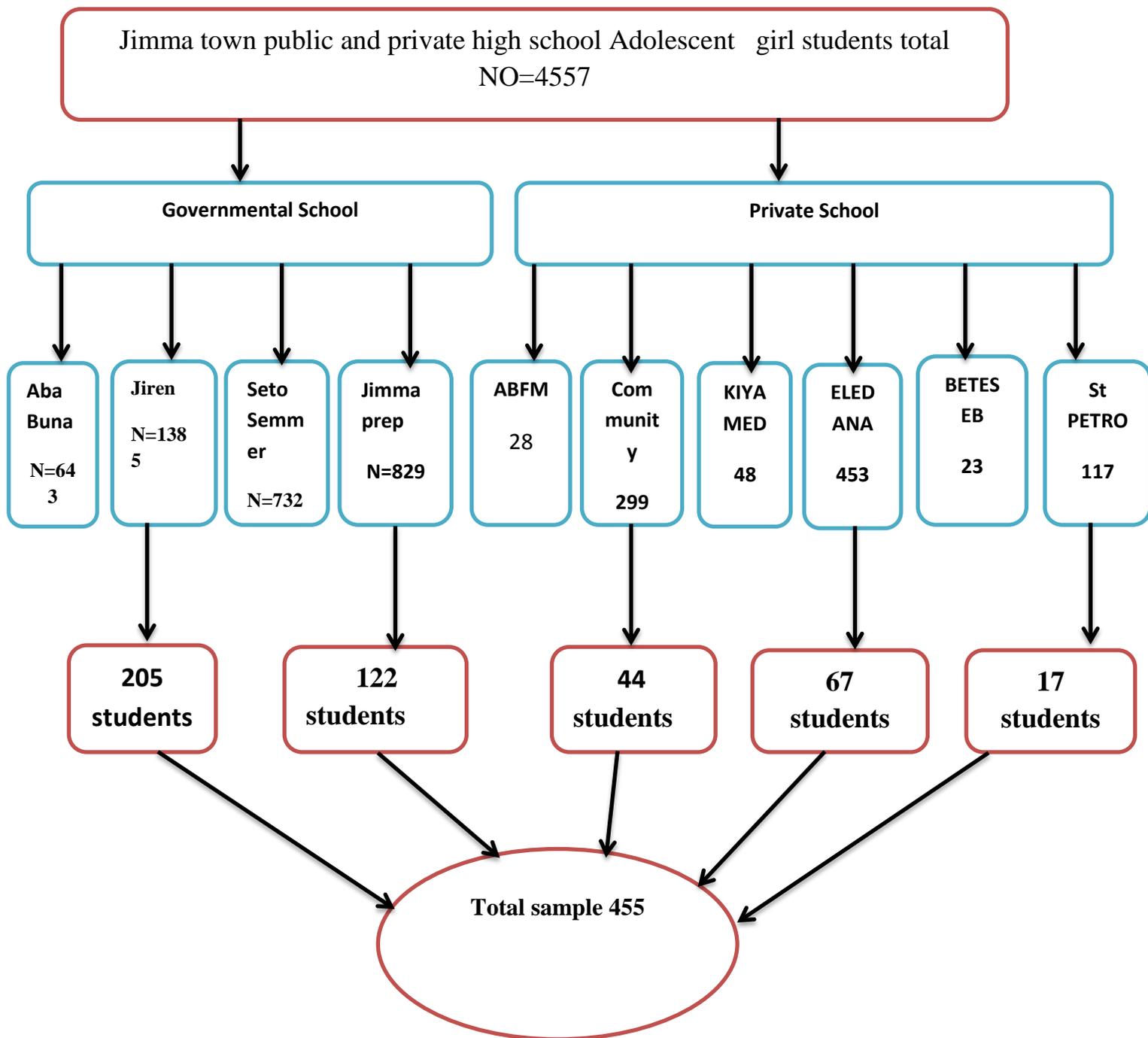


Figure 2: Schematic presentation of sampling technique.

## **4.5 Study variables**

### **4.5.1. Dependent variable**

- Dietary Diversity Score

### **4.5.2 Independent variables**

1. Socio Demographic characteristics
  - Age, Religion, Ethnicity, Grade level
  - Economic situation of house hold
  - Family unit size
  - Parent educational status, Parent occupational status
2. Personal factors (food preference, self-image ,dieting, meal skipping, Meal frequency)
3. Culture factors (culture belief, food taboo, peer norms and influences Mass Media)

## **4.6 Inclusion and Exclusion criteria**

### **4.6.1 Inclusion criteria**

- Government and private school adolescent girls whose age 10-19 years old from grade 9 to grade 12

### **4.6.2 Exclusion criteria**

- Subjects who are not resident within the study area for more than six months before prior to data collection.

## **4.7. Data collection tools and techniques**

Interviewer- administered questionnaire was used to collect data on socio-demographic characteristics and dietary practice which adopted from EDHS, FAO and WHO. Dietary diversity was measured using the WHO & FAO one day (24-hour dietary recall) diversity questionnaire. The diversity questionnaire used consists of 15 groups of foods, which covers almost every food taken to obtain information on subject's food intake. Subjects were asked to recall all foods eaten and beverages taken in the previous twenty-four hours inside and outside home.

After the respondent recalls all the foods and beverages consumed, participants were probed for snacks eaten between main meals, probed for added foods such as sugar in tea, oil in mixed dishes or fried foods.

#### **4.7.1 Data collectors**

In the data collection process five trained diploma nurses and two BSc nurses who are fluent in the local language were participated as a data collector and supervisor respectively. Two days training was given to data collectors to discuss each of the questions in the questionnaire how they should fill it. Mock interviews and practical field exercise was given to data collectors and supervisors to ensure the quality of the field operation. During data collection, the supervisors followed data collectors and performed quality checks with principal investigator.

#### **4.8 Data quality control**

The questionnaire was prepared in English and the questionnaire was adapted from FAO, 2011 guide line. Training of data collectors and supervisors and pre testing of questionnaire were made to ensure the quality of data. Pre-testing was performed on 20 students in one of the unselected school. After pre-testing, clarifications and corrections were done on the questionnaires. The principal investigator and two supervisors were monitored the data collection process, they were included in the spot of data collection to check and review all the questionnaires to ensure completeness and consistency of the information. Data were double entered by using Epi Data version 3.5.3 then exported to SPSS v 20 for analysis.

#### **4.9 Data analysis and presentation**

The data were entered with EPI-data software version 3.5.3 then data were coded, cleaned, checked for completeness, outliers and missing values then exported to SPSS (Statistical Package for Social Sciences) version 20 for analysis. Frequency table were used to display the socio-demographic characteristics and the main findings of the responses given by the participants. PCA was used for wealth index from 24 items and ranked in tertial adapted from EDHS.

A bivariate analysis was used to check association between dependent and independent variables. Variables with p-value < 0.25 on bivariate analysis was entered to Multivariate Binary Logistic Regression model to identify the factors that affect the dietary diversity of adolescent

girls and deal with confounding effect. Results were claimed to be statistically significant when the p-value is equal or less than 0.05. Finally the result displayed using charts, graphs and tables.

#### **4.10 Ethical consideration**

Prior to data collection, letter of support were obtained from Population and Family Health department and submitted to the school director. Ethical clearance was obtained from Institutional Review Board of Jimma University. Permission was obtained from Jimma town Education Office and respective School Directors .All study participants were briefed about the purpose of the study including how the study will be beneficial to them and for the whole country. In addition, confidential of information will be assured and privacy of the study population will be respected and kept as well. Moreover, to ensure confidentiality the name of respondents were not written in the consent form. Respondents were informed that they can refuse or discontinue participation at any time.

#### **4.11 Dissemination plan**

The results of the study will be disseminated to Jimma university college of health science, department of population and family health, Jimma zone education office and respective bodies, regional health bureau and zonal health departments .Finally to ministry of health and Moreover the results will be sent for publication in reputable Journals .

## 4.12 Operational Definition

**Adolescent girls:** Female students whose ages are 10-19 years.

**Malnutrition** in the study is defined as a state when the body does not have enough of the required nutrients (under-nutrition).

**Nutritional status** is a measurement of the extent in which individuals physiological needs for nutrients are being met and was measured using weight, height and MUAC.

**Dietary diversity scores:** In the study will be created by summing up the number of food groups consumed over a 24 hours period by an individual.

**High dietary diversity score:** Adolescent girls with age 10-19 years old who receive foods > or equal to five food groups out of the nine food groups.

**Low dietary diversity score:** Adolescent girls with age 10-19 years old who receive foods < five food groups out of the nine food groups.

Consumption of any amount and quality of food from each food group was sufficient to 'count' (WHO, 2008, FAO, 2011).

**Cultural factors:** refer to beliefs and norms about foods and dietary diversity practices

**Meal frequency:** Adolescent girls with age group 10-19 years old usual frequency of meal in a day.

**Food preference:** Selection of one food over another based on personal or cultural belief.

**Knowledge** of adolescents in nutrition related information is labeled based on the response of respondents' knowledge on carbohydrate, fat, fiber, iron, food source of vitamins, deficiency of vitamin A, iodine and cause of anemia, advantages of diversified food, definition of malnutrition, cause of malnutrition (7).

- **Good knowledge**- total score above mean value ( $>5.6$ )
- **Poor knowledge**- total score below mean value ( $\leq 5.6$ )

**Wealth index;** was developed based ownership of fixed asset using PCA then it was ranked by terterial and recorded as low, middle and high.

## **Chapter Five; Result**

### **5.1. Socio-demographic characteristics of study participants**

A total of 455 students aged between 14 to 19 years old were included in the study with the 100% response rate. The large number of study participants was from government school (77.4%) and the majority of students (35.2%) were grade 9. The mean ( $X \pm SD$ ) age of study the participants were 16.83( $\pm 1.292$ ). Majority (53.4%) of respondents belong to Oromo ethnic group. The religion of respondents were Orthodox (46.6%), Islam (28.8%) Protestant (22.6%) and (2%) catholic respectively. The majority (97.8%) of students' marital status was single. More than one fourth of adolescent's mothers (26.4%) were attended secondary school and most of them are government employee (40.9%). Paternal education (37.6%) of adolescent's father where attended above secondary school and most of them are government employee (52.1%) (Table1).

Table 1. Socio demographic characteristics of high school adolescent girls in Jimma town 2015

<b>Variables</b>		<b>Frequency(N)</b>	<b>Percent (%)</b>
<b>Age</b>	14-16	184	40.4
	17-19	271	59.6
<b>School</b>	Government	352	77.4
	private	103	22.6
<b>Ethnicity</b>	Oromo	243	53.4
	Amhara	86	18.9
	Guragie	31	6.8
	Dawuro	25	5.5
	Tigray	70	15.4
<b>Religion</b>	Orthodox	212	46.6
	Islam	131	28.8
	Protestant	103	22.6
	Catholic	9	2
<b>Grade level</b>	9	160	35.2
	10	91	20.0
	11	98	21.5
	12	106	23.3
<b>Marital status</b>	Single	445	97.8
	Married	7	1.5
	Others	3	0.6
<b>Family members</b>	1-6	374	82.2
	6-12	81	17.8
<b>Mother education</b>	No formal education	71	15.6
	Can read and write	87	19.1
	Primary school	87	19.1
	Secondary school	120	26.4
	Above secondary school	90	19.8
<b>Mother occupation</b>	House wife	159	34.9
	Government employee	186	40.9
	Private organization	23	5.1
	Merchant	72	15.8
<b>Father education</b>	Daily laborer	15	3.3
	No formal education	25	5.5
	can read and write	30	6.6
	Primary school	97	21.3
	secondary school	132	29.0
<b>Father occupation</b>	Above secondary school	171	37.6
	Farmer	38	8.4
	Gov't & Private employee	257	56.5
	employee	93	20.4
	Merchant	67	14.7
	Daily laborer		

## 5.2 Dietary intake practice

Majority of study participants (97.6%) consumed cereal based foods. Greater than three fourth (76.7%) of the study participants were consumed legumes, nuts and seeds .More than half (54.3%) of study participants were consumed white roots & tubers. Nearly half (44.6%) of study participants consumed dark green leafy vegetables. Almost one third (32.5%) of respondents were consumed vitamin A rich fruits. Small number of students reported that they consumed organ meat (9.9%), and flesh meat (16.3%). Forty nine (10.8%) students were consumed fish and sea foods (**Table-2**).

Table 1: Types of food groups consumed among school adolescent girls in Jimma town, south west Ethiopia, 2015.

<b>Food groups</b>	<b>Frequency(N)</b>	<b>Percent (%)</b>
Cereals	444	97.6
White roots and tubers	247	54.3
Vitamin A rich vegetables and tubers	247	54.3
Dark green leafy vegetables	203	44.6
Other vegetables	350	76.9
Vitamin A rich fruit	148	32.5
Other fruits	94	20.7
Organ meat	45	9.9
Flesh meat	74	16.3
Eggs	64	14.1
Fish and seafood	49	10.8
Legumes and nuts	349	76.7
Milk and milk products	81	17.8
Oils and fats	399	87.7
Sweats	371	81.5

Findings show that majority of adolescent girls meal frequency was three times a day 226 (49.7) followed by four times a day 197(43.3)

### 5.3. Dietary diversity score of adolescent girls

The mean ( $\pm$ SD) dietary diversity score of adolescent girls was 4.34( $\pm$ 1.415). Based on (FAO 2011), their dietary diversity practice was assessed using 15 food items. Two hundred seventy nine (61.3%) students had dietary diversity score less than five food groups. The minimum dietary diversity score of adolescent girls was 2 and the maximum dietary diversity score was 9 (Table 3)

**Table 3: Distribution of school adolescent girls' dietary diversity score in Jimma town 2015.**

Dietary diversity score	Frequency(N)	Percent (%)
Two food groups	30	6.6
Three food groups	102	22.4
Four food groups	147	32.3
Five food groups	91	20.0
Six food groups	48	10.5
Seven food groups	22	4.8
Eight food groups	13	2.9
Nine food groups	2	0.4
Low(Less than five food groups)	279	61.3
High(Five and more food groups)	176	38.7

## 5.4 Nutrition related Knowledge

Eleven items about nutritional knowledge was assessed based on literatures finding. These items were aimed to assess whether students knew enough about the nutrients, advantage of diversified food, and cause of mal nutrition depending on common foods. A total nutrition knowledge score was obtained by adding the responses, scoring one for each correct answer and zero otherwise. A correct response was given a score of one, and an incorrect one a score of zero. The mean value for knowledge related correct responses was 5.6. Total responses above mean value were considered as good and those below mean value were considered as poor. The total possible score for knowledge was 11. “Good knowledge” was described by an aggregate score of >5.6-11, and “poor knowledge” by 5.6 or below.

According to the evaluation of knowledge related responses, majority 254 (55.8%) of adolescent girls had good knowledge but the rest 201 (44.2%) had poor knowledge (**Table 4**).

**Table 4: Distribution of the responses for nutrition related knowledge items given by school adolescent girls, Jimma town, 2015**

Nutrition knowledge item	Yes (%)	No (%)
knowledge related to carbohydrate	214(47)	241(53)
knowledge related to fat	112(24.6)	343(75.4)
Knowledge related to fiber	12(2.6)	443(87.4)
Knowledge related to iron	94(20.7)	361(79.3)
Knowledge related to definition of malnutrition	415(91.2)	40(8.8)
Knowledge related to Cause of malnutrition	321(70.5)	134(29.5)
Knowledge related to Vitamins?	455(100)	0(0)
Knowledge related to Cause of anemia	256(56.3)	199(43.7)
Knowledge related to Cause of goiter	371(81.5)	84(18.5)
Knowledge related to vitamin A deficiency	299(65.7)	156(34.3)
Knowledge related to benefit of diversified diet	440(96.7)	15(3.3)
Poor knowledge	201(44.2)	
Good knowledge	254(55.8)	

### **5.5 Source of nutrition related information**

The majority of school adolescent girls (86.6%) got nutrition related information from school followed by mass media 291(64), friends 201(44.2) and family 188(41.3).

## 5.6 Food preference of Adolescent girls

Considering adolescent girls food preferences that avoid to ate, the majority (52.1%) of study participants respond they had no any food preference. However (47.9%) school adolescent girls respond that they had food preferences and mentioned their own reasons some of the reasons are because of food taste, colour, flavor, abdominal discomfort and loss of interest. (Figure-3).

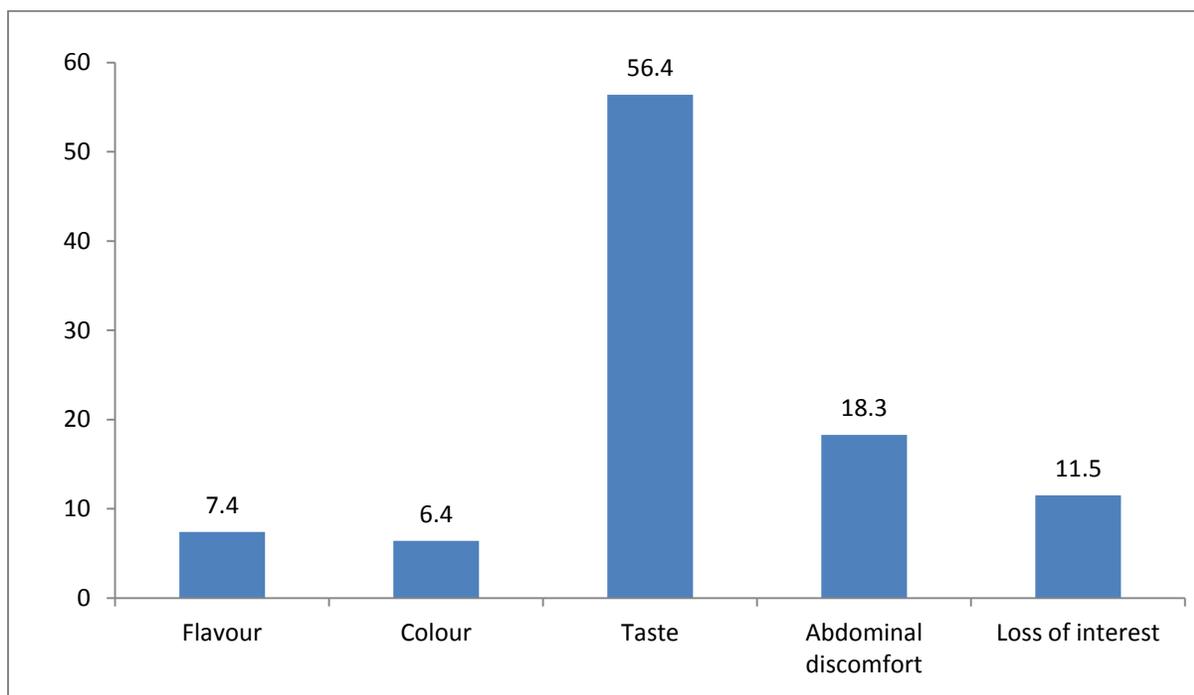


Figure 3: Distribution of adolescent girls' response of reason for food preference in Jimma town, 2015

## 5.7 Factors associated with low dietary diversity score.

In the Bivariate logistic regression age, type of school, grade level, head of the house hold ,mother education, mother occupation, father education, father occupation, food preference , meal frequency, knowledge of nutrition and house hold economic status entered to this model and the variable which had a p-value < 0,25 were candidate for multi variable logistic regression,

so from the above all variables only school type, mother education, father education , family size ,father occupation and house hold economic status are the only candidate for multivariable logistic regression. Finding from the final model of multivariable logistic regression shows school type, family size, mother education, father occupation and house hold economic status are factors for low dietary diversity score of school adolescent girls.

In the multi variable logistic regression model findings of this study showed that students who were learning in government school were five times more likely to have low dietary diversity score as compared to adolescent girls who are learning in private school (AOR 5.2 95%CI =2.89,9.35).

Adolescent girls whose mothers have no formal education were 8 times more likely to have low dietary diversity score than whose mothers were attended secondary school and above (AOR 7.65 ,95%CI=3.40-17.19 ). Adolescent girls whose mothers can read and write were six times more likely to have low dietary diversity score than whose mothers were attend above secondary school (AOR 6.03, 95%CI=2.86-12.70).Adolescent girls whose mothers have primary educational status were five times more likely to have low dietary diversity score than whose mothers were attended above secondary school (AOR 5.43, 95%=2.61, 11.32).

Adolescent girls whose fathers were merchants had less likely to have low dietary diversity diet by 66% than adolescent girls whose father's occupation were farmer (AOR. 0.34; 95%CI = (0.18, 0.873). Adolescent girls whose fathers were in private organization had less likely to have low dietary diversity by 72.4% than adolescent girls whose father's occupation were farmer (AOR 0.276, 95%CI=0.08, 0.95). Adolescent girls whose fathers were in government employee had less likely to have low dietary diversity score by 52.8% than adolescent girls whose fathers occupation were farmer (AOR 0.47, 95% CI=0.22, 0.99).

Increasing in one family member in the house hold increases the likely hood of low dietary diversity score in one times (AOR.1.34, 95%CI=1.14, 1.58). Adolescent girls whose families are in low economic status were nearly two times more likely to have low dietary diversity score than those high family economic status (AOR. 1.87,95%CI =1.041,3.365) (Table 5)

**Table-5: Multi variable logistic regression model predicting the likely hood of low dietary diversity score of adolescent girls.**

Variables	Dietary diversity score		COR(95%CI)	AOR(95%CI)
	LOW	HIGH		
<b>Type of school</b>				
Government	241(68.5)	111(31.5)	3.714 (2.34,5.87) **	5.204 (2.89,9.35)
Private	38(36.9)	65(63.1)	1	1
<b>Mother education</b>				
No formal education	56(78.9)	15(21.1)	5.348 (2.63,10.85)**	7.649 (3.40-17.18) **
Can read and write	67(77)	20(23)	4.799 (2.49,9.21) **	6.028 (2.86-12.70) **
Primary education	67(77)	20(23)	4.799 (2.499,9.21) **	5.433 (2.61,11.32) **
Secondary Education	52(43.3)	68(56.7)	1.095 (0.63,1.90)	0.958(0.51,1.79)
Above secondary school	37(41.1)	53(58.9)	1	1
<b>Economic status</b>				
Low	103(68.2)	48(31.8)	1.116 (0.69,1.80)	1.872 (1.04,3.365) *
Medium	76(50)	76(50)	0.520 (0.32,0.825) **	0.622(0.36,1.08)
High	100(65.8)	52(34.2)	1	1
<b>Father occupation</b>				
Farmer	29(76.3)	9(23.7)	1.275 (0.51,3.19)	0.984 (0.32,3.01)
Government employee	140(59.1)	97(40.9)	0.571 (0.31,1.03)	0.472 (0.22,0.99) *
Private organization	9(45)	11(55)	0.324*(0.12,0.90)	0.276*(0.08,0.95)
Merchant	53(57)	40(43)	0.524 (0.27,1.03)	0.339*(0.18,0.873)
Daily laborer	48(71.6)	19(28.4)	1	1

<b>Father education</b>				
No formal education	16(64)	9(36)	1.232(0.52,2.95)	0.555(0.18-1.75)
Can read and write	25(85.7)	5(13.7)	3.465*(1.26,9.49)	3.060 (0.91-10.29)
Primary school	62(63.9)	35(36.1)	1.228(0.73,2.05)	0.711(0.34-1.49)
Secondary school	75(56.8)	57(43.2)	0.912(0.58,1.44)	0.551(0.30-1.00)
Above secondary school	101(59.1)	70(40.9)	1	1

**NB:** \*\* and \* indicates significance at 0.001 and 0.05 respectively

## CHAPTER SIX: DISCUSSION

The present study demonstrated that the prevalence of low dietary diversity among high school adolescent girls in Jimma town were 61.3% and the mean dietary diversity score was  $4.34 \pm 1.41$  which is relatively low compared to the study done among adolescents girls in Ahvaz-Iran where the mean dietary diversity score was  $6.81 \pm 1.75$ . This might be due to lack of sufficient knowledge and low socio-economic status of our country (4, 14).

This study finding showed that family education, occupational status and poor socio economic status has positive contribution to low dietary diversity score among school adolescent girls. Which is consistent with, a comparative cross sectional study conducted in north and south Iran adolescents that shows poor socio economic status and parents' education were significantly associated with low dietary diversity score (30).

Findings of this study showed that high house hold economic status was associated with high dietary diversity score, this is consistent with study conducted in Jimma zone adolescents which showed that high house hold economic status of adolescents were was positively associated having high dietary diversity score (29).

This study showed that nutrition related knowledge of adolescents had no significant association with dietary diversity score which is inconsistent with study done in Ghana showed that nutrition related knowledge of adolescents had significant association with dietary diversity score where poor knowledge had positive association with low dietary diversity of school adolescents. This difference may be due to adolescent girls in this study are dependent on their family's for their dietary intake and their families might have poor nutrition related knowledge (32).

In the present study Nutrition related knowledge was given in the school to 89.7% of adolescent girls. Among these 56.7%, 65.7% and 81.5% of adolescent girls know about iron deficiency anemia, vitamin A deficiency and Iodine deficiency disorder respectively which is better

knowledge than findings from Indian adolescent girls showed that about 30.37%, 17.04% and 2.22% subjects knew about the iron, iodine and vitamin A deficiencies respectively (7).

Findings from this study showed that overall dietary knowledge of adolescent's girls was relatively high when compared to the finding from the Bangladesh. Where the finding from Bangladesh the overall dietary knowledge of adolescent's girls were low and more than half them could not name the main food sources of energy and protein. Additionally, they don't have awareness about the importance of taking extra nutrients during adolescence. This might be due to an exposure to different nutrition related health education through mass media and different advertisements (16).

In this study 97.6% of girls consumed cereals, 44.6% consumed green leafy vegetables and more than half 76.9 % consumed other vegetables. This result is consistent with the study from Tehran majority of study participants were 99% of adolescents consumed cereal based foods (21).

In the present study school type had a big difference between adolescent girls who were learning in government and private school and it shows a positive significant association to low dietary diversity score, adolescent girls who were learning in government school had significant association to low dietary diversity score which is inconsistent finding study conducted in Iran adolescent girls which showed that school type had no significant association with dietary diversity of adolescent girls this difference might be due to similar socio economic status in both government school and private school (1).

This study showed that an increment of family member in the house hold increases the likelihood of low dietary diversity score in adolescent girls and had a significant association with diversity score this might be due to if there is no an increment in the house hold income or economic status of house hold people start to share foods available in the house hold and purchase cheap and same type of food because of scarcity of money they are unable to diversify their food, so this will reduce the quality of food indirectly(34).

In general lack of dietary diversity is particularly a considerable problem among poor populations of developing world including Ethiopia as their diets are predominantly based on starchy staples In the present study, cereal consumption was about (97.6%) and almost all other

food group consumption was low especially, their animal food consumption was poor as indicated in the present study organ meat and fish consumption was (9%), (10%) respectively.

### **Limitation of the study**

The FAO's third version of the guidelines for measuring house hold and individual dietary diversity only asked about the last 24 hours might not be reflection of the usual habits of adolescents.

## **Chapter seven**

### **7. Conclusion and Recommendation**

#### **7.1 Conclusion**

The majority of the study participants had low dietary diversity score. The results of this study indicated that high school girls' in private and government school had a significant difference in dietary diversity. Socio economic status also contributes for the difference in dietary diversity where higher socio economic status is associated with high dietary diversity score. Educational status of the parents affects the dietary diversity of the participants; i.e. advanced educational status is associated with high dietary diversity score and paternal occupational status also contributes to preventive factors to low diversity score of adolescent girls. Increasing household family size or family member also increases the low diversity score.

#### **7.2 Recommendation**

Based on the findings of this study it is recommended that:-

##### **To ministry of education**

- To incorporate nutritional education within the school curriculum

##### **To Regional health office**

- Improving nutritional knowledge of mothers and providing nutrition education for them through health extension workers with collaboration of school administration.
- To create community awareness about nutritional knowledge through health extension workers considering adolescents and their specific condition in designing educational and interventional programs for improving nutrition and health status of community.
- It is suggested that other stakeholders also cooperate with the government in order to implement nutritional intervention programs for adolescent girls particularly among students with low socio economic status in government schools.

##### **To Jimma high schools**

- Since adolescent girls are future mothers, the school should give nutritional education for adolescent girls through mini media in the school to improve adolescent girls dietary intake behavior.

#### **To researchers**

- Further additional research is suggested that show relations between various dietary diversity indicators and nutrient intake, nutrient adequacy with assessment of nutritional status for adolescent girls.

## References

1. Vakili M, Abedi P, Sharifi M, Hosseini M. Dietary Diversity and Its Related Factors among Adolescents : A Survey in Ahvaz-Iran. 2013;5(2):181–6.
2. Belachew T, Hadley C, Lindstrom D. Differentials in measures of dietary quality among adolescents in Jimma zone, Southwest Ethiopia. *Ethiop Med J.* 2008;46:133–42.
3. Lillian M. Dietary Diversity and Nutritional Status of Pregnant Women Aged 15-49 YearS Attending Kapenguria District Hospital West Pokot County , Kenya. 2013;49.
4. FAO Nutrition and Consumer Protection Division. Guidelines for measuring household and individual dietary diversity. 2011.
5. Jaya Krishna CM and GS. DIETARY DIVERSITY OF URBAN ADOLESCENT GIRLS IN VARANASI. 2012;43(3):1–5.
6. Mansourian M, Marateb H, Kelishadi R, Motlagh M, Aminaee T, Taslimi M, et al. First growth curves based on the World Health Organization reference in a Nationally-Representative Sample of Pediatric Population in the Middle East and North Africa (MENA): the CASPIAN-III study. *BMC Pediatr* [Internet]. *BMC Pediatrics*; 2012;12(1):149. Available from: *BMC Pediatrics*
7. Choudhary Seema, Mishra CP SK. Dietary Pattern and Nutrition Related Knowledge of Rural Adolescent Girls. *Indian J Prev Soc Med.* 2010;41(3):208–15.
8. Kennedy G, Fanou-fogny N, Seghieri C, Arimond M, Koreissi Y, Dossa R, et al. Food Groups Associated with a Composite Measure of Probability of Adequate Intake of 11 Micronutrients in the Diets of Women in. 2010;2070–8.
9. Maunder EMW, Matji J. A RTICLES E NJOY A VARIETY OF FOODS — DEVELOPING COUNTRIES. 2001;Vol. 14, N:7–11.
10. Allen LH. To what extent can food-based approaches improve micronutrient status? *Asia Pac J Clin Nutr.* 2008;17:103–5.
11. Kant AK. Dietary patterns and health outcomes. *Journal of the American Dietetic Association.* 2004. p. 615–35.
12. Savy M, Martin-Prével Y, Sawadogo P, Kameli Y, Delpuech F. Use of variety/diversity scores for diet quality measurement: relation with nutritional status of women in a rural area in Burkina Faso. *Eur J Clin Nutr.* 2005;59:703–16.

13. Mulugeta a, Hagos F, Stoecker B, Kruseman G, Linderhof V, Abraha Z, et al. Nutritional Status of Adolescent Girls from Rural Communities of Tigray, Northern Ethiopia. *Ethiop J Heal Dev.* 2009;23.
14. Amanu W, Mekonnin D. Nutritional Status of Adolescent Girls Living in Southwest of. *Food Sci Qual Manag.* 2014;34:58–65.
15. Brinkman H-J, de Pee S, Sanogo I, Subran L, Bloem MW. High food prices and the global financial crisis have reduced access to nutritious food and worsened nutritional status and health. *J Nutr.* 2010;140:153S – 61S.
16. Alam N, Roy SK, Ahmed T, Ahmed a. MS. Nutritional status, dietary intake, and relevant knowledge of adolescent girls in rural Bangladesh. *J Heal Popul Nutr.* 2010;28(1):86–94.
17. Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviors. *J Am Diet Assoc.* 2002;102:S40–51.
18. World Health Organization. Nutrition in adolescence : issues and challenges for the health sector : issues in adolescent health and development. WHO Discuss Pap Adolesc. 2005;(ISBN 92 4 159366 0):8–10.
19. Taffa N, Sundby J, Bjune G. Reproductive health perceptions, beliefs and sexual risk-taking among youth in Addis Ababa, Ethiopia. *Patient Educ Couns.* 2003;49:165–9.
20. Unicef. Improving child nutrition. The achievable imperative for global progress [Internet]. 2013. Available from: <http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:IMPROVING+CHILD+NUTRITION+The+achievable+imperative+for+global+progress#0>
21. Mirmiran P, Azadbakht L, Esmailzadeh A, Azizi F. Dietary diversity score in adolescents - A good indicator of the nutritional adequacy of diets: Tehran lipid and glucose study. *Asia Pac J Clin Nutr.* 2004;13(August 2003):56–60.
22. Kersting M, Sichert-Hellert W, Vereecken C a, Diehl J, Béghin L, De Henauw S, et al. Food and nutrient intake, nutritional knowledge and diet-related attitudes in European adolescents. *Int J Obes (Lond).* 2008;32 Suppl 5(May 2006):S35–41.
23. Bukania ZN, Mwangi M, Karanja RM, Mutisya R, Kombe Y, Kaduka LU, et al. Food Insecurity and Not Dietary Diversity Is a Predictor of Nutrition Status in Children within Semi-arid Agro-Ecological Zones in Eastern Kenya. 2014;2014.
24. Arimond M, Wiesmann D, Becquey E, Carriquiry A, Daniels MC, Deitchler M, et al. Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor settings. *J Nutr.* 2010;140:2059S – 69S.

25. Mirmiran P, Azadbakht L, Azizi F. Dietary diversity within food groups: an indicator of specific nutrient adequacy in Tehranian women. *J Am Coll Nutr.* 2006;25:354–61.
26. Azadbakht L, Esmailzadeh A. Dietary diversity score is related to obesity and abdominal adiposity among Iranian female youth. *Public Health Nutr.* 2011;14:62–9.
27. Savy M, Martin-Prével Y, Danel P, Traissac P, Dabiré H, Delpeuch F. Are dietary diversity scores related to the socio-economic and anthropometric status of women living in an urban area in Burkina Faso? *Public Health Nutr.* 2008;11:132–41.
28. Thorne-lyman AL, Valpiani N, Sun K, Semba RD, Klotz CL, Kraemer K, et al. Dietary Diversity in Rural Bangladesh. *J Nutr [Internet].* 2010;1–7. Available from: <http://jn.nutrition.org/content/140/1/182S.full.pdf>
29. Belachew T, Lindstrom D, Gebremariam A, Hogan D, Lachat C, Huybregts L, et al. Food Insecurity, Food Based Coping Strategies and Suboptimal Dietary Practices of Adolescents in Jimma Zone Southwest Ethiopia. *PLoS One.* 2013;8(3):1–9.
30. Pouraram H, Abtahi M, Djazayeri A, Eshraghian MR, Khodadadi E. Dietary pattern of adolescent girls in relation to socio-economic factors ; A comparison between North and South Tehran. 2013;4(4).
31. Labadarios D, Steyn NP, Nel J. How diverse is the diet of adult South Africans ? *Nutr J [Internet].* BioMed Central Ltd; 2011;10(1):33. Available from: <http://www.nutritionj.com/content/10/1/33>
32. Nti CA, Brown A, Danquah A. Adolescents ' Knowledge of Diet-Related Chronic Diseases and Dietary Practices in Ghana. 2012;2012(November):1527–32.
33. Choi E, Shin N, Jung E, Park H, Lee H, Song K. A study on nutrition knowledge and dietary behavior of elementary school children in Seoul. 2008;2:308–16.
34. Taruvinga A, Muchenje V, Mushunje A. Determinants of rural household dietary diversity : The case of Amatole and Nyandeni districts , South Africa. 2013;2(4).

## **Annex I**

### **Consent form**

Jimma University College of health science

#### **Jimma University Department of Population and Family Health- English version questionnaire for dietary diversity and meal frequency study. March 2015**

Hello! My name is \_\_\_\_\_ am from Jimma University and I am going to collect some information about Dietary practice and associated factors of adolescent girls who are attending their education in Jimma town. The main objective of this study is to assess dietary diversity and associated factors among adolescent girls in Jimma town. You are one of the participants, your name will not be written in this form and the information you give is kept confidential. Your participation is important for the success of this research, besides the findings of this research will help further studies in this area. You are selected randomly to participate in this study, your willingness and support to answer all of the questions would be appreciated.

**Would you participate in responding to questions in this questionnaire?**

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, acknowledge the respondent and proceed to the next respondent

**Name and signature of interviewer who sought consent** \_\_\_\_\_

Date of interview \_\_\_\_\_ Starting time \_\_\_\_\_ completed \_\_\_\_\_

## Annex II

### Questionnaire

Jimma university college of health science			
A. Background information (Identification and socio demographic characteristics).			
A0	Identification number (ID NO)		skip
A1	Age	_____ years	
A2	Place of residence	1,urban      2,rural	
A3	Type of school	1, Government      2, Private	
A4	Ethnicity	1. Oromo    2. Amhara    3. Guragie    4.Dawuro    5. Tigre    6,Others(Specify)	
A5	Religion.	1. Orthodox    2. Muslim    3. Protestant    4. Catholic    5. Other (specify)	
A6	Grade level	1.9 <sup>th</sup> 2.10 <sup>th</sup> 3.11 <sup>th</sup> 4.12 <sup>th</sup>	
A7	Marital status	1,single    2,married      3,divorced      4,widowed	
A8	How many people reside within your household		_____
A9	Mother education	1. No formal education    2. Can read and write    3. Primary school 4. Secondary school    5. College and above	
A10	Maternal occupation	1. House wife    2. Government employee    3. NGO employee.    4. Merchant 5. Daily laborer    6. Other (specify)_____	
A11	Paternal education	1. No formal education    2. Can read and write    3. Primary school 4. Secondary school    5. College and above	
A12	Paternal occupation	1. Farmer    2. Government employee    3. NGO employee.    4. Merchant 5. Daily laborer    6. Other (specify)_____	
A 13	Who is the head of household?		
	1. Father	2. Mother	3, .Other (Specify).....
A14	Who decides on house hold income? 1, my Father 2, my mother 3,Both jointly		
<b>House hold wealth index</b>			
Does your household have any of the following (circle all answers)			<b>Yes</b>
			<b>No</b>
A15	Own house		
A16	Sofa		
A17	Mattress		
A18	Car		
A19	Bicycle		
A20	Motor cycle		

A21	Television			
A22	Refrigerator			
A23	Electric stove			
A24	Mitad electric			
A25	Gas stove			
A26	Table and chair			
A27	DVD player/CD/VCD			
A28	Video camera			
A29	Digital camera			
A30	Washing machine			
A31	mobile phone			
A32	Telephone wire less			
A33	Fixed line telephone			
A34	Computer			
A35	Shelf			
A36	Domestic animals			
A37	Radio/tape			
A38	Bajaj			
<b>B.DIETARY PRACTICE</b> <b>Are you currently fasting?      1.yes      2,no</b>				fr
B1	Cereals	Maize, teff, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. Injera, bread, noodles, porridge or other grain products) + insert names for the local foods e.g. porridge, injera, kinche, atmit, bread, local pasty & biscuits.....	1 yes 2 no	
B2	White roots & tubers	White potatoes, white yam, white cassava, or other foods made from roots like godore, enset....	1,ye s 2,no	
B3	Vitamin A rich Vegetables & tubers	Pumpkin, carrot, squash, or sweet potato that are orange inside + other locally available vitamin A rich vegetables (e.g. red sweet pepper)	1,ye s 2,no	
B4	Dark green leafy Vegetables	Dark green leafy vegetables, including wild forms + locally available vitamin A rich leaves such as cassava leaves, kale, spinach	1.ye s 2.no	
B5	Other vegetables	Other vegetables (e.g. tomato, onion, eggplant) + other locally available vegetables	1.ye s 2.no	
B6	Vitamin A rich fruit	Ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + other locally available vitamin A rich fruits	1,ye s 2.no	
B7	Other fruits	Other fruits, including wild fruits and 100% fruit juice made from these	1.ye s 2.no	

B8	Organ meat	Liver, kidney, heart or other organ meats or blood-based foods	1.yes 2.no			
B9	Flesh meats	Beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects	1.yes 2.no			
B10	Eggs	Eggs	1.yes 2.no			
B11	Fish & seafood	Fresh or dried fish or sardines	1.yes 2.no			
B12	Legumes, nuts & seeds	Dried beans, dried peas, lentils, nuts, seeds or foods made from these (Eg. shiro wet, kik wet, misir wet, shimbra kolo, bakela ashuk, adenguare, boloke.....)	1.yes 2.no			
B13	Milk & milk products	Milk, cheese, yogurt or other milk products like aguat, arera....	1.yes 2.no			
B14	Oils and fats	Oil, fats or butter added to food or used for cooking	1.yes 2.no			
B15	Sweets	Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	1.yes 2.no			
B16	Do you eat fast foods that are not prepared at home outside your home?		1,yes 2,no			
B17	How many times do you usually eat per day?		1	Meals	<input type="text"/>	
			2	Snacks	<input type="text"/>	
			3	Total	<input type="text"/>	
B18	Timing of meals. 1.Fixed 2.Irregular					
B19	Who decides/selects the type of food you usually eat?					
	1. Myself alone	2. My parents/caretakers	3. Myself & my parents together			
	4. My husband	5.Other(specify):				
B20	Do you usually skip any meal in a day A, yes B, No					
B21	If the answer is yes for Q19 which meal do you usually skip?	1. Breakfast 2.Lunch 3.Dinner				
B22	Why do you skip your meal? _____					
<b>C. Personal behavior and Nutrition related knowledge</b>						
C1	Is their nutrition related information is given in your school?					
	1.Yes	2.No	3,Not applicable			

C2	From the following food items Which one is a high carbohydrate diet?	1, Meat 2.butter 3.Bread 4. Cheese 5. do not know					
C3	Which foods are high in fat?						
	1, Potatoes		3,Margarine		5,do not know		
	2,Boiled sweet potato		4. Cheese				
C4	Which has no fiber?	1, Brown bread 2, Beans 3, White bread 4, Meat 5, do not know					
C5	Which diet is the best source of iron?						
	1, Milk		3, beef and breakfast cereal/Rice		5, chips and biscuits		
	2, Cheese and eggs/Nuts		4, dried beans and cauliflower		6,liver 7,donot know		
C6	Select one correct statement about malnutrition? 1. It is a condition that occurs with adequate supply of nutrients to the body 2. It is a condition with inadequate supply of nutrients to the body 3. Malnutrition can result from serious infectious disease 4. 2 and 3 are correct.						
C7	Which one of the following causes malnutrition?						
	1, Infection or illness		4, lack of knowledge about nutritious foods				
	2,shortage of food		5,All		6,do not know		
C8	Which one of the following foods are rich sources of vitamins?						
	1,Banna		3,kale				
	2,mango		4,Spinach				
C9	What causes Anemia?						
	1, Disease like intestinal parasite		2,Iron deficiency		3, Not aware of 4, others specify_		
C10	What Causes goiter						
	1, Iodine deficiency( non-iodized salt		2,Hereditary		2,Not aware		
C11	Adverse effect of vitamin A deficiency						
	1,Causes night blindness		2, Decreased immune system		3,Not aware		
C12	What are the benefits of diversified diet or variety (balanced diet)?						
	1,It gives different types of nutrients		4,It provides energy				
	2,It helps to protect from disease		5, all of them				
	3, It builds body helps for growth		6,Do not know				
<b>D. Personal behavior related factors</b>							
D1	Do you believe that your dietary habit have an influence in your health?						
	1, yes		2,No				
D2	Where did you get this the above nutrition related information?						
	1. Mass media		2. Friends		3, family		
	4. School based health education		5. other (specify____				
D3	What it looks like your nature of diet.						

	1,Non vegetarian	2,Vegetarian	3,Ocationaly vegetarian		
D4	Did you have any food preference that you do not want to eat?				
	1.Yes	2.No			
D5	If yes What kinds of food? _____				
D6	If the answer is yes for the above question D22what is your reason?				
D7	What influence your food choice				
	1.Friends (peer influence 2, mass media 3,family 4, No body influence me on my food choice5,others(specify _____)				
D8	DO you relate your self-image to your diet?		1.yes 2.no		
D9	Do you eat fast foods that are not prepared at home outside your home?		1.yes 2.no		
D10	If yes how often	1.Always	2.Sometimes	3.Rarely	
	<b>E. Cultural factors</b>				
E1	Do you have any food taboo (restricted food in your culture or environment),				
	1.Yes	2.No			
E2	If the answer is yes for QE1 what foods are restricted? _____				
E3	Why reason out? Specify_____				
E4	Do you practice any food taboo that are mentioned in the above		1.yes 2.no		
E5	Is there any cultural norm or practice that females eat fewer amounts and less quality than boys in your environment or home? 1,Yes 2,No				