

Comparative Study Of Undernutrition And Associated Factors Among High School Adolescent Girls In Urban And Rural Settings Of Sorro District, Hadiya Zone, Southern Ethiopia



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**Undernutrition And Associated Factors Among High Schools Adolescent Girls
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Abstract

Background: Adolescence is individuals in the age groups of 10–19 years age. It is second most physical growth rate taken place next to infants. In most developing countries including Ethiopia, nutrition initiatives like first 1000 days have been focusing on only children and pregnant mothers to halt intergenerational effect of malnutrition. However, addressing the nutritional needs of adolescent girls is the right time to break the vicious cycle of intergenerational malnutrition. Few journal studies were conducted to find out undernutrition and associated factors among adolescent girls in Ethiopia general and in this study area particularly.

Objectives: To assess prevalence and factors associated with undernutrition among adolescent girls attending high schools in rural and urban settings of Sorro District, Hadiya Zone, Southern Ethiopia.

Methods: institution based comparative cross-sectional study was employed among 414 adolescent girls attending high schools in rural and urban settings of Sorro District. Adolescent girls were selected using multistage sampling technique. Data were collected by a structured questionnaire, pretested, interviewer administered and anthropometric measurement. The study was conducted from March 15 to April 15 2019. Data were entered into Epidata Version 3.1 and analyzed using SPSS for windows version 20. Indices for assessing undernutrition were generated using WHO Anthroplus version 1.0.4. The results of the descriptive statistics were expressed as percentages and frequencies using tables and graphs. Associations between independent variables and dependent variables were analyzed using bivariate and multivariable binary logistic regression analyses. Odds ratio with 95% CI were used to determine association. A statistical significance was declared at p value <0.05.

Results: Overall prevalence of stunting and thinness were 25.1% and 6.8%, respectively. The prevalence of stunting was significantly higher among rural adolescent girls (30.4%) than urban adolescent girls (19.8%). Likewise thinness was also higher among rural adolescent girls (8.7%) than in urban areas (4.8%). On multivariate binary logistic regression model; stunting was significantly associated with place of residence (AOR: 1.9; 95% CI: 1.8-2.94) and nutrition knowledge (AOR: 1.8; 95% CI: 1.07-2.76) whereas thinness was significantly associated with households' wealth tertile (AOR: 4.2; 95% CI: 1.13-15.49), source of drinking water (AOR: 2.3; 95% CI: 1.01-5.30), dietary diversity (AOR: 2.9; 95% CI: 1.28-6.92) and skipping breakfast (AOR: 3.9; 95% CI: 1.15-13.82).

Conclusion and Recommendation: the study revealed that prevalence of stunting was significantly higher in rural areas than in urban area. The prevalence of thinness was higher in rural than urban areas but it was not significant. Hadiya zone health department and Sorro District health offices should design nutrition intervention which targets adolescent girls' undernutrition by giving priority for rural areas.

Key words: adolescent girls, high schools, stunting, thinness, urban and rural settings.

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Acronyms and Abbreviations

APARQ: Adolescent Physical Activity Recall Questionnaire

AOR:- Adjusted Odd Ratio

BAZ: - Body mass index for Age Z-score

BMI: - Body Mass Index

CI:- Confidence Interval

COR:- Crude Odd Ratio

EHNRI:- Ethiopia Health and Nutrition Research Institute

EDHS: Ethiopia Demographic and Health Survey

DHS: - Demographic and health Surveys

FAO: - Food and Agriculture Organization

FMOE: - Federal Minister of Education

FMOH: - Federal Minister of Health

HAZ: - Height for Age Z-score

LMIC: - Low and Middle Income Countries

NNP: - National Nutrition Program

NSFS: - National School Feeding Strategy

OR: Odd Ratio

SD: - Standard Deviation

USAID: - United State of America International Development

UNICEF: - United Nation International children`s Emergency Fund

WHO: - World Health Organization

CHAPTER 1: INTRODUCTION

1.1 Background

World Health Organization (WHO) define adolescences as individuals in the age groups of 10-19 years of age and it is the transition period that lies between childhood and adulthood (1).

There were 1.2 billion adolescents aged 10–19 in the world, forming 16 percent of world population and it is estimated to reach 1.3 billion by 2050. The vast majority of adolescents, 90 percent live in low and middle-income countries (LMICs) and from their total populations 19 % were adolescents and 23% of sub-Sahara Africa populations were adolescents in 2016 and it is expected to have more adolescents than any other region by 2050. In 2016 Ethiopia 25% of the total populations were represented by adolescents(2).

Adolescence is the second most rate of growth period regarding physical growth in life cycle after infants, due to this their nutritional needs are high and accompanied by the gradual development of reproductive organs, secondary sexual characteristics and menarche in girls (3). Adolescence is also particularly unique period in life because it is a time of intense physical, biological, psychosocial, social changes and cognitive development. Increased nutritional needs at this period relate to the fact that adolescents gain up to 50% of their adult weight, more than 20% of their adult height and 45% of their adult skeletal mass during this period(4).

WHO recommend the new WHO Growth Reference to measure undernutrition among adolescent by using Height-For-Age (HAZ) and Body mass index-for-Age (BAZ) indices. BAZ is the recommended indices for assessing thinness whereas HAZ is the recommended indices for stunting. Therefore undernutrition among adolescents is defined as thinness those which their BAZ is less than -2 SD and stunting those their HAZ is less than -2SD according to the 2007 WHO growth Reference (5).

1.2 Statement of the problem

Globally, the prevalence of thinness among adolescent girls was 8.4% and the trends of prevalence of thinness decreased from 9.2% in 1975 to 8.4% in 2016 (6). However there is regional disparity; systematic review conducted in LMICs shown that the prevalence of thinness and stunting were 11% and 10.2% respectively. According to this review, prevalence of thinness was highest in south Asia and Africa which were 41% and 12.5%, respectively(7). Multicenter study done by WHO on South East Asia region in India , Bangladesh, Nepal and Myanmar was found that 23%, 48% , 47% and 39% of adolescents were stunted and 53% , 63%, 36% and 32% of adolescent were thin respectively (8). According to study done in India reported the prevalence of thinness (29%) and stunting (32.5%) was higher in rural areas than the prevalence of thinness (13.6%) and stunting (29%) those who live in urban areas (9)

Adolescent girls' undernutrition is also prevalent in Sub Saharan Africa. According to study done in Nigeria, 34% of adolescent girls were stunted and 18% of adolescent girls were thin. Prevalence of stunting was more higher in rural schools than urban (10). The study conducted in Eastern Sudan found that prevalence of stunting and thinness were 13.7% and 17.5%, respectively(11,12).

Ethiopia reported survey on nutrition baseline for National Nutrition Program one (NNP) indicated that 23% of adolescent girls were stunted and 14% were thinned and indicated those living in rural areas are more likely to more undernourished than urban (13). A study done South-West Ethiopia in Mizan District reported that prevalence of stunting (40.9%) and thinness (26.5%) in rural areas was higher than the prevalence stunting (19.8% and thinness (22.3%) in urban area (14).

The factors associated with undernutrition are not typical across different study areas in Ethiopia. According to a systematic review on factors associated with adolescent girls' undernutrition in Ethiopia reported that place of residence, family size, source of water and house hold food security status were risk factors associated with adolescent girls stunting whereas lack of latrine, diet quality, family size, household food security status and mother educational status were risk factors associated with adolescent girls thinness (15).

Poor nutrition during adolescence adversely affects adolescent girls' intellectual development, Growth, health, social skills, school attendance and achievement. Moreover Since adolescent girls are the tomorrow mothers undernutrition during this period also had intergeneration

malnutrition impact. It is also a strong predictor of the new borne child having risk of chronic non-communicable diseases later during adulthoods (16).

In most developing countries including Ethiopia, nutrition initiatives like first1000 days have been focusing on children and pregnant mothers to halt intergenerational effect of poor nutrition. This is too late to break intergenerational cycle of malnutrition (17). However addressing the nutritional needs of adolescent girls is right time to break the vicious cycle of malnutrition problems that passes from one generation to the next generation (18).

Ethiopia is implementing many strategies on adolescent girls, however most of them are focusing on reproductive issues and the one implemented to halt intergenerational cycle of undernutrition programs like the first 1000 days initiative not had a specific intervention for adolescent girls. But the other Program like national nutrition programs (NNP) especially two and National School Feeding Strategy (NSFS) was give some attention about adolescents nutrition due to that the baseline survey of NNP reported that 23% of adolescent girls were stunted and 14% was thin (13).

Few journal studies conducted to find out the magnitude of the problem and understand factors associated with adolescent girls' poor nutritional status in Ethiopia generally and in the study area particularly.

Therefore the aim of this study was to assess the prevalence of undernutrition and associated factors among adolescent girls attending high school in Soro District, Hadiya Zone, Southern Ethiopia. The finding this study will help the program planners to fill the gap on improving adolescent girls' nutrition, reducing morbidity and mortality.

1.3 Significance of study

Investments in adolescent girls' nutrition and wellbeing brings a triples of benefits for now adolescent girls themselves, in future adult life and for the next generation of children. Adolescence period is the last window of opportunity to implement strategies to correct potential growth deficits thereby breaking the vicious cycle of intergenerational malnutrition impact Despite the fact that, assessing prevalence of undernutrition and factors associated among adolescent girls do have paramount important for planning, initiating and implementing of intervention programs.

So this study intended to fill information gap about adolescent girl's nutritional profile in both urban and rural settings context. Information gathered from this study will provide baseline data, will elicit support and promote cooperation among the different stakeholders towards the initiation of a sustainable nutrition promotion program for adolescents girls in this study areas and similar setting, finally this study used for further research study as a reference.

CHAPTER 2: LITERATURE REVIEW

2.1 Prevalence of stunting and thinness

According to systematic review done in United State of America (USA) showed that The global prevalence of thinness among adolescent girls is 8.4% and the prevalence of the thinness is highest in south Asia; one in five are adolescent girls are thin (19).

Another Systematic review conducted in LMICs indicated that the regional estimates of stunting was lowest for western pacific (5%) and highest for southeast Asia (18.2%) with prevalence of stunting ranged 0%(Niue) to 36.5%(Myanmar) and the regional estimates of thinness was lowest for western pacific(1.8%) and highest for southeast Asia(12.4%) with prevalence of thinness ranged from 0% (Nauru, Tonga, and Niue) to 25.1% (Sri Lanka) (6,20).

A cross sectional study done in Wardha, India on the Nutritional Status of Adolescents in Rural indicated that prevalence adolescents of thinness were 53.8%, this study found that the prevalence of thinness in adolescent girls were high which was 69.8% (21), but this study did not determine prevalence of stunting. comparative study done in west Bengal, India on nutritional Status of urban and rural school adolescent Girls undernutrition indicated that 32.5% of adolescent girls were stunted and 20.2% were thin which is major health problems among school adolescent girls in rural areas of India than urban areas whose prevalence of stunting (35.7%) thinness (26.3%) (22). However this study was not use Body mass index- For- Age- Z score (BAZ) and Height-For-Age-Z Score (HAZ) which is recommended by WHO 2007 growth reference to report undernutrition among adolescent rather did use the three indicator to determine undernutrition which are stunting, underweight and thinness and did not identify factors associated with undernutrition.

According to the study that conducted rural Bangladesh reported that 50.3% of adolescent girls were stunted and 32% were thin(23) and another study that conducted in Pune reported that the overall prevalence of underweight (13.92%) in urban areas is lower than the prevalence of underweight (19.08%) in rural areas (24).

A study done in Eastern Sudan showed that prevalence of stunting (13.7%) and thinness (38.3%) (12). But this study did not identify factors associated with stunting and thinness.

Nutrition baseline survey for NNP in Ethiopia showed that the prevalence of stunting and thinness were 23% and 14% respectively and this survey evaluated that those living in rural areas are more likely under nourished than urban areas (13). Community based cross sectional study conducted in rural Tigray, Northern Ethiopia reported that 58.8% of adolescent girls were stunted and 26.5% was thin (25) and Another study conducted in Amhara region, Northern Ethiopia with prevalence of underweight (13.6%) and stunting (31.%) (26) Which indicates there was public health problem of undernutrition in rural areas of Northern Ethiopia.

According to study conducted in Southwest Ethiopia indicated that the prevalence of the thinness and stunting were 80% and 16% respectively and most of the underweight adolescents were females (53.3%), reside in rural (61.6%) (27). This study showed that prevalence of undernutrition is public health problem among adolescent girls especially residing in rural areas.

The study done Addis Abeba, Ethiopia show that the prevalence of stunting (7.2%) and thinness (6.2%) (28) and another study which was conducted in Adam city, Ethiopia reported that the prevalence of stunted (15.6%) and underweight (21.1%) (29). Moreover the study done in Goba Town south east Ethiopia show that prevalence of stunting and underweight were 20.9% and 11.9%, respectively (30). According to these three urban setting studies prevalence of undernutrition among adolescent girls was not only the problem of rural communities but also urban areas.

According comparative cross-sectional study done in South-west Ethiopia on urban-rural disparities on adolescent girls nutrition status showed that the overall prevalence of stunting (29.3%) and thinness (24.4%) in both rural and urban adolescent girls. In urban areas the prevalence of stunting (17.8%) and thinness (22.3) while in rural areas the prevalence of stunting (40.9%) and thinness (26.5). This study showed that there was difference in undernutrition based on place residence particularly the prevalence of stunting was significantly higher in the rural group (40.9%) than in the urban group (17.8%) (14). This study also reported that thinness was higher in rural areas as compares to urban areas.

Study done in Wolaita sodo town Southern Ethiopia found that prevalence of stunting (4.4%) and thinness (1.1%) in urban area. According to this study the prevalence of stunting in rural area (8.8%) was higher than that of urban area stunting (4.2%) in (31). A study done in Bale Zone Oromia Region South East Ethiopia The which contrary to another studies in above

reported that there was no difference prevalence of thinness (13.68%) based on the place of residence (32).

2.2 factors associated with undernutrition among adolescent girls

2.2.1 Demographic and Socioeconomic characteristics

According to study done in Jimma Zone, South West Ethiopia showed that factors like place of residence and family size were significantly associated with nutritional status of adolescents (27) and contrary to this study which was conducted in Bale Zone, South East Ethiopia and in Tigray, Northern Ethiopia did not identify the place of residence and family size as an independent predictors of adolescent girls nutritional status (25,32).

According to studies conducted in Wolaita Sodo Town, Southern Ethiopia; Adama City, Central Ethiopia and Goba Town, south east Ethiopia maternal educational status is identified significantly associated with nutritional status among adolescent girls (29–31).

The longitudinal study on south west Ethiopia showed that adolescents are particularly affected by food insecurity, as adolescence represents a period of rapid growth, additional energy and nutrients are required. It has been hypothesized that adolescents from low income households are more likely to experience chronic food insecurity (33) and contrary to this study which were done Adama city and west Ethiopia showed that the house wealth index did not significantly associated with nutritional status of adolescent girls(29,34).

2.2.2 Dietary diversity practice, Dietary habit and Meal pattern

The studies which reported from Adam city, Ethiopia; Southern Ethiopia; Jimma Zone, Southwest Ethiopia; Tigray, Northern Ethiopia; Bale Zone, Oromia Region South East Ethiopia and West of Ethiopia showed that the dietary diversity practice and frequency of meal were significantly associated with the nutritional status of adolescent girls (25,27,29,32,34) But the study which was conducted in Wolaita Sodo Town, Southern Ethiopia reported that meal frequency is not significantly associated with adolescents nutritional status (31).

2.2.3 Physical exercise and housework chores

The study done in Mizan district South west Ethiopia indicated that the majority of the urban and rural groups was engage at least 40 minutes physical activity per day in five or more days during the week preceding the interview. More household chores were performed in rural settings than urban area(14)

2.2.4 Environmental factors and history of illness

According to study conducted in Arsi Zone, Oromia region Ethiopia showed that any history of illness experience is associated with nutritional status of adolescent girls (35) and also another study which was done South West Ethiopia reported history of illness like abdominal pain and cough is significantly associated with the nutritional status adolescent girls (27).

A study done in northwest Ethiopia indicated that unavailability of latrine and poor hand washing practice were associated with stunting and history of illness in the last two weeks was associated with thinness among adolescents(26). According to study in Gob town, Ethiopia showed that adolescents girls who begin to menstruation more likely stunted than who do not begin (30) and this study is contrary to the study which conducted in Rural Bangladesh indicate no onset of menstruation and irregular menstruation are significantly associated with stunting and thinness of adolescent girls (35).

According to community based cross sectional study conducted in Northern Ethiopia indicated that not having information related nutrition and health significantly associated with undernutrition particularly stunting of adolescent girls(26).

The gap identified from the previous literature is:

There is limited study differentiability on prevalence and factors associated with undernutrition of adolescent girls in urban and rural setting particularly in this the study areas. Developing countries are exposed to undernutrition in adolescent girls varies in urban and rural setting. In Ethiopia undernutrition are common among Adolescent girls which can affect their growth and development. Adolescent girls are the worst sufferers of undernutrition because of their increased nutritional needs. Some efforts to improve nutrition status of adolescent girls are going; like in Ethiopia; national adolescent school feeding strategy and National Nutrition Program particularly two but the problem is still there without significant change. This shows that the problem needs further findings. Up to my knowledge there is inadequate credible

evidence on undernutrition of adolescent girls, its associated factors and their disparities between urban and rural settings particularly in this study area.

This study will fill the gap and can deliver important information which can help plan makers to integrate the finding which focus in adolescent girls' nutrition. Therefore the study will assess quantitatively the undernutrition and factors associated with adolescent girls in urban versus rural areas.

2.3 Conceptual frame work for adolescent girls undernutrition

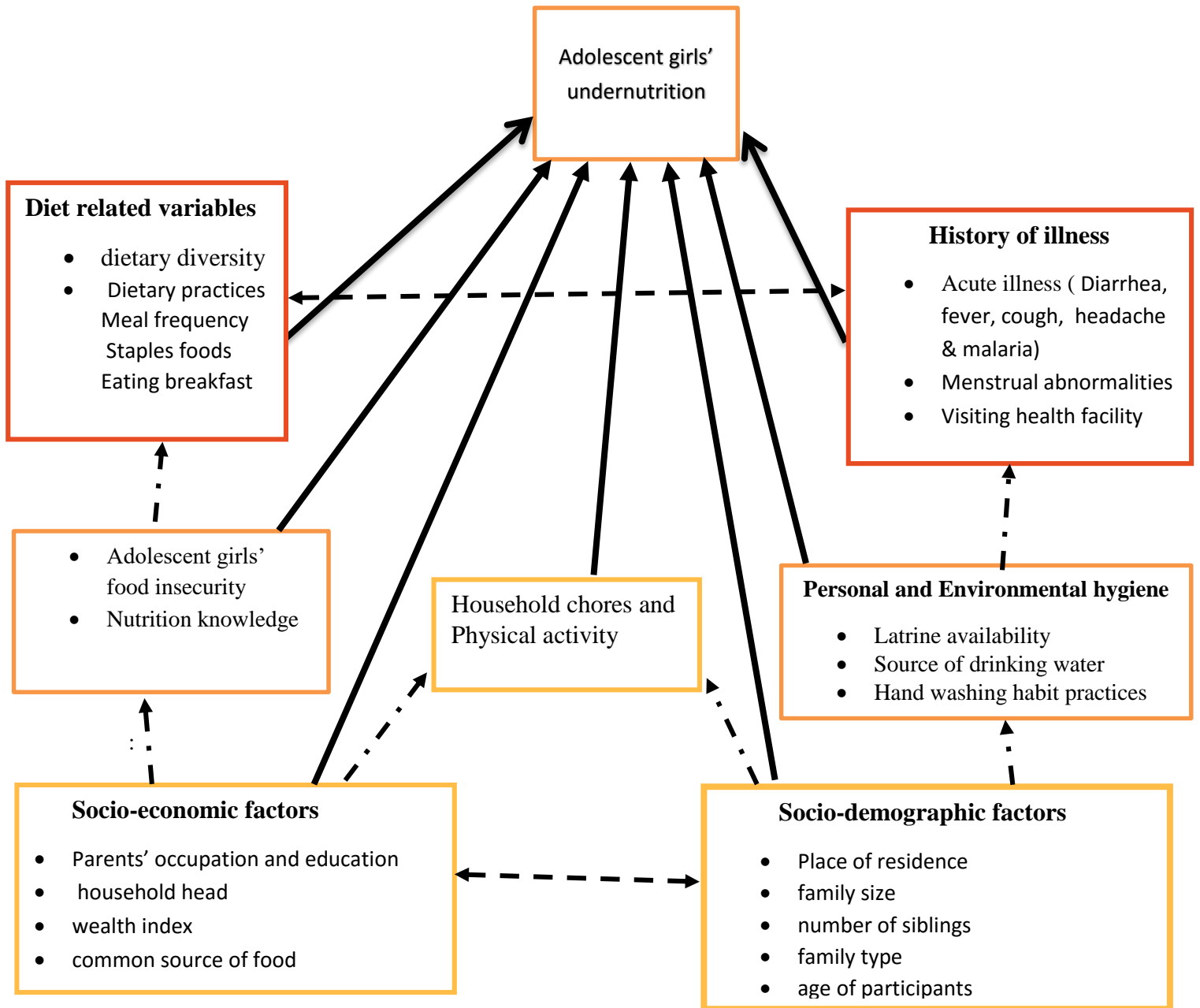


Figure 1: Diagrammatic illustration of factors that can associated with under nutrition among adolescent girls, Soro District 2019.

Source: Adapted from UNICEF Malnutrition conceptual framework 1999.

3 CHAPTER THREE: RESEARCH OBJECTIVES

3.1 Objectives

3.1.1 General objective

- To assess the prevalence of undernutrition and associated factors among adolescent girls attending high schools in urban and rural settings of Sorro District, Hadiya Zone, Southern Ethiopia, 2019.

3.1.2 Specific objectives

- To compare prevalence of stunting among adolescent girls attending high schools between urban and rural settings of Soro district.
- To compare prevalence of thinness among adolescent girls attending high schools between urban and rural settings of Soro district.
- To identify factors associated with stunting among adolescent girls attending high schools in Soro district.
- To identify factors associated with thinness among adolescent girls attending high schools in Soro district.

CHAPTER 4: METHODS AND MATERIALS

4.1 Study area and period

Sorro District is located in the Hadiya zone, Southern Regional state of Ethiopia. Geographically, it is situated at 32 Km South-East from Hossana-Hadiya Zone capital town, at a distance of 206 km from Hawassa-regional capital city and 264 Km away from Addis Abeba. The total area of the district is 706 square km. The district is bounded by north by Gombora woreda, south by Duna woreda, eastern by Lemo Woreda and west by Kambta Zone.

According to the district finance and economic development offices 2018 report the total population of Sorro District is 245,578 while nearly 85% of them lives urban areas. There are 123,288 females accounting for 50.2 % of total population. It has 46 rural kebeles and the Gimbichu Town which is self-administered town and capital town of Sorro District. The district has ten secondary school from this schools there are 4, 395 adolescent girls, one district hospital, eighty public health centers, one non-government organization (NGO) health center and forty six health posts. Main economic activity of the rural district peoples depend on agricultural product and main agricultural product is teff, wheat, enset, barley, sorghum, bean pea and domestic animals' productivity. The main economic activity of towns is market oriented business activities and civil servants services.

The study was conducted from March 15 to April 15, 2019, in rural and urban setting of Sorro District

4.2 Study design

Institution based comparative cross sectional study was employed.

4.3 Source population

All adolescent girls attending their high schools at rural and urban setting of Sorro District.

4.4 Study population

Randomly selected adolescent girls attending high school at rural and urban setting of Sorro District.

4.5 Inclusion and exclusion criteria

4.5.1 Inclusion criteria

All adolescent girls who are attending their secondary education in high schools found in urban and rural areas of Sorro District

4.5.2 Exclusion criteria

- Adolescent girls in urban setting who came from rural areas and join the school in this academics.
- Adolescent girls who have visible physical deformity.

4.6. Sample size determination and sampling technique

4.6.1 Sample size determination

Sample size was calculated for each specific objective by using Epi info version 7 and /or Fleiss double population proportion formula

$$n1 = \frac{\{Z\alpha/2\sqrt{(1+1/r)p(1-p)} - Z\beta\sqrt{P_1(1-P_1) + [P_2(1-P_2)]/r}\}^2}{(P_1 - P_2)^2}$$

Sample size was determined by using two population proportion formula for each specific objectives, was used by considering the following assumptions and finally the largest sample size was taken

- Confidence level = 95%
- Power $(1 - \beta) = 80\%$
- Design effect = 2
- Ratio = 1:1
- Non response rate 10%.

For objective one: To compare prevalence of stunting among adolescent girls attending high schools between rural and urban setting.

P_1 (proportion one among exposed) = 0.41, P_2 (proportion two among unexposed) = 0.18 prevalence of stunting from previous study on rural- urban disparities among adolescent girls nutritional status in Mizan District southern Ethiopia(14).

For objective Two: two compare prevalence of thinness among adolescent girls attending high school between urban and rural settings. P_1 (proportion one among exposed) = 0.148, P_2 (proportion two among unexposed) = 0.011 prevalence of thinness from previous study from rural community of Aseko district Arsi Zone and Wolaita Sodo, respectively (31,36).

For objective 3: To identify factors associated with stunting among adolescent girls.

For this objective sample size was calculated by considering proportion value of independently associated factors (percent of exposed with outcome and percent of unexposed with outcome) of family size with stunting from previous study on prevalence of undernutrition and associated factors(37).

For objective 4: To identify factors associated with thinness among adolescent girls.

For this objective sample size was calculated by considering proportion value of independently associated factors (percent of exposed with outcome and percent of unexposed with outcome) of source drinking water with thinness from previous study on prevalence of undernutrition and associated factors (37).

Table 1: Sample size calculation for the each three specific objectives.

Specific objectives	Assumptions				Sample size (N)
	P_1	P_2	$Z_{\alpha/2}$	power	
Objective 1	0.409	0.198	1.96	0.84	365
Objective 2	0.148	0.011	1.96	0.84	326
Stunting among adolescent girls who have :					
Family size > 5 = 31.2%					
Objective 3	Family size ≤ 5 = 13.2%		1.96	0.84	414
Thinness among adolescent girls who use:					
unimproved water = 48.5%					
Objective 4	improved = 17.6%		1.96	0.84	185

Four hundreds forty teen (414) was taken and then 207 adolescent girls attending high schools from each urban and rural settings was included in the sample.

4.6.2 Sampling technique and procedure

A multi stage sampling methods was employed to select the study subjects. Initially Sorro district was selected purposively. The high schools were stratified in to two rural areas of Sorro worda high schools and urban area of Gimbichu Town high schools according to their place of residence. At the first stage there are two urban high schools and eight rural high schools. Then these high schools was listed and five high schools was selected from two settings. From rural areas three high schools was selected using simple random sampling of lottery method and the two high schools was taken from urban area since it has only two high schools. Secondly, subtotal sample size for rural and urban settings separately was proportionally allocated to size for each grades of selected high school and then to each sections of grade based on number of study subjects was found. Finally, simple random sampling of lottery methods was used to select study subjects from each section of grades by using students' roster as the sampling frame.

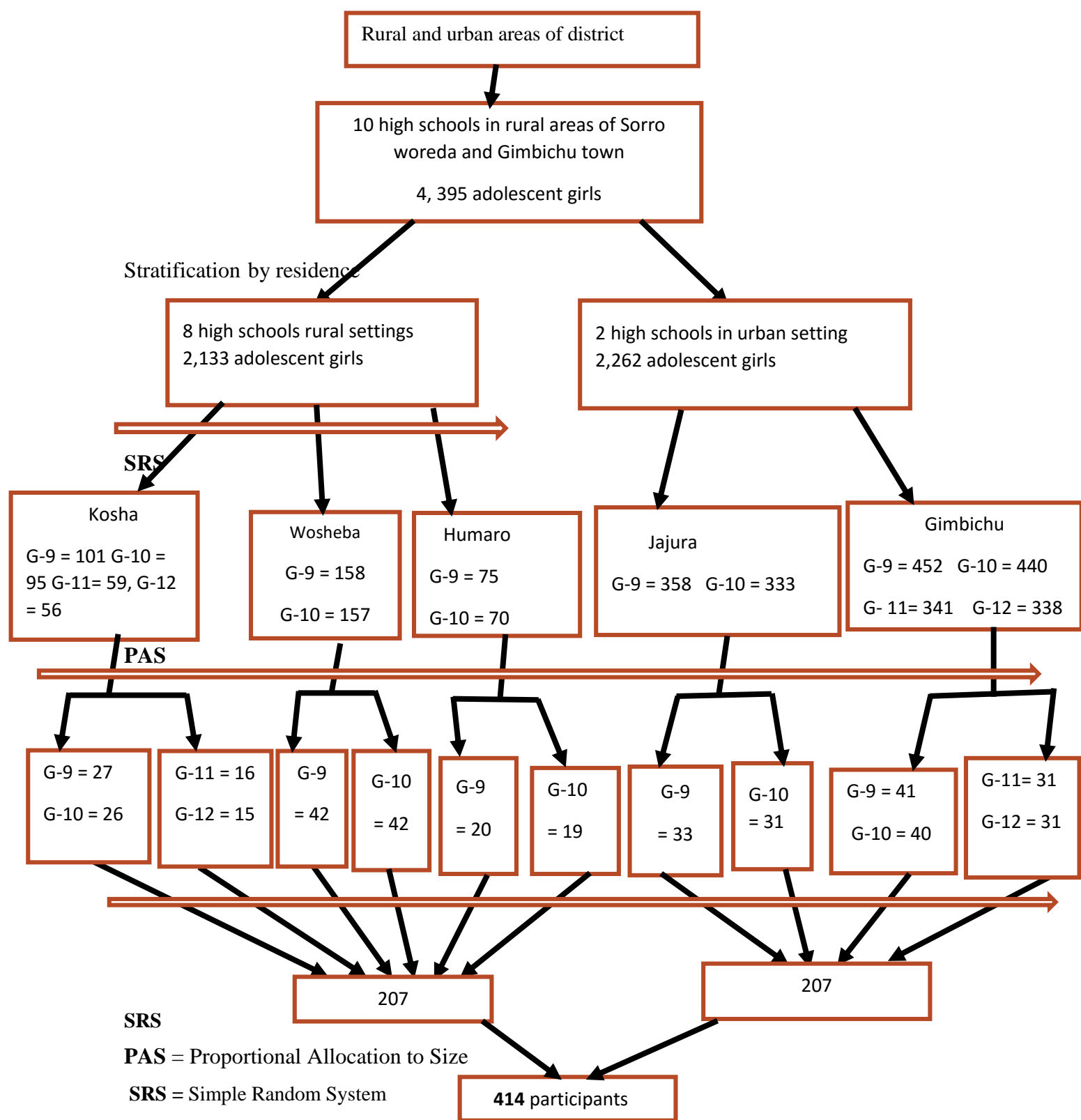


Figure 2: Schematic representation of sampling frame for adolescent girls attending high school in rural and urban setting Sorro district.

4.7 Data collection tools and methods

4.7.1 Data collection tools

Structured and pretested questionnaire was used to collect the following in concerning socio economic and demographic characteristics, households' assets wealth index variables, dietary intakes and dietary diversity practices, adolescents' food insecurity, adolescents' physical activity and household chores, nutrition knowledge, history of illness, environmental and personal hygiene. Anthropometric measurement like UNICEF portable electronic digital weight scale and Stadiometer with a moveable headboard (Hannover, Germany) was used to measure study subjects anthropometry. Four females' diploma nurses collected the data and supervised by two health officers. Moreover, the principal investigator monitors and coordinates over all activities.

4.7.2 Data collection methods

Data were collected from through Interviewer administered face to face technique by using structure questionnaire and anthropometric measurements. We measured weight to the nearest 0.1kg using UNICEF portable electronic digital scale (SECA) and height measured to the nearest 0.1 cm stadiometer with a moveable headboard (Hannover, Germany). The subjects' weight and height was measured barefoot and light clothes. Each subject was asked to stand on the flat surface, with weight distributed evenly on both feet, heels together against the stadiometer and the head positioned Frankfurt plane. The arms hanging freely to the sides and the head, back, buttocks and heels were in contact to the measuring stadiometer. The moveable headboard was brought on to the topmost point on the head with sufficient pressure to compress the hairs. To reduce the possible recall bias the age of the study subjects reported were compared with age records in the register.

A four-item adolescences food security scale, developed and tested in another study was used to assess adolescent girls food security status, the questions in the scale asked whether girls within the last three month had (1) ever worried about having enough food, (2) ever had to reduce food intake because of shortage of food or lack of money to buy food, (3) ever had to go without eating because of shortage of food or money to buy food or (4) ever had to ask outside the home for food.

Dietary intakes: study subjects main staple food, common source of food in household, skipping breakfast, meal frequency,

Dietary diversity data: was collected by asking participants the type of consumed in home or outside of compound in previous 24 hour before recall from nine food groups (38).

Knowledge of adolescents in nutrition related information is labeled based on the response of respondents' knowledge on health diet, carbohydrate, protein, iron deficiency, vitamin A, iodine, advantages of diversified food and definition of malnutrition(39).

Physical activity and household chores: adapted from Adolescent Physical Activity Recall Questionnaires (APARQ) and physical exercise in the schools and any household chores worked in their household in pervious last seven days and the amount of times in each days was asked (40).

4.8 Study variables

4.8.1 Dependent variables

- Thinness
- Stunting

4.8.2 Independent variables

- Socio demographic variables of adolescent girls
 - Age
 - Number of siblings,
 - Religion
 - Place of residence
- Family related characteristics
 - Educational level of mother and father
 - Occupation of mother and father
 - Household wealth index
 - Common source of food in household
 - Household head
 - Family size
 - Type of family
 - Ethnicity
- Environmental and personal hygiene variables

- Source of drinking water
- Availability of latrine at home
- Hand washing practice
- Dietary intakes
 - Meal frequency
 - Skipping breakfast
 - Staple food of adolescent girls
- Dietary diversity
- History of illness
 - Diarrhea
 - Fever
 - Cough
 - Common cold
 - Malaria
- Nutrition knowledge of adolescent girls
- Adolescent girls physical activity and household chores
- Food security status of adolescent girls.

4.9 Standard and operational definition

Adolescent girls: females whose age between 10-19 years old (5) .

Undernutrition- those adolescents classified as having stunting and/ or thinness according to WHO 2007 growth reference (5).

Stunting - adolescent girls whose Height-for-Age (HAZ) is below the -2 Z -scores of the median of the Who reference population are considered short for their age (stunted) or chronically malnourished (41)

Thinness - Adolescent girls whose BMI-for-age (BAZ) is below the -2 Z –scores the median of the WHO reference population are considered as thin acutely malnourished (41)

Dietary diversity score: in the study was created by summing up the number of food groups consumed over 24 hours' periods by an individuals.

Adequate dietary diversity - Proportion of adolescent girls who received foods greater than four food groups from out of nine food groups per 24 hours of yesterday

Inadequate dietary diversity- Proportion of adolescent girls who received foods less than or equal to four food groups from out of nine food groups per 24 hours of yesterday (38).

Adolescent girls food security status was determined as follows: girls will be 'food secure' only when the responses for all the four items were 'no'; otherwise, the girls will be labeled as 'food insecure' for those who will have a value of 0. The index has high internal consistency (Cronbach's Alpha=0.82). which is above the cut off for reliability(42)

Good knowledge: adolescent girls who answered the nutrition knowledge assessment questionnaire in average and above.

Poor knowledge: adolescent girls who answered nutrition knowledge assessment questionnaire below average(39).

Wealth index: is composite measure of the cumulative living standard of a household. The wealth index was calculated using easy-to-collect on households' ownership of selected assets. Generated with a statistical procedure known as principal component analysis (PCA).

Improved water source: piped water, public taps or stand pipes and protected springs

Unimproved water source: unprotected springs, surface water and unprotected dug well(43)

4.10 Data analysis process and procedure

The data entry were done with Epi-data version 3.1, cleaned, edited and was exported to SPSS for windows version 20 for analysis. The data were checked by exploratory analysis for missing values and outliers. BAZ and HAZ of study subjects were analyzed by using WHO anthro plus of software version 1.0.4 (5) and recoded into dichotomies variables like stunting and thinness in SPSS. Descriptive statistics including proportion, percentage, tables, graphs, frequency distribution, mean and standard deviation was used to describe the data. Dietary diversity, adolescent girls' food security and nutrition knowledge variables were done by counting variables and then recode into different variables according to their operations definition. Principal component analysis was used assess household wealth status.

Independent-sample t-test and Chi square (χ^2) tests was used to compare statistical significant difference of variables between rural and urban settings. Bivariate logistic regression analysis was done to see the association between individual explanatory and outcome variables with P-value < 0.25 and to select candidates for multivariate binary logistic regression. Multi-collinearity was checked by Variance Inflation Factors (VIF) < 10 and model goodness-of-fit by Hosmer-Lemeshow p-value > 0.05 was checked. Then finally in multivariate binary logistic regression model by using Adjusted Odds Ratio (AOR) with 95% confidence interval (CI) was used to measure independently predictor variables with outcome variables and P-value less than 0.05 was used to declare level of statistical significance.

4.11 Data quality management

Intensive training was given for the data collectors and supervisors before data collection begin. The tools was pretested 5% of the total sample outside of sampled high schools. The questionnaire was first developed in English, then translated to Hadiyisa and checked for consistency by another person who speaks both Hadiyisa and English. Weight scale was calibrated and checked before starting the data collection and after holding from place to place. Weight of the study subjects was validated with weighing known object regularly. Body weight and body height was measured by trained diploma female nurses according to the standard procedure. Weight measurement was standardized by giving training for data collectors and supervisors by principal investigator and limiting coefficients of variation to be less than 3%. The quality of collected data was checked by supervisors and principal investigator daily during data collection. Before data entering and analysis, cross-checking was done on the data to ensure the quality of the data by principal investigator.

4.12 Ethical consideration

Ethical clearance and supportive letter was obtained from the Jimma University, Institute of Health Ethical review board and formal letter of permission was taken from Soro District education offices for each high schools which was included in sample. All the adolescent girls was informed about the objective and importance of the study. Their verbal consent was obtained before conducting data collection and told to them have right to withdraw at any time during responding if they want without telling the reason for why they withdraw from participating.

4.13 Dissemination plan

The result of the study will be submitted to Department of Population and Family health, Faculty of public health, Institutes of Health, Jimma University. In addition, the paper will be disseminated to the concerned body such as Sorro District health offices, Hadiya Zone Health Department and other NGOs. Efforts will also be made to publish in peer-reviewed journal.

CHAPTER FIVE: RESULTS

5.1 Socio demographic and economic characteristics of study participants

A total of 414 high schools adolescent girls were participated in this study.

The result showed that there was no statistical significant difference in mean age (17.01 ± 1.55 versus 16.90 ± 1.48 , $P = 0.437$) from rural and urban adolescent girls was respectively ($p < 0.05$).

In both settings 197 (95.2%) in rural areas and 189 (91.3%) dominant ethnic group was Hadiya likewise protestant was also dominant in both settings (85.5% in rural and 82.1% in urban). One hundred eighty four (88.9%) in rural areas and 173 (83.6%) urban area of the adolescent girls comes from a family have more than five family members. The result showed that there was similarity in ethnicity, religion and family size between rural and urban settings ($p > 0.05$) but concerning in type of family from rural 18 (8.7%) and urban areas 9 (4.3%) there was statistical significant difference ($p < 0.05$).

Concerning mothers educational status, in rural setting nearly two third (63.3%) of mothers didn't attend formal education but the reverse is true for mothers from urban setup, 124 nearly (60%) attend at least some forma education. Regarding occupational status of mother, the large proportion, 177 (85.5%) in the rural areas and less than the half (45.4%) in urban setting were housewife likewise father occupational status large proportion, 170 (82.1%) in rural areas were farmers whereas more than half (58.5%) in urban area were merchants. Larger proportion of staple food in the rural adolescent girls was maize (38.2%) whereas in urban adolescent girls was teff (71%).

The result showed that there was statistical significant difference in educational and occupational status of parents, common source of food in the household and staple food of adolescent girls between rural and urban settings ($p < 0.05$).

Table 2: Socio demographic and economic characteristics of adolescent girls attending high schools and their households in rural and urban settings of Sorro District, Hadiya Zone Southern Ethiopia, 2019.

variables	Categories	Areas		Total (N = 414) (%)
		Rural (n = 207) (%)	Urban (n =207) (%)	
Age category	13-14	10 (4.8%)	12 (5.8%)	22 (5.3%)
	15-19	197 (95.2%)	195 (94.2%)	392 (94.7%)
Religion	Protestant	177 (85.5%)	170 (82.1%)	347 (83.8%)
	Orthodox	6 (2.9%)	18 (8.7%)	24 (5.8%)
	Catholic	24 (11.6%)	19 (9.2%)	43 (10.4%)
Ethnicity	Hadiya	197 (95.2%)	189 (91.3%)	386 (93.2%)
	Amhara	6 (2.9%)	10 (4.8%)	16 (3.9%)
	Kambta	3 (1.4%)	6 (2.9%)	9 (2.2%)
	Others	1 (0.5%)	2 (1%)	3 (0.7%)
Family size	≤5	23 (11.1%)	34 (16.4%)	57 (13.8%)
	> 5	184 (88.9%)	173 (83.6%)	357 (86.2%)
head of the HH	Father	188 (90.8%)	188 (90.8%)	376 (90.8%)
	Mother	14 (6.8%)	15 (7.2%)	29 (7%)
	Others	5 (2.4%)	4 (1.9%)	9 (2.2%)
Type of family	Monogamy	189 (91.3%)	198 (95.7%)	387 (93.5%)
	Polygamy	18 (8.7%)	9 (4.3%)	27 (6.5%)
Mothers educational status	No formal education	131 (63.3%)	62 (30%)	193 (46.6%)
	5-12 grade	74 (35.7%)	124 (59.9%)	219 (52.9%)
	Diploma and above	2 (1%)	21 (10.1%)	23 (5.5%)
Father's educational status	No formal education	86 (41.5%)	44 (21.3%)	130 (31.4%)
	Formal education	108 (52.2%)	115 (55.6%)	223 (53.9%)
	Diploma and above	13 (6.3%)	48 (23.2%)	61 (14.7)
Mother's main occupation	Housewife	177 (85.5%)	94 (45.4%)	271 (65.5%)
	Daily laborer	8 (3.9%)	15 (7.2%)	23 (5.6%)
	Merchant	15 (7.2%)	70 (33.8%)	85 (20.5%)
	Civil servant and NGO	7 (3.4%)	28 (13.5%)	35 (8.4%)
	Farmer	170 (82.1%)	13 (6.3%)	183 (44.2%)
Father's main occupation	Daily laborer	6 (2.9%)	25 (12%)	31 (7.5%)
	Merchant	20 (9.7%)	120 (58%)	140 (33.8%)
	Civil servant	11 (5.3%)	49 (23.7%)	60 (14.5%)
Common source of food in household	Own production	136 (65.7%)	14 (6.8%)	150 (36.2%)
	Purchase	10 (4.8%)	70 (33.8%)	80 (19.3%)
	Mixed	61 (29.6%)	123 (59.7%)	184 (44.5%)
Main staple food of the areas	Maize	79 (38.2%)	11 (5.3%)	90 (21.7%)
	Wheat	25 (12.1%)	47 (22.7%)	72 (17.4%)
	Kocho	45 (21.7%)	2 (1%)	47 (11.4%)
	Teff	58 (28%)	147 (71%)	205 (49.5%)
Wealth index	Lower	58 (28%)	65 (31.4%)	123 (29.7%)
	Middle	87 (42%)	73 (35.3%)	160 (38.6%)
	Higher	62 (30%)	69 (33.3%)	131 (31.6%)

5.2 History of illness of adolescent girls attending high school in rural and urban setting of Sorro District, Hadiya Zone, southern Ethiopia.

There was similarity in regarding experience of illness two weeks prior to the survey and menstrual irregularity of adolescent girls attending high school in both setups ($P > 0.05$) but there was statistical significant difference in regarding visiting health facility during any illness between rural and urban adolescent girls ($P < 0.05$).

Table 3: History of illness in the study participants in rural and urban settings of Sorro District, Hadiya Zone, Southern Ethiopia, 2019.

Variables	Categories	Areas		Total (N = 414) (%)
		Rural (n = 207) (%)	Urban (n = 207) (%)	
History of illness	Yes	23 (11.1%)	24 (11.6%)	47 (11.4%)
	No	184 (88.9%)	183 (88.4%)	367(88.6%)
Malaria	Yes	5 (2.4%)	3 (1.4%)	8 (1.9%)
	No	202 (97.6%)	204 (98.6%)	406 (98.1%)
Headache	Yes	8 (3.9%)	13 (6.3%)	21 (5.1%)
	No	199 (96.1%)	194 (93.7%)	393 (94.9%)
Fever	Yes	4 (1.9%)	3 (1.5%)	7 (1.7%)
	No	203 (98.1%)	204 (98.5%)	407 (98.1%)
Diarrhea	Yes	5 (2.4%)	1 (0.5%)	6 (1.4%)
	No	202 (97.6%)	206 (99.5%)	408 (98.6)
Common cold	Yes	3 (1.5%)	3 (1.5%)	6 (1.4%)
	No	204 (98.5%)	204 (98.5%)	408 (98.6)
Visiting health facility	Yes	162 (78.3%)	188 (90.8%)	350 (84.5%)
	No	45 (21.7%)	19 (9.2%)	64 (15.5%)
Frequency of menstruation	Regular	169 (81.6%)	173 (83.6%)	342 (82.6%)
	Irregular	31 (15%)	32 (15.5%)	63 (15.2%)

5.3 Environmental and person hygiene of adolescent girls attending high school in rural and urban setting of Sorro District, Hadiya Zone, Southern Ethiopia.

More than half (52.7%) of rural areas and majority (91.8%) of urban areas get drinking water from improved water source. Regarding the availability of latrine, 147 (71%) of home in rural areas and 193 (93.2%) in urban area have latrine in their compound. Concerning hand washing practice 122 (58.9%) and 177 (85.5%) of the adolescent girls wash their hand after toilet and before meal from rural and urban setting, respectively.

The Current study showed that there was statistical significant difference in concerning source of drinking water, hand washing practices and latrine availability of home between rural and urban areas ($P < 0.05$)

Table 4: Environmental and personal Hygiene in the study participants in rural and urban settings of Sorro District, Hadiya Zone, Southern Ethiopia, 2019.

Variables	Categories	Areas		Total (N =414) N (%)
		Rural (n =207) (%)	Urban (n = 207) (%)	
Source of drinking water	Improved	109 (52.7%)	190 (91.8%)	299 (72.2%)
	unimproved	98 (47.3%)	17 (8.2%)	115 (27.8%)
Availability of HH latrine	Yes	147 (71%)	193 (93.2%)	340 (82.1%)
	No	60 (29%)	14 (6.8%)	74 (17.9%)
Hand washing practice	Yes	122 (58.5%)	177 (85.5%)	299 (72.2%)
	No	85 (41.1%)	30 (14.5)	115 (27.7%)

5.4 Food security status of adolescent girls attending high school in rural and urban setting of Sorro district, Hadiya Zone Southern Ethiopia, 2019.

From the rural areas 78 (37.7%) and from urban areas 54 (26.1%) of the study participants reported that they were food insecure in the past three months during the survey time. This study showed that there was statistical significant difference in adolescent girls food security status between rural and urban areas ($P = 0.011$), (Figure 3).

Table 5: Food security status of adolescent girls attending high school during the last three months before the survey in rural and urban settings of Sorro District, Hadiya Zone, Southern Ethiopia, 2019.

Variables	Categories	Areas		Total (N = 414) (%)
		Rural (n = 207) (%)	Urban (n =207)(%)	
Worry run out of food	Yes	68 (32.9%)	36 (17.4%)	104 (25.1%)
	No	139 (67.1%)	171 (82.6%)	310 (74.9%)
Reduce number of meal in a day because of shortage of food	Yes	24 (11.6%)	24 (11.6%)	48 (11.6%)
	No	183 (88.4%)	183 (88.4%)	366 (88.4%)
Spend the whole day without eating because of shortage of food	Yes	8 (3.9%)	8 (3.9%)	16 (3.9%)
	No	199 (96.1%)	199 (96.1%)	398 (96.1%)
Ask someone for or money to buy food (beg)	Yes	1 (0.5%)	3 (1.4%)	4 (1%)
	No	206 (95.5%)	204 (98.6%)	410 (99%)

Adolescent girls food security

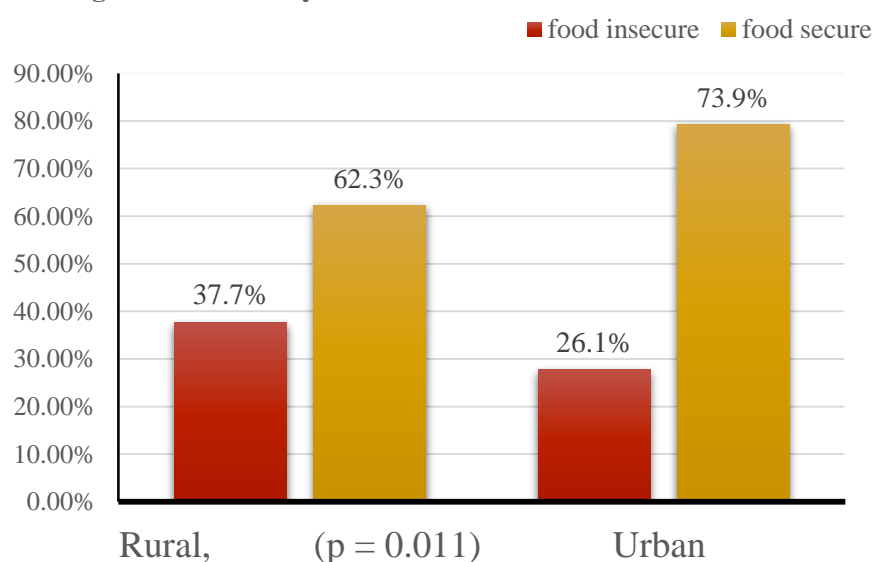


Figure 3: Food security status of adolescent girls attending high school during the last three months before the survey in rural and urban settings of Sorro District, Hadiya Zone, Southern Ethiopia, 2019.

5.5 Physical activity and household chores of adolescent girls

The variables treated as continuous so the mean works load of rural areas were 2.93 ± 1.84 whereas the mean work load of urban area were 1.95 ± 1.72 . The difference was statistical significant between rural and urban areas of adolescent girls (t-test p-value = 0.001). (See table below 6)

Table 6: School physical exercise, distance for walking to school and return to home and housework chores adolescent girls attending High school in rural and urban setting of Sorro District, Hadiya zone Southern Ethiopia, 2019.

Variables	Areas		Total (N = 414)	P
	Mean(SD) Rural (n = 207)	Mean(SD) Urban (n = 207)		
Time spend on physical exercise per day (min)	12.02 (0.18)	10.39 (0.17)	11.20 (0.18)	0.075
Time taken to go to school and return to home per day (hours or min)	1.08(0.49)	0.24(0.22)	0.46 (0.44)	0.001
Household chores per day (hours)	2.93 (1.84)	1.95 (1.43)	2.44 (1.72)	0.001

5.6 Dietary diversity scores of adolescent girls attending high school in rural and urban setting of Sorro District Hadiya zone, Southern Ethiopia, 2019.

The maximum dietary diversity in rural and urban were 7 and 8 respectively whereas minimum dietary diversity were 2 in both areas. The mean (SD) of dietary diversity score was 3.72 ± 1.01 and 4.63 ± 1.16 in rural and urban areas respectively. More than three fourth (79.7%) and more than the than half (57%) of the adolescent girls reported from rural and urban areas that they did not have get adequate dietary diversity per day during survey time respectively. There was statistical significant difference in concerning dietary diversity between rural and urban settings (P = 0.001)

Table 7: Dietary diversity score distribution of adolescent girls attending high school in rural and urban setting of Sorro District, Hadiya zone, Southern Ethiopia, 2019.

Food type or groups	Categories	Areas		Total (N = 414) (%)
		Rural (n = 207) (%)	Urban (n = 207) (%)	
Grains or other starchy	Yes	207 (100%)	207 (100%)	414 (100%)
Vitamin A rich fruits and vegetables	Yes	59 (28.5%)	114 (55.1%)	173 (41.8%)
	No	148 (71.5%)	93 (44.9%)	241 (58.2%)
Dark green vegetables	Yes	181 (87.4%)	188 (90.8%)	372 (89.9%)
	No	26 (12.6%)	19 (9.2%)	42 (10.1%)
Organ meat	Yes	6 (2.9%)	9 (4.3%)	15 (3.6%)
	No	201 (97.1%)	198 (95.7%)	399 (96.4%)
Flesh meat	Yes	23 (11.1%)	24 (11.6%)	47 (11.4%)
	No	184 (88.9%)	183 (88.4%)	367 (88.6%)
Other fruits and vegetables	Yes	96 (46.4%)	184 (88.9%)	280 (67.6%)
	No	111 (53.6%)	23 (11.1%)	134 (32.4%)
Eggs	Yes	14 (6.8%)	28 (13.5%)	42 (10.1%)
	No	193 (53.1%)	179 (86.5%)	372 (89.9%)
Legumes and nuts	Yes	110 (79.7%)	145 (70%)	255 (61.6%)
	No	97 (46.9%)	62 (30%)	159 (38.4%)
Dairy products	Yes	72 (34.8%)	147 (71%)	132 (31.9%)
	No	135 (65.2%)	60 (29%)	282 (68.1%)
Dietary diversity score	Mean(SD)	3.72 (1.01)	4.63 (1.16)	4.18(1.18)

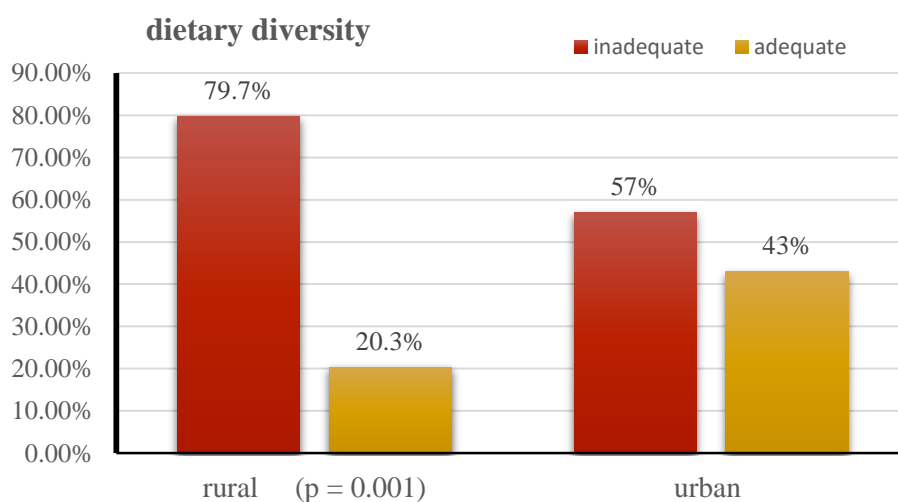


Figure 4: dietary diversity of distribution of adolescent girls attending high schools in rural and urban setting of Sorro District, Hadiya zone, Southern Ethiopia 2019.

5.7 Nutrition knowledge of adolescent girls attending high school in rural and urban setting of Sorro District, Hadiya Zone, Southern Ethiopia, 2019

In this study, in both setups more than two third (66.6%) of adolescents girls were found to have good nutrition knowledge, likewise the mean nutrition knowledge of adolescent girls in rural and urban is reported as 5.06 ± 1.9 and 5.29 ± 1.8 , respectively. There was no statistical significant difference in regarding adolescent girls nutrition knowledge from rural and urban areas ($P = 0.752$) _Figure 5).

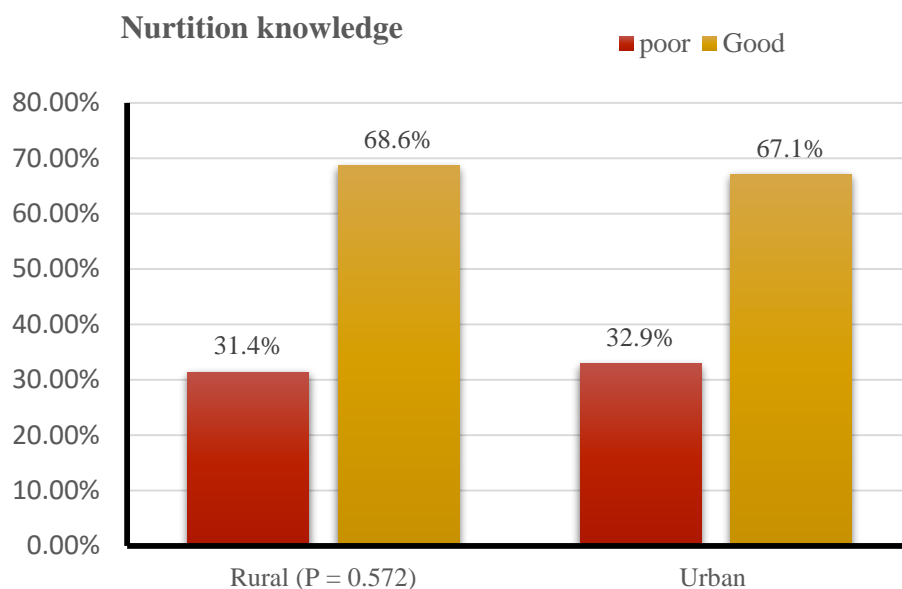


Figure 5: Nutrition knowledge of adolescent girls attending high school in rural and urban setting of Sorro District, Hadiya zone, Southern Ethiopia 2019.

5.8. Prevalence of stunting and thinness of the adolescent girls attending high school in rural and urban setting of Sorro District, Sothern Ethiopia, 2019.

The current the study found that prevalence of stunting 63 (30.4%) with 95% (CI: 24.2-36.7) among rural high schools adolescent girls was higher than prevalence of stunting 41(19.8%) 95% (C.I: 14.5-25.6) among urban high schools adolescent girls. This difference was statistical significant ($P = 0.013$).

Prevalence of thinness 18 (8.7%) with 95% (CI: 5.3-12.6) among rural high schools adolescent girls was higher than the prevalence of thinness 10 (4.8%) with 95% (CI: 1.9 – 8.2) among urban high school adolescent girls) but the difference was not statistically significant ($P = 0.117$) (figure 6)

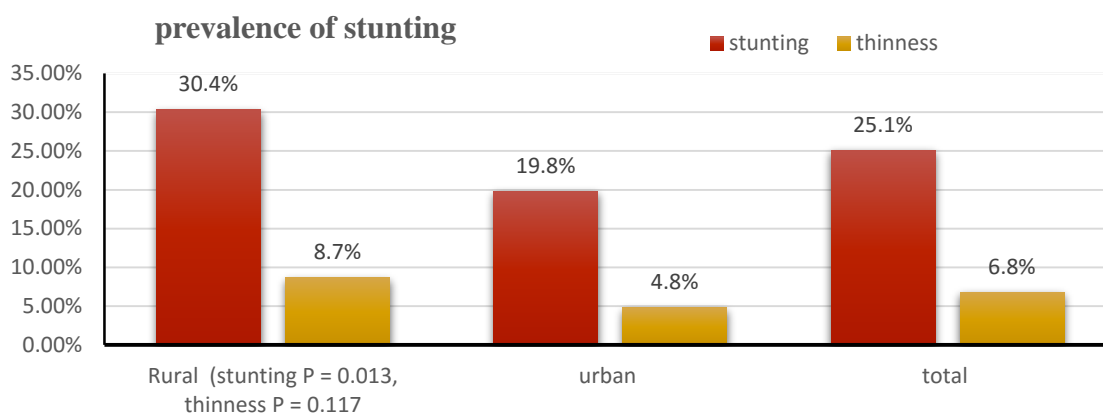


Figure 6: prevalence of stunting and thinness of the adolescent girls attending high schools in rural and urban setting of Sorro District, Hadiya Zone, Southern Ethiopia, 2019.

5.9 Factors associated with stunting and thinness of adolescent girls attending high schools in rural and urban setting of Sorro District, Hadiya Zone Southern Ethiopia, 2019.

5.9.1 Factors associated with stunting

Firstly bivariate binary logistic regression analysis was done between stunting and each explanatory variables to find factors associated with stunting, accordingly family type, Place of residence, age category, mother educational status, father and mother occupation, home latrine, hand washing at critical time, dietary diversity, common source of food, father educational status, frequency of menstrual cycle, household chores and adolescent nutrition knowledge become a candidate variables for multivariate binary logistic regression model at P-value less than 0.25.

Multivariate binary logistic regression analysis was done to identify independent predictors of stunting, accordingly place of residence and adolescent girls' nutrition knowledge were found to be an independent predictors of stunting. The odds of being stunted among adolescent girls was two times higher in rural areas as compared to urban areas (AOR: 1.9; 95% CI: 1.8-2.94). Odds of being stunted was 1.7 times higher among high schools adolescent girls who have poor nutrition knowledge than that of adolescent girls who have good nutrition knowledge (AOR: 1.7; 95% CI: 1.03-2.7). (Table 8)

Table 8: bivariate and multivariate binary logistic regression output showing that factors associated with stunting of adolescent girls attending high schools in rural and urban setting of Sorro District, Hadiya Zone Southern Ethiopia, 2019.

Variables	Categories	Stunting		P	Crude OR (95% CI)	
		Stunted	No stunted			
Family type	Polygamy	14 (17.9%)	64 (82.1%)	0.108	0.59 (0.32-1.12)	
	Monogamy	90 (26.8%)	246 (73.2%)		1	
Place of residence	Rural	63 (30.4%)	144 (69.6%)	0.013	1.77 (1.13-2.78)	1.9 (1.8-2.94)*
	Urban	41 (19.8%)	166 (80.2%)		1	
Age category	15-19	102 (26%)	290 (74%)	0.094	3.52 (0.81-15.31)	3.66 (0.82-16.31)
	13-14	2 (9.1%)	20 (90.9%)		1	
Household head	Mother	8 (27.6)	21 (72.4)	0.757	1.14 (0.49-2.67)	
	Others	2 (22.2)	7 (77.8)	0.849	0.86 (0.17-4.19)	
	Father	94 (25)	282 (75)	1		
Marital status	Single	99 (24.8%)	301 (75.2%)	0.357	0.59 (0.19-1.81)	
	Married	5 (35.7)	9 (64.3%)		1	
Father education	No formal	59 (30.3%)	136 (69.7%)	0.006	3.28 (1.41-7.65)	
	5-12 grade	38 (23.9%)	121 (76.1%)	0.051	2.38 (0.99-5.67)	
	Diploma and above	7 (11.7%)	53 (88.3%)	1		
	No formal	55 (28.5%)	138 (71.5%)	0.059	4.18 (0.95-18.45)	
Mother education	5-12 Grade	47 (23.7%)	151 (76.3%)	0.119	3.27 (0.74-14.46)	
	Diploma and above	2 (8.7%)	21 (91.3%)	1		
Father occupation	Farmer	54 (29.5%)	129 (70.5%)	0.008	3.17 (1.35-7.41)	
	daily laborer	15 (48.4%)	16 (51.6%)	0.001	7.09 (2.47-20.43)	
	Merchant	28 (20%)	112 (80%)	0.160	1.89 (0.78-4.61)	
	Civil servant	7 (11.7%)	53 (88.3%)	1		
Mother occupation	Housewife	82 (27.9%)	212 (72.1%)	0.18	1.87 (0.75-4.67)	
	Merchant	16 (18.8%)	69 (81.2%)	0.83	1.21 (0.39-3.15)	
	Civil servant	6 (17.1%)	29 (82.9%)	1		

Frequency menstrual cycle	Irregular	22 (34.9%)	41 (65.1%)	0.070	1.70 (0.96-3.02)	
	Regular	82 (24%)	260 (76%)		1	
Common Source of food	Own production	48 (32%)	102 (68%)	0.026	1.75 (1.07-2.86)*	
	Purchase	17 (21.1%)	63 (78.8%)	0.992	1.003 (0.53-1.91)	
	Mixed	39 (21.2%)	145 (78.8%)		1	
History of illness	No	35 (30.4%)	80 (69.6%)	0.434	1.35 (0.67-2.55)	
	Yes	90 (24.5%)	277 (75.5%)		1	
Visiting health facility	No	15 (23.4%)	49 (76.6%)	0.736	0.89 (0.48-1.68)	
	Yes	89 (25.4%)	261 (74.6%)		1	
Hand washing	No	35 (30.4%)	80 (69.6%)	0.123	1.46 (0.90-2.36)	
	Yes	69 (23.1%)	230 (76.9%)		1	
Source of water	Unimproved	26 (22.6%)	89 (77.4%)	0.465	0.83 (0.049-1.38)	
	Improved	78 (26.1%)	221 (73.9%)		1	
Home latrine	No	23 (31.1%)	51 (68.9%)	0.194	1.44 (0.83-2.50)	
	Yes	81 (23.8%)	259 (76.2%)		1	
Stables of respondent s	Maize	24 (26.7%)	66 (73.3%)	0.094	1.65 (0.92-2.97)	
	Wheat	25 (34.7%)	47 (65.3%)	0.004	2.41 (1.32-4.41)	
	Kocho	18 (38.3%)	29 (61.7%)	0.003	2.82 (1.42-5.60)	
	Teff	37 (18%)	168 (82%)		1	
Household chores	High	52 (30.8%)	117 (69.2%)	0.028	1.65 (1.05-2.58)	
	Low	52 (21.2%)	193 (78.8)		1	
Meal frequency	< 3	20 (28.6%)	50 (71.4%)	0.66	1.24 (0.69-2.19)	
	≥ 3	84 (24.4%)	260 (75.6%)		1	
Food security	Insecure	33 (25%)	99 (75%)	0.969	0.99 (0.61-1.59)	
	Secure	71 (25.2%)	211 (74.8%)		1	
Dietary diversity	Inadequate	71 (28%)	183 (72%)	0.095	1.49 (0.93-2.39)	
	Adequate	33 (20.6%)	127 (79.4%)		1	
Nutrition knowledge	Poor	41 (30.8%)	92 (69.2%)	0.067	1.54 (0.97-2.45)	1.7 (1.07-2.76)*
	Good	63 (22.4%)	218 (77.6%)		1	1

OR = Odd Ratio, 1= reference group, Asterisk (*) = P < 0.05, Hosmer-Lemeshow p = 0.166

5.8.2 Factors associated with thinness

Primarily bivariate binary logistic regression analysis was done between thinness and each explanatory variables to find factors associated with thinness, accordingly Family type, Place of residence, household wealth tertile, visiting health facility, main staple food of participants, source of drinking water, adolescent food security, availability of home latrine, hand washing practice, history of illness, meal frequency, skipping breakfast and individual dietary diversity were become a candidate variables for multivariable logistic model at P-value less than 0.25.

Multivariate logistic regression analysis was done to identify independent predictors of thinness, accordingly household wealth tertile, source of drinking water, dietary diversity and skipping breakfast were found to be an independent predictors of thinness.

Adolescent girls attending high schools had found to be four times higher odds of being thin (AOR: 4.19; 95% C.I: 1.13-15.47) in the low households wealth tertile as compared to those from high households Wealth tertile. The odd of being thin was more than two times higher among adolescent girls who use drinking water from unimproved source as compared to adolescent girls who use drinking water from improved source (AOR: 2.3; 95% C.I: 1.01-5.30). The odds of being thin was three times higher among high school adolescent girls who skip breakfast than adolescent girls who did not skip breakfast (AOR: 2.97; C.I: 1.28-6.92). Adolescent girls being thin was four times more likely higher among high school adolescent girls who did not get adequate dietary diversified food as compared to high schools adolescent girls who get adequate dietary diversified food (AOR: 3.99; C.I: 1.15-13.82). (Table 9)

Table 9: bivariate and multivariate binary logistic regression output showing that factors associated with thinness of adolescent girls attending high schools in rural and urban setting of Sorro District, Hadiya zone Southern Ethiopia, 2019.

Variables	Categories	Thinness		P	Crude OR	Adjusted OR
		Thin	Not thin		95% (CI)	95% (C I)
Family type	Polygamy	12 (15.4%)	66 (84.6%)	0.001	3.64 (1.64-8.04)	
	Monogamy	16 (4.8%)	320(95.2%)		1	
Father education	No formal	16 (8.2%)	179 (91.8%)	0.699	1.25 (0.40-3.89)	
	5-12 grade	8 (5%)	151 (95%)	0.636	0.74 (0.22-2.56)	
	Diploma & above	4 (6.7%)	56 (93.3%)		1	
Mother occupation	housewife	25 (8.5%)	269 (91.5%)	0.267	3.16 (0.42-24.07)	
	Merchant	2 (2.4%)	83 (97.6%)	0.892	0.82 (0.07-9.34)	
	Civil servant & NGO	1 (2.9%)	34 (97.1%)		1	
Place of residence	Rural	18 (8.7%)	189 (91.3%)	0.122	1.88 (0.84-4.17)	
	Urban	10 (4.8%)	197 (95.2%)		1	
Household wealth tertile	Low	14 (11.4%)	109 (88.6%)	0.009	5.48 (1.54-19.57)	4.19 (1.13-15.49)*
	Middle	11 (6.9%)	149 (93.1%)	0.083	3.15 (0.86-11.54)	3.09 (0.82-11.64)
	High	3 (2.3%)	128 (97.7%)		1	1
Hand washing	No	15 (13%)	100 (87%)	0.003	3.30 (1.52-7.18)	
	Yes	13 (4.3%)	286 (95.7%)		1	
Home latrine	No	10 (13.5%)	64 (86.5%)	0.014	2.79 (1.23-6.33)	
	Yes	18 (5.3%)	322 (94.7%)		1	
History of illness	Yes	7 (14.9%)	40 (85.1%)	0.023	2.88 (1.15-7.20)	
	No	21 (5.7%)	346 (94.3%)		1	
Source of water	Unimproved	15 (13%)	100 (87%)	0.003	3.30 (1.52-7.18)	2.31 (1.01-5.30)*
	Improved	13 (4.3%)	286 (95.7%)		1	1
Staple food	Maize	10 (11.1%)	80 (88.9%)	0.165	1.85 (0.78-4.38)	
	Wheat	4 (5.6%)	68 (94.4%)	0.811	0.87 (0.27-2.76)	
	Kocho	1 (2.3%)	46 (97.9%)	0.320	0.32 (0.045-2.76)	
	Teff	13 (6.3%)	192 (93.7%)		1	
	Irregular	5 (7.9%)	58 (92.1%)	0.728	1.19 (0.44-3.27)	

Menstrual cycle	Regular	23 (6.7%)	319 (93.3%)		1	
Skipping breakfast	Yes	15 (16.3%)	77 (83.7%)	0.001	4.6 (2.12-10.14)	2.98 (1.28-6.92)*
	No	13 (4%)	309 (96%)		1	1
Meal frequency	< 3	10 (14.3%)	60 (85.7)	0.008	3.02 (1.33-6.86)	
	≥ 3	18 (5.2%)	326 (94.8%)		1	
Dietary diversity	Not adequate	11 (12.2%)	79 (87.8%)	0.005	2.52 (1.13-5.58)	3.99 (1.15-13.82)*
	Adequate	17 (5.2%)	307 (94.8%)		1	1
Adolescent food security	Insecure	12 (12.9%)	81 (87.1%)	0.037	2.82 (1.28-6.21)	
	Secure	16 (5%0	305 (95%)		1	

Key: OR = Odd Ratio, 1 = reference group asterisk (*) = P < 0.05, 1 = reference group, Hosmer-Lemeshow p =0.697

6. CHAPTER SIX: DISCUSSIONS

Undernutrition during adolescence can adversely affect adolescent girls' intellectual development, growth, health, social skills, school attendance and achievement. Moreover, since adolescent girls are tomorrow's mothers' undernutrition during this period also had intergeneration malnutrition impact.

This study was conducted to determine the prevalence and associated factors with undernutrition among adolescent girls attending high schools in rural and urban settings.

Prevalence of stunting and thinness

The overall prevalence of stunting and thinness was 25.1% and 6.8%, respectively. The current study demonstrates there was difference in between urban and rural adolescent girls attending high school in terms of undernutrition. The prevalence of stunting was found to be significantly higher in rural areas (30.4%) as compared to urban area (19.8%) and prevalence of thinness was higher in rural area (8.7%) than that of urban area (4.8%). These could be because of that the current study found that there was statistical significant difference between two settings in terms of educational and occupational status of parents, household chores, source of drinking water, adolescent food security status and dietary diversity between urban and rural settings which are major indicators of socio economic disparity of these areas. The higher prevalence of stunting and thinness in rural adolescent girls are in consistent with other comparative studies reports such as Northern Ethiopia, South-Western Ethiopian, India and Pakistan (9,14,44,45).It is documented that rural adolescent girls are more likely suffer from stunting and thinness than urban adolescent girls. Adolescent girls stunting and thinness differences between urban and rural areas could be because of the fact that there are cumulative effect of a series socio economic disparity between the urban and rural areas.

Factors associated with stunting and thinness

In this study, factors like place of residence and adolescent girls' nutrition knowledge were independently associated with stunting while household wealth tertile, source of drinking water, dietary diversity and skipping breakfast were independently associated with thinness.

The current study revealed that place of residence among high school adolescent girls was independent predictors of stunting. The odds of being stunted among adolescent girls was two

times higher in rural areas as compared to urban areas. This finding was consistent with the studies of Mizan District and Jimma zone (14,27). This could be because of fact that there is disparity in social- economic status, life style, infrastructure accessibility and nutrition between urban and rural populations.

The current study revealed that nutrition knowledge of high school adolescent girls was independent predictors of stunting. Odds of being stunted was 1.7 times higher among high schools adolescent girls who have poor nutrition knowledge than that of adolescent girls who have good nutrition knowledge which were consistent with the study from northern Ethiopia adolescent girls nutritional status (26). Adolescence could be stage of open to new idea and a point at which life style choice of attitudes and behaviors may be determined an individual life course. This is could be because of that adolescent girls who are stunted have poor school achievements and cognitive impairment.

Adolescent girls attending high schools had found to be four times higher odds of being thin in the low households' wealth tertile as compared to those from high households Wealth tertile. The finding was consistent with study conducted in Aksum town and Jimma zone (46,47). This could reflect the fact that household wealth gives an idea of household ability to access food and gives information about economic situation of households. It is also used to differentiate between wealthier and poorer household food security related indicators like food consumption.

The current study revealed sources of drinking water among high schools adolescent girls was independent predictor of thinness. The odds of being thin was more than two times higher among adolescent girls who use drinking water from unimproved source as compared to adolescent girls who use drinking water from improved source which is agreed with study conducted in Adwa , northern Ethiopia (37). This could be because of fact that the use of unimproved source of drinking water is vehicle for intestinal parasite and water borne disease which leads to vicious cycles of undernutrition and disease. The odds of being thin was three times higher among high school adolescent girls who skip breakfast than adolescent girls who did not skip breakfast which was agreed with the study from Wolaita Sodo Town, Southern Ethiopia(31). Fifty percent of adolescents in LMICs do not eat three meals per day; most skip breast fast(7). Adolescent girls meal pattern is often disorganized and they tend to miss their breakfast at home as they get older(17). Skipping breakfast leads to inadequate dietary intake, skipping breakfast leads to being thin.

Adolescent girls being thin was four times more likely higher among high school adolescent girls who did not get adequate dietary diversified food as compared to high school adolescent girls who get adequate dietary diversified food. The finding was agreed with studies which was conducted in different parts of Ethiopia like Adama city, Jimma Zone, south west Ethiopia, rural Tigray region and bale zone (25,27,29,32,34). The fact that during adolescents' period, the growth is fast and nutritional requirements are increased to promote this growth. But the increased demands of nutrients during adolescent period could leads to thinness if dietary diversity is inadequate.

The findings have wider practical implication especially in Ethiopia where the rate of childhood scrubbing pervasively high. The findings urge the need for enhancing direct nutritional interventions targeting adolescents to redeem huge tall of stunting accrued from childhood on the one hand and prevent stunting and thinness during the adolescence, which is the last phase of human growth.

6.1 Strength of the study

- This study show new information of undernutrition and associated factors among adolescent girls attending high schools in rural and urban setting of Sorro District

6.2 Limitation of the study

- Knowing the correct age of participants was difficult. It was challengeable obtaining birth date of adolescent girls.
- This study includes only adolescent girls from high schools and so most the early adolescent girls did not included.
- Since household information from adolescent girls it have might limitation.

7 CHAPTER SEVEN: CONCUSSION AND RECOMMENDATIONS

7.1 Conclusion

Generally, this study revealed that the prevalence of stunting was significantly higher in rural areas than that of urban areas and the prevalence of thinness was higher in rural areas than in urban area.

The finding of study shown that place of residence and nutrition knowledge were independent predictors of stunting while household wealth tertile, source of drinking water, dietary diversity and skipping breakfast were independent predictors of thinness.

7.2 Recommendations

Hadiya Zone Health Department and Sorro District Health Offices may need design nutrition intervention which targets adolescent girls' undernutrition by giving priority for rural areas.

Sorro Woreda and Gimbichu town administration education offices may need provide health education on dietary diversity and nutrition knowledge in addition to regular education activities in school.

Sorro District agriculture offices may need work for improving household economy by broadening micro finance institution and strength agricultural extension program to increase agricultural production. So that Sorro district health offices shall provide nutrition education on increase eating breakfast and dietary diversity intake.

Sorro District water and mining offices may need work in accessibility of improved water source supply for the population of Districts.

Parents may need work hard to increase household wealth status which could decrease thinness among adolescent girls.

Adolescent girls may need increase adequate diversified food from which accessible in the household.

Lastly for **researchers**, community based studies with different study design on adolescent nutrition are encouraged.

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Annexes

Annex 1: English Version of the Questionnaire

Jimma University

Institute of Health

Department of population and family science

Consent Statement

A questionnaire prepared to assess the prevalence and associated factor of undernutrition among adolescent girls' high schools in urban and rural setting of Sorro district, Hadiya Zone, Southern Ethiopia.

Greeting

How are you, my name is-----I am here on behalf of Denebo Ersulo, second year Master of Science in Human Nutrition student in Jimma University, Institute of Health, Department of population and family health.

I would like to ask you a few questions about your socio-demographic status, dietary practice, history of illness, environmental and personal hygiene, your knowledge on nutrition, your food security status and finally I will measure your weight and height.

This will help to improve in the prevention and control of undernutrition among adolescent girls in Sorro district based on the information you provide us. Your name will not be written in this form and will never be used in connection with any information you tell us. All information given by you will be kept strictly confidential. Your participation is voluntary and you are not obligate to answer any question which you do not wish to answer. If you fill discomfort with this, please fill free to drop it any time you want. This will take about 20 minutes.

Could I have your Permission to continue?

1. If yes, continue the interview.
2. If no, skip to the next participant.

Time started _____ Time completed _____

Result of interview: 1. Completed 2. Respondent not available 3. Refused 4. Partially completed

Data collectors Name-----signature-----date-----

Checked by: Supervisor: Name _____ Signature _____

For any questions you have, you can contact the Principal Investigator

By: phone No_ **0916784175**

Identification No-----

Table 10: Questionnaire assessing prevalence and factors associated with undernutrition among adolescent girls' high schools in rural and urban setting Sorro district, Hadiya zone, Southern Ethiopia, 2019.

Section A; Socio Demography and Socio Economic factors of the adolescent females			
Sr.no	Question	Response and code	Skip
100	How old are you?	_____age in yeas	
101	Marital status?	0, single 1, married	
102	Place of you and your family residence?	0, Urban 1, Rural	
103	What is your Religion	0. Protestant 1. Orthodox 2. Catholic 3. Muslim 4. Other(specify)_____	
104	What is your Ethnicity	0. Hadiya 1. Kembata 2. Gurage	

		3. Silte 4, Amhara 5, Other (specify) _____	
105	Type of your family?	0, Monogamy 1, Polygamy	
106	Household heads	0, Father 1, Mother 2, Other/specify_____	
107	How many people including yourself, live in your household?	_____ Size in number	
108	How Many Siblings do you have?	_____ Size in number	
109	What is your father's Educational status?	0, Not read and write 1, Read and write 2, Primary school (5-8) 3, High school (9-12) 4, Diploma/ Degree and above	
110	What is your Mother's Educational status?	0, Not read and write 1, Read and write 2, Primary school 3, High school (9-12) 5, Diploma/ Degree and above	
111	What is your father's Occupation?	0, Farmer 1, Daily laborer 2, Civil Servant 3, driver 4, Merchant 5, other/specify_____	

112	What is your mother's occupation?	0, housewife 1, daily laborer 2, Merchant 3, Civil Servant 4, other/specify_____	
Section B; Dietary habit of adolescent girls			
113	What is the common source of food in your household?	0, own production 1, purchase 2, mixed source	
114	What is your main staples food? (Only single answers)	0, maize 1, wheat 2, kocho (enset) 3, teff 4, sorghums 5, Other/ specify_____	
115	How many times do you eat per day? Meal request	0, less than three times 1, three or more times 3, other/specify _____	
116	Do you eat breakfast before you go to school?	0, No 1, Yes	
117	Did you eat out of your home	0, No 1, yes	
Section C; Dietary diversity in 24 hour recall, please circle (1) if you ate (0) if you did not eat from this food groups in previous 24 hour.			
	Food groups	Examples of local food item	0, No 1, Yes
118	Grains or other starchy roots and tubers (cereals)	Corn/maize, wheat, sorghum, enset or any other grains or foods made from these (e.g. keta, kocho, bread, injera, porridge, white potato, or other grain products.	

119	Vitamin A rich fruits and vegetables	carrot, sweet potato, mango, , ripe papaya, dried peach, and 100% fruit juice	
120	Dark green leafy vegetables	Cabbage,	
121	Organ meat	liver, kidney, heart or other organ meats	
122	Flesh foods (meat and fish)	beef, lamb, goat, chicken,	
123	Other fruits and vegetables	tomato, onion, sweet peeper	
124	Egg		
125	Legumes and nuts	beans, peas, lentils, nuts, seeds or foods made from these	
126	Dairy products	milk, cheese, yogurt, Butter or other milk product	

Section D; history of illness and environmental factors

Ser no	Questions	Response and code	
127	Type of water source used for drinking and food preparation?	0, Piped water 1, protected Well/spring water 2,unprotected/well/Spring/River 3, surface water 3, Others (specify)_____	
128	Does the household own latrine?	0, No 1, Yes	
129	Does your school have latrine?	0, No 1, Yes	
130	Do you wash your hands after toilet?	0, No 1, Yes	
131	Do you have history any disease in last two month?	0, No 1, yes	Skip _ if none que NO 137
132	Diarrhea	0, No 1, yes	
133	cough	0, No	

		1, yes	
134	fever	0, No 1, yes	
135	Headache	0, No 1, yes	
136	malaria	0, No 1, yes	
137	Do you go health facility during the time of disease happen?	0, no 1, yes	
138	Menstruation status '	0, None menstruating 1, Menstruating	Skip _ if none que NO 141
139	Age of first menstruation	_____ years	
140	If yes frequency of menstruation	0, Regularly 1, Irregularly	

Section E. nutrition knowledge assessing questions

	Questions	Choose your answers	
141	Healthy diet is important for human being to be become healthy	T	F
142	Not eating balanced diet can promote health and prevent disease	T	F
143	Eating balanced diet can prevent disease	T	F
144	Most of the proteins source of food comes from wheat	T	F
145	vitamins and minerals provides energy for our body	T	F
146	The bread, cereal, rice and pasta are groups' source of? 0, Carbohydrate 1, Calcium 2, Vitamin A 3, Vitamin D 4, I don't know		
147	Nutrient most important for prevention of anemia? 0, Calcium 1, Vitamin A 2, Iron 3, Protein 4, I don't know		
148	Nutrient is most important for prevention of goiter? 0, calcium 1, iron 2. Vitamin B ₁ 3, Iodine 4, I don't know		
149	Vitamin most important for vision? 0, Vitamin C 1, Vitamin A 2, Vitamin D 3, Vitamin K 4, I don't know		

150	Nutrient deficiency caused by lack of energy is? 0, beriberi 1, goiter 2, marasmus 3, anemia 4, I do not know
-----	--

Section F :Adolescent girls’ food insecurity assessing questions

151	During the last 3 months did you ever worry that you would run out of food or not have enough money to buy food?	No Yes
152	During the last 3 months did you ever had to reduce the number of meals eaten in a day, because of shortages of food or money to buy food?	No Yes
153	During the last 3 months did you had to spend the whole day without eating, because of shortages of food or money to buy food?	No Yes
154	During the last 3 months did you ever had to ask for food or money to buy food (beg)	No Yes

Section G : physical activity and household chores

I would like to ask activities you do in house. In the last seven days how many and times have you done each of the following activities?

No	Question	Number of Days per week (0-7)	hours: minutes per day
155	Fetch water	_____	_____
156	Fetch fire wood	_____	_____
157	Washing clothes	_____	_____
158	Cooking	_____	_____
159	Child care	_____	_____
160	Carry heavy load	_____	_____
161	Any other work	_____	_____

Travel to and from places(For example to school) per in previous last seven days (0_7)

162	In a typical week on how many days do you walk or use a bicycle to go to your school and return to your home?	_____ No of days
-----	---	------------------

163	How much time do you spend walking or bicycling for travel in a typical day?	Hours: minutes _____
Now I would like to ask you about sports, in your school per in previous last seven days (0_7)		
164	Sports, fitness or recreational activities?	_____No of days
165	How much time do you spend doing sports, fitness or recreational activities in a typical days?	Hours: minutes _____
Section H Wealth index of households related questions		
166	Private home	0, No 1, yes
167	Electricity?	0, No 1, yes
168	An electric metal?	0, No 1, yes
169	A refrigerator	0, No 1, yes
170	Solar	0, No 1, yes
171	A television?	0, No 1, yes
172	A Bajaj?	0, No 1, yes
173	Motor cycle	0, No 1, yes
174	A radio	0, No 1, yes
175	mobile telephone	0, No 1, yes
176	A table	0, No 1, yes
177	A chair	0, No 1, yes
178	A bed with cotton/ sponge/spring matters	0, No 1, yes
179	A kerosene lamp/pressure lamp	0, No 1, yes
180	Annual farm product per quintal	0, no 1, yes
180a	Wheat 1.Yes 2.No	----- quintal
180b	Teff 1.Yes 2.No	----- quintal
180c	Maize 1.Yes 2.No	----- quintal
180d	barley 1.Yes 2.No	----- quintal
180e	bean 1.Yes 2.No	----- quintal
180f	Sorghums 1.Yes 2.No	----- quintal

180g	Pea	1.Yes 2.No	----- quintal	
181	Does household own any agricultural land		0, No 1, yes	if no skip to Q-186
181a	How many (local units) of agricultural land do you obtained?		1 Private -----(local unit) 2 By rent ----- (local units)	
182	Presence of cattle's	0, No 1, yes	0, No 1, yes	
182a	Milk cows, oxen or bulls	0, No 1, yes	----- in no_	
182b	Horses, donkeys, or mules	0, No 1, yes	----- in no_	
182c	Goats /Sheep	0, No 1, yes	----- in no_	
182d	Chickens	0, No 1, yes	----- in no_	
Section I: Anthropometry measurement				
			Response	
		Frist measure	Second measure	Average
183	Weight in kg			
184	Height in cm			

Hadiyisi summune Gudaako landi fayaa'ommi bikina xammo xammichuwwa

Jimmi universite'e

Fayaa'omi institute Minadaaphane abarosi fayaa'om losishi lossa'n baxancha

Xuumaato

Hinikodo'i xumma he'lla, ii summi _____yamaamoomo ani keye waarumoki Danabo Ersullo bikaattete, la'm hinchoonne manni hurbaaxi se'll bikkina maasiteerisi lossaanicho, Jimmi univeriste'ene, Fayaa'omi istuttutanne , minadaaphaannone abaaroomsi fayaa'omi lossa'n baxanichaanne.

Dolla xamicha

Ku xamichuwwi Gudukoki ka soro'l woradane yoo lossan landa bikina ihaa hurbaatinne and fayaa'omi hofeechine amaxama waaro jabbi yimimmi horiyyem gundimi bikinaa, wiccimi bikina; ka lamemmi hawi mahinne ku'i hawi iheenne xanoda'e sorobo'o issimma, Soro'i worada, Hadiyi zoonaa, Woroo'n Giri Gichoo Ethiope'e.

Ani kaba hofiqaxam amaanem kanni woroonne yoo xammichuwwa okimi kii biikina, ki'i abaroossi biikina, ki'n abroossina yoo amaaxi biikina, hurbaata etimi halaxi biikina, ki'i hurbaaxi hofe'nomi biikina, losa'ni minnene baxaakami oraachi xoxoollichi biikinaa; kinnuwwi minnene baxaakami baxi biikina, fayaa'ommi bikina, hegeqaninaa gaqi mucuuro'mii biikina mulli keeninaame xamoomo. Lassanichoone kii ullichaa, ke'matto keenomi.

Ku sorobimi haraamookkoko landane hurbaata seeraminsa itiima hogiminne, fayaa'omi hofeechine mulli keeninnem amaxama waaro jabo gaasaka'a hooriminaa, jabuwwinse fayaa'imina woradane, zoonne yoo fayaa'om eggechchi minewwi qodamonnna haaramoko.

Ki summi kinnone kitabamoyyo oddime kiininse sidammu maraja'i, mulli mani la'ona uwwinomoyyoo mahineme exoyyo. Ka soorobimmane awoonttookki ki doolinetete bagaanni

ayime gidiisenna xanoyyo oddim kina mishisubeelase xamichuwwi bedonem uteena xanitootto. Ku xamichuwwi luule’omannem 20 daqiqqa masooko.

Kaba xamoona

1 itiita

2 saaba

Balla _____ xaamichi asheramuki amane _____ beeduki amane _____

Xaamichuwwi: beedaako _____ kolli gatooko _____

maraja’a wiixa’ancho summa _____ furmaa- _____ balla _____

ijaajachi summa _____ furmaa _____ balla _____

Ayyi xamichuwwime yoolanse ka silikine horori sorrobbancho sidimma xantooto .

Lossaani landi horiyyem gundimmi bikkinaa wiccimmi bikkinaa kukim mahi mashika’inne waaruda’e soroobimmina gudaakoo xa’mmichchuwwa Sooro’o disitirkitanne, Hadiyyi zoonaa, woroo’n giiri giichchi Ethiope’e, 2019.

baxxanchi A; minaadaphphi bikkinaa abaaroosi bikkinaa xa’mmimina gudaakoo xa’mmichchuwwa		
xigo	Xa’mmichcha	Dabacha
100	Ki umuri mee’o	_____ hiinichcho
101	tidara issitaa ?	0, isumoyyo 1, isaamo
102	Atii ki’n mi’n manni hee’llakami beyyi hanno ?	0, katama 1, gaxara
103	Ki ama’nati maricho ?	1, a’mmanaancho (Protisittanta) 2, Orthodoqisa 3, Cathoolica 4, Musliima 5, mullanne _____
104	Ki giichchi te’im zari marichcho ?	1, Hadiyya 2, Kambaata 3, Guraage’e 4, Silxe’e 5, Amaara 6, mulane _____

105	Ki'n mi'ni abaroosina waameeti yoo?	0, bee'e 1, yookko
106	Ki'nuwwi mi'ni horoori gasaanchi ayye?	0, anna 1, amate 2, mullane ____
107	Ki'nuwwi mi'n manni xigi mee'o?	
108	Kiina yooki aayuwii abaayuwii mee'o ?	
109	Kiyyani mee'i afeebe'e lossaa ?	1, mahame losukoyyo 3, luxxi gaballa (5-8) losaako 2, kitaabimmaa qananaa'ima xanookko 4, la'imi gaballa (9-12) losaako 5, Diplooma(Degre'e) te'im hanaatte
110	Kiyumma mee'i afeebe'e lossa'a ?	1, mahame loso'oyyo 2, kittaabimmaa qananaa'ima xanitamo 3, luxxi gaballa (5-8) losso'ookko 4, la'imi gaballa (9-12) losso'ookk 5, Diploma(Degre'e) te'im hanaanete
111	Kiyyani baxi marichcho?	1, abuullaanchcho 2, Balli baxaancho 3, shufeecho 4, daddaraancho 5, Manigisti baxaancho 6, mullanne_____
112	Kiyyummi baxi marichcho?	1, Mi'ni baxaanchchote 3, daddaraanchchote 2, balli baxaanchchote 4,Manigisti baxaanchotte 5, mullane_____
Baxxanchi B; ki hurbaaxi haallaxi bikkina xa'mmoo xa'mmichchuwwa		
113	Ki'nuwwi mine hurbaati lophphoo amane hanii siidamoo?	0, abuulli mishiinse 1, meeri bito aa'aka'a 2, lamemi googinneme
114	Ati lophphita itoo hurbaaxi hagari hinkane ?(xalle'i mati dabacha uwwe)	1, boqolli qorisho'o 2, arasi daabo'o 3, weesi wassa 4, xaafe'i injeera 5, saratiinse siidamoo hurbaata 6, mullane _
115	Mati ballanne mee'i kore itoo?	0, 1 te'im 2 kore 1, 3 te'im 3 hanaane 2, mullane —

116	Da'lli ginjira hundi amanem lossa'n mine mateena itoo ?	0, itoomoyyo 1, itoomo
117	Ki'nuwwi miniinse biirane itoo?	0, itoomoyyo 1, itoomo

baxxanchi C; beeballi dara insii ki'lliti amanii ki'aa hii'mo'i afeebe'e 24 saatanne iti hurbaata xa'moomo itibeelase zeero xigo (0) mare'e isse ititaanina mati xigo (1) mare'e isitaa higee.

	Hurbaaxi baxxancha	Hurbaaxi kobi'llisha finto'o	0. itumoyyo 1. itaamo
118	Iibbaa malaayyee uwwoo hurbaata	Boqolliinse, arasiinse, saratinse, weesiinse te'im iibbaa malaayyee uwwoo hurbaatinse (kobi'llishina daabo'o, injeera, waasa, qorisho'o, mooqa, dinichcho, te'im mulli keeno)	
119	viitaamini A uwwoo duubi kaashshi mishshuwwa	kaaroota, sukkaa'lli dinichcho, mango'o, , paapaayaa mishshuwwi juusa,	
120	Buyya itakami duubbi kaashshi	Shaana, xaaxami shaana	
121	Maa'lli baxxanchiise	Afare, muro, wodano, sattoo te'im mulli keeno	
122	Itakami ayyi maarama	laleewika, fella'ika, gereebika antabaa'ika	
123	Duubbi kaashshuwwiinse	shinkuruuta, tuma , wokaasha mulli keenome	
124	Quunqa		
125	Orachcho goboo hurbaatuwwiinse	baaqeela, atara, otongora te'im mishira	
126	Ado	Gimma , salalo, gi'ina, buuro, ugaata	

Baxxanchi D; Faya'oomi bikina heegeeqaaninaa gaqi muccuroo'mi bikinaa xa'moo xa'mmichuwwa

xigo	xa'mmichcha	dabachcha
-------------	--------------------	------------------

127	Aggakamokaa hurbaata sarakami wo'o ki'n mine hanii siiddakamo ?	0, boombiinse 1, ootamaakoo bu'iinse	2, ootamu bee'i bu'iinse/ 3, mulaaniise
128	Ki'ni mine shu'mi mini yoo ?	0, bee'e	1, yookko
129	Ki'nuwwi lossa'n mine shu'mi mini yoo?	0, bee'e	1, yookko
130	Qoori shuma shu'mellaa lasso hundi amanem anga aansha'itoo?	0, aansha'oomoyyo	1, aansha'oommo
131	Ka agana orachi xissaa laqoo?	0, xissukoyyo	1, xissaakko Xissukoyyo hige X
132	Adiite	0, xissukoyyo	1, xissaakko
133	Kuxissookko	0, xissukoyyo	1, xissaakko
134	Iibisooko	0, xissukoyyo	1, xissaakko
135	Damunisooko	0, xissukoyyo	1, xissaakko
136	Woba'a	0, xissukoyyo	1, xissaakko
137	Orachi xissooki amane gundanne akii'mmi mine matoo ?	0, moroomoyyo,	1, maroommo
138	Orachchi Xuri waarimma asheeraa?	0, asheerukoyyo	1, asheeraakko Asheerukoyyi ihulase 148 xigo hige

139	Luxxeka mee'i umura asheerukko	_____ umura
140	Xuri waarookoki hinkidete ?	0, amane egeraa agana mataa 1, hasukisa

Baxxanchi E. hurbaaxi bikkina hurbaatine amaxxamaa waaro jabi bikina la'ima (lachcha keenimma)

xigo	Xa'mmichchuwwa	Hanqa (H) te'im qophphano (Q) yitaa doo'le	
141	Manchi beeti itookki hurbaati faya'oomina araqa awaadooko	H	Q
142	Gudaanchi hurbaata itoo bee'i manna jabbi amadeena xanooyyo	H	Q
143	Gudaanchi hurbaata itimmi jabbiinse egerookko	H	Q
144	Lobakati orachcho goboo hurbaaxi hagari arasiinse waarookko	H	Q
145	vataamini meneraalli orachchina malaayye uwitamo	H	Q
Kanni woroonne yoo dollichchuwwiinse Hanqoi dabachcha dole'e			
146	daabo'ii, boqolli, paasta'i marichchi nuutireenti baxxanchchuwwa _____ 1, caarboohydreta 2. kaalishi'eema 3. vataamini A 4. vataamini D 5. la'oomoyyo		
147	Meneraaliinse xiiqqi hofechcha (animia) hoorookokki hinkanne _____ 1, kaalishi'emma 2. Vataamini A 3. Areena(iron) 4. prootiina 5. la'oomoyyo		
148	Leella'i dashsiima te'im loome'ijabbi hooroo meneeralli te'im nutireenti hinkaane 1, caalishi'emma 2, areena 3. Vataamini B ₁ 4. ayyoodina 5. la'omoyyo		
149	Vataaminiinse manchi illina lobakata awaado hinkanne _____ 1, Vatamin C 2 vatamin A 3, vatamin D 4, vitamin K 5, la'oomoyyo		
150	Iibbaa malaayye uwwoo hurbaaxi hofechchinne amadoo jabbi hinkanne 1, beriberi 2, gooteri 3, marasimasa 4 aniimaa 5 la'oomoyyo		

Baxxanchi G, landi hurbaaxi hofechooma te'im ihiimmi qaxooma keeno xa'michchuwwa

151	higu sasi aganaanne itoo hurbaati bee'okko te'im hofe'ookko yitaa sawwiita laqqoo?	0, sawuumoyyo 1, sawaamo
152	higu sasi aganaanne hurbaaxi hofechchi mashika'inne ginjiiraa, hoshoo te'imi himmii hurbaata itoo'n higissaa laqqoo ?	0, higisuumooyyo 1, higisaamo
153	Ka sasi aganaanne hurbaaxi hofechchi mashika'ine mati balla itoo'ne hossa?	0, hosuumooyyo 1, hossaamo
154	higu sasi aganaanne hurbaaxi hoffeechi mashikaa'ine ayyi mannichimmi hurbaata te'im birra uwoonna unxiitaa?	0, unxiuumoyyo 1, ooyya

Baxxanchi H:orachchi xoxoollishsha annanni annanni minenne baxakami baxxuwwa bikkina xa'mo xa'michchuwwa

Higu saantanne ki'nuwwi minenne te'im mulli beyonne baxxi baxxuwwa balla, sa'ata daqqiqqi qaxooma kure

xiggo	Xamichuwwa	santanne mee'i balla (0 - 7)	Mati Ballanne mee'i sa'ata daqqiiqa
155	wo'o bu'iniinse te'im daajiinse eebima		
156	Gii'lli haqqa feerimaa mine iyaka'a eebima		
157	Habiillo aanshimma		
158	Hurbaata sarimma		
159	Chiilluwwa amaddimaa lellishima		
160	Kee'maalli baxo baxximma		
161	Mulleka Ayyi baxxome (K.b soorobimma)		

Miniinse lossa'n mine te'im lossa'n miniinse mine daballachina awaaxxakaami ama'n qaxooma

162	Ki'ni miniinse lossa'n mine lokkinne saantanne mee'i balla daballanito?	_____ balla (0-7)
-----	---	-------------------

163	Mati ballanne Ki'ni miniinse lossa'n mine mee'i sa'ata daballanito?	_____ sa'ata: daqiiqa
Kaba ki'ni lossa'n mine baxxakami orachi xoxollishi baxxi bikkina xa'imoomo		
164	Ki'nuwwi losa'n mine orachi xoxollishi baxxo santanne mee'i balla baxo?	_____ balla
165	Mati ballanne mee'i sa'ata'a ka'i orachchi xoxollish baxxo baxxoo?	_____ sa'ata: daqiiqa

Kanni woroonne yoo keeniinse Ki'nuwwi mine yoo luwwa yookko yihe bee luwwa bee'e yihe

166	Gattakami mini ki'nuwwanneme	0, takarayatete 1, nihaneme	
167	Elektrikkisiite'e mabiraati	0, bee'e 1, yookko	
168	electriqqii mixaadi	0, bee'e 1, yookko	
169	Soollaari	0, bee'e 1, yookko	
170	firiije	0, bee'e 1, yookko	
171	Televejiinni	0, bee'e 1, yookko	
172	Baajaaji	0, bee'e 1, yookko	
173	motori	0, bee'e 1, yookko	
174	reedo'i	0, bee'e 1, yookko	
175	Siliki/ mi'n siliki	0, bee'e 1, yookko	
176	xaraphpheezuwwi	0, bee'e 1, yookko	
177	Soofa'i	0, bee'e 1, yookko	
178	Faamella'i alligi ferashshineme	0, bee'e 1, yookko	
179	Shaama'e te'im kurraazi	0, bee'e 1, yookko	
180	Hinchoonne abuuline agoo hurbaaxi qaxoomi	0, bee'e 1, yookko	
180a	arasi	0, bee 1, yookko	_____ koontaalla
180b	xaafe'i	0, bee 1, yookko	_____ koontaalla
180c	boqolli	0, bee 1, yookko	_____ koontalla
180d	so'i	0, bee 1, yookko	_____ koontalla
180 e	baqeelli	0, bee 1, yookko	_____ koontalla
180 f	Sarati	0, bee 1, yookko	_____ koontalla
180g	Atari	0, bee 1, yookko	_____ koontalla

181	Ki'nuwwi minina abuullitakami uulli hee'aa	0, bee'e	1,yookko	
181 a	Mee'i hectaara te'im xindda abullitakami te'imi kolliina baxxakami ulli ihoo?	_____ hectara te'im	_____ xindaa	
182	Ki'nuwwina dinnatti yoo ?	0, bee	1,yookko	Bee hige 183
182a	Axxi lari, balluwwi labeenuwi te'im aduwwi hundime mati ihaa mei'o ihoo?	_____ ihooko		
182b	Baqulli, halli te'im faraadi hunidime mati ihaa mee'o ihoo ?	_____ ihooko		
182c	Fella'i te'im geeraba mati mee'o ihoo ?	_____ ihooko		
182d	anitaaba'i xigi mee'o ihoo ?	_____ ihooko		

Ki keemato ullichcha kab keenoommo

	kenaancho	Luxii kenaato	la'm kenaatoo	Lamemi kenatomi lamina baxxansama
183	Keemato killo kiraamanne (kg)			
184	Ullichii centimetriiranne(cm)			

Galaxinoomo!!

Declaration

I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or any other university and that sources of materials used for the thesis have been fully acknowledged

Name: _____

Signature: _____

Name of the institution: _____

Date of submission: _____

This thesis has been submitted for examination with my approval as University advisors:

Name and signature of the first advisor

Name and signature of the second advisor
