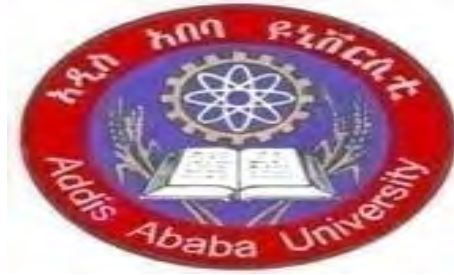


**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH**



Are Adolescents of Damot Gale district getting adequate amount of macro and micro nutrients from their diet?

Thesis submitted to the school of graduate studies, Addis Ababa University in Partial Fulfilment of the requirement for the degree of masters of public health in public health nutrition

By Beza Yilma

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**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

Are Adolescents of Damot Gale district getting adequate amount of macro and micro nutrients from their diet?

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Acronyms

BMI	Body Mass Index
DRI	Dietary Reference Intake
EAR	Estimated Average Requirement
EDHS	Ethiopian Demographic and Health Survey
EPHI	Ethiopian Public Health Institute
FAO	Food And Agriculture Organization
Kcal	Kilo Calorie
NNP	National Nutrition Programme
RDA	Recommended Dietary Allowance
RNI	Recommended Nutrient Intake
SNNP	Southern Nation, Nationalities and People
USDA	United States Department of Agriculture
WHO	world Health Organization

Abstract

Background: - Adolescence is a nutritionally vulnerable period of life because of the dramatic changes in physical growth and development and the change of life style and food habits that affect both nutrient intake and needs. Inadequate quality and quantity of food are the prime determinants of nutrition. However studies are limited regarding adolescent nutrition and there is very little information on the adequacy of dietary intake among adolescents.

Objective: - To estimate the level of macro and micro nutrient intake and to evaluate prevalence of inadequacy among adolescent girls 10-19 years.

Method; - A community based cross-sectional study was conducted in Damot Gale district, Woliya zone, SNNP Region. Data were collected from 288 female adolescents after random selection from six kebeles. Face to face interview was conducted using Repeated multiple pass 24-hour dietary recall method. Data on all foods and drinks consumed by the adolescents in the previous 24 hours before interview was obtained. All data collectors were equipped with dietary weighing scale, calibrated locally used utensils and salted replica of staple foods for portion size estimation. Nutrient content of foods was calculated using software package Nutrisurvey. Adequacy of nutrient intake was analysed using IMAPP (Intake Modelling, Assessment and Planning Program) and STATA 14 software. Prevalence of inadequate intake was estimated using estimated average requirement cut point method. For the intake of iron, the probability approach was used as the EAR approach was not appropriate for menstruating girls.

Result: - The study found that Cereals, roots/tubers were consumed by 96.9% and 75.3% of the adolescents. However, only less than one percent of them consumed flesh food. The mean energy, carbohydrate, protein intake of the adolescent girls per day was 1452.7 (SD 356.3) kcal, 305.6 (SD 72.4) grams, and 35.7 (SD 13.3) grams respectively. Median intake of fat was 15(IQR 8.8, 19.8) grams. The prevalence of inadequate intake of protein was 60.9%. The prevalence of inadequate intake was greater than 90% for vitamin B12, vitamin C and calcium. The prevalence of inadequate intake for folate and zinc was 83.9%, 58% respectively. The prevalence of inadequate intake of iron for early adolescents (10-14 years) and late adolescents (15-19 years) was 82% and 53% respectively.

Conclusion: - The result indicated a high prevalence of inadequate intake of nearly all nutrients among adolescent girls of Damot gale district.

Recommendation: - Interventions are needed to improve the intake of both macro and micro nutrients of the adolescent girls.

Table of content

Contents

Acknowledgement.....	III
Acronyms.....	IV
Table of content.....	VII
1, Introduction.....	1
1.2 Background.....	1
1.2 Problem statement.....	2
1.3 Significance of the study.....	3
2 Literature review.....	4
2.1 Adolescent nutrition.....	4
2.2 Energy and Macro Nutrients.....	4
2.3 Micro nutrients.....	6
2.3.1 Vitamins.....	7
2.3.2 Minerals.....	9
Dietary intake and inadequacy of Calcium.....	9
3 Objectives.....	12
3.1 General objective.....	12
3.2 Specific objectives.....	12
4 Method.....	13
4.1 Study area and study period.....	13
4.2 Study Design.....	14
4.3 Source population.....	14
4.4 Study population.....	14
4.5 Sample size.....	14
4.6 Sampling procedure.....	15
4.7 Data collection tools and procedures.....	17
4.7.2 Data collection procedures.....	17
4.7.2.1 Preparation for data collection and Calibration of equipments.....	17
4.7.2.2 Recruiting data collector.....	18
4.7.2.3 Data collection.....	18
4.8 Data quality management.....	19

4.9 Data Analysis procedures	20
4.9.1 Compilation of food composition table	20
4.9.2 Calculating nutrient content of food	20
4.9.3 Identifying usual nutrient intake and prevalence of inadequate nutrient intake	21
4.10 Ethical consideration.....	22
5, Result	23
5.1 Socio demographic characteristics	23
5.2 Foods and drinks consumed.....	25
5.3 Nutrient intake of adolescent girls	26
5.4 Prevalence of inadequate intake of nutrients among female adolescents	27
Recommendation.....	32
References	33
Annex I	36
Annex II:.....	37
Annex III.....	39
Annex IV:	40
Annex V socio-demographic questionnaire.....	41
Annex IV Dietary assessment questionnaire.....	48
Annex VI- Recipe of foods consumed by adolescent girls of Damot Gale district	53

List of tables and figures

Table 1 Socio-demographic characteristics	23
Table2 Nutrient intake of adolescents	26
Table 3 Means, standard deviations, refe	27
Figure 1- Sampling procedure	16
Figure 2: Proportion of food group consumed by adolescent girls of Damot gale district, SNNP, 2017.....	25

1, Introduction

1.2 Background

There are 1.2 billion adolescents in developing nations, making up one fifth to one quarter of their country's populations. The relatively uniform growth of childhood is suddenly altered by an increase in the velocity of growth which is associated with hormonal, cognitive and emotional changes. It's a period where they attain approximately 15% of their final adult Height, about 45% of the maximal skeletal mass and 50% of the ideal adult weight (1).

The phenomenal growth that occurs in adolescence, second only to that in the first year of life, creates increased demands for energy and nutrients. Total nutrient needs are higher during adolescence. It is an especially nutritionally vulnerable period of life because of the dramatic changes in Physical growth and development and also the change of life style and food habits that affect both nutrient intake and needs.

For many adolescents, inadequate quality and quantity of food are the prime determinants of nutrition problems. These conditions may be due to household food insecurity, intrahousehold allocation of food that does not meet their full range of dietary needs, livelihoods insecurity, and lack of nutrition knowledge.

Micronutrient malnutrition and chronic energy deficiency resulting in low Body Mass Index or BMI) and stunting results mostly from poor diet. Excessive physical activity patterns(e.g., heavy workloads and walking long distances) and infection may also contribute to under nutrition(2).

Adolescents at the peak of their growth velocity required large quantities of nutrients. They require twice the amount of calcium, iron, zinc, magnesium and nitrogen in their bodies during the years of growth spurt as compared to that of other years. Nutrition influences growth and development throughout infancy, childhood, and adolescence (3).

Several facets of eating behaviour are different or more pronounced in adolescents than at other ages and can cause concern in the older members of their family such as missing meals, especially breakfast, distinctive likes and dislikes for foods, high consumption of soft drinks and the start of alcohol consumption (4).

1.2 Problem statement

Ethiopia has been showing improvement in combating malnutrition over the past years. Levels of nutritional indices (stunting, wasting and underweight) and micronutrient deficiencies are showing an improving trend. The Ethiopian government has developed the national nutritional program (NNP) and set target to prevent and control malnutrition. One of the strategic objectives of this program is to improve the nutritional states of women (15-49 years) and adolescents (10-19 Years) (5).

Nutritional problems of adolescents, whether under nutrition or nutrition-related chronic diseases, are mainly the result of dietary inadequacies. According to the national food consumption report monotonous diet was common and substantial difference in macronutrient intakes were observed across the nation (6).

Nutritional requirements increase during the adolescent period which makes them vulnerable to nutritional problems. Studies conducted in developing countries and in some parts of Ethiopia showed that Stunting, thinness and anaemia among adolescents are major problems of public health significance (7-9).

According to the 2011 EDHS, The median age for marriage is around 16.5 and 12% of adolescents 15-19 years of age are either are mothers or pregnant with their first child (10). Malnutrition in pregnant adolescents leads to an intergenerational cycle of nutritional problems which may lead to stillbirths, low birth weight, growth failure, increased risk of maternal and neonatal mortality, impaired cognitive development, and suboptimal productivity in adults and decreased economic growth for the nation. To prevent these problems, the cycle must be broken by ensuring that adolescent girls are nutritionally fit before they become mothers.

Studies are limited regarding adolescent nutrition and there is very little information about dietary and nutritional status of adolescents in our country. This study will provide information on the dietary intake of adolescents and will determine the prevalence of inadequate intake of macro and micro nutrients.

1.3 Significance of the study

Data on dietary intake are essential for guiding health and nutritional interventions. Since adolescence is a transition phase to adulthood, understanding dietary intake during this period could aid the mapping of dietary interventions for primary prevention. This study will provide information on the dietary intake of adolescent girls which was included in the Ethiopian national food consumption survey conducted on 2013.

2 Literature review

2.1 Adolescent nutrition

WHO defines Adolescents as persons 10- 19 years of age. Nutrient needs for this age group increase sharply with the greatest nutrient demands occurring during the peak velocity of growth. At the peak of the adolescent growth spurt, the nutritional requirements may be twice as high as those of the remaining period of adolescence (11).

Nutrition and physical growth are integrally related; optimal nutrition is essential for achieving full growth potential. Failure to consume an adequate diet at this time can result in delayed sexual maturation and can arrest or slow linear growth (12). Nutrition is also important during this time to help prevent adult diet-related chronic diseases, such as cardiovascular disease, cancer, and osteoporosis.

2.2 Energy and Macro Nutrients

Energy needs of adolescents are influenced by activity level, basal metabolic rate, and increased requirements to support pubertal growth and development. Basal metabolic rate is closely associated with the amount of lean body mass. Adolescent males have higher caloric requirements since they experience greater increases in height, weight, and lean body mass than females. Due to the wide variability in the timing of growth and maturation among adolescents, the calculation of energy needs based on height will provide a better estimate than total daily caloric recommendation (13).

According to a systematic review done in 2014, the intake of energy was found out to be inadequate for the majority of schoolchildren and adolescents in developing countries and it was found out that the total energy consumed during the day was not well distributed among the meals. Breakfast contributed the least proportion of the day's energy because most of the children and adolescents went to school without eating breakfast. Lunch and the evening meal contributed the largest proportion of the day's total energy requirement (14).The evening meal provided 67.5% of the mean intake of kcal per day among adolescents in congo (15).

The sources of energy in middle and low income countries especially for those from poorer households were limited to a monotonous intake of a few staples, adolescents consumed

barely adequate or less than adequate (16-19). Were as in some countries the mean intakes of energy for adolescents were close to the RDA (15,20, 21).

Carbohydrate is the body's primary source of dietary energy. Carbohydrate-rich foods, such as fruit, vegetables, whole grains, and legumes are also the main source of dietary fiber. Dietary recommendations suggest that 50% or more of total daily calories should come from carbohydrate, with no more than 10-25% of calories derived from sweeteners. In the US, Foods that contribute the most carbohydrate to the diets of adolescents include yeast bread, soft drinks, ready-to-eat cereal, and foods such as cakes, cookies, quick breads, donuts, sugars, syrups, and jams (22). In our country, the highest proportion of foods consumed by women and men come from the cereals and grain group. Roots and tubers ('enset', potato, sweet potato and cassava) contribute higher proportion of foods consumed in SNNP than in other regions which are sources of carbohydrate and fiber and it was reported that carbohydrate contributes 67.2%, 73.5 %, and 68.1% of the total energy intake in children, women and men respectively (23).

Fat is a rich source of energy that is the second contributor to human's diet next to carbohydrate. The human body requires dietary fat and essential fatty acids for normal growth and development it also serves as an important vehicle for fat solvent vitamins. The intake of fats depends on the foods most commonly consumed. The consumption of fats was high or low depending on whether intake of animal products was frequent or not (24).

Some studies revealed a higher intake of fats than recommended, especially for those children and adolescents from middle- and high-income settings, particularly from urban (21, 22, 25). Whereas adolescents consumed less fat than the recommended amounts in low and middle income countries (21, 26-28)

In Ethiopia, Fat contributes 23%, 16.5%, and 20.7% of total energy intake in children, women and men, respectively and total fat intake as a percentage of total energy intakes among children was less than 20% in Tigray (16.2%), Amahara (15.5%), SNNP (18%) and Benshangul Gumuz (18%) regions.

Protein needs of adolescents is influenced by the amount of protein required for maintenance of existing lean body mass and accumulation of additional lean body mass during the adolescent growth spurt. Protein requirements per unit of height are highest for females in the 11 to 14 year age range and for males in the 15 to 18 year age range corresponding to the

usual timing of peak height velocity. When protein intakes are consistently inadequate, reductions in linear growth, delays in sexual maturation and reduced accumulation of lean body mass may be seen.

Adolescents in most Developed countries consume more than adequate amounts of protein. US teens consume about twice the recommended level of protein and 31% of adolescent boys 14-18 years of age consume more than twice the RDA for protein (29). Adolescents who may be at risk for marginal or low protein intakes include those from food-insecure households, those who severely restrict calories, and vegans. Less animal protein were consumed in developing countries probably because of cost (26, 28). Average protein intake in the age group 10-12 years and 18-19 among Indian adolescents was 30.57+ 8.25 and 38.38+9.33 gm/day, respectively. These values were 75.67% and 72.63% of the respective RDA values. Protein intake as percentage of RDA was 61.91% in the age group 13-15 years and 51.56 %in the age group 16-17 years (26).

There was very little variation across regions of Ethiopia in the percent of calories contributed by protein. Nationally, Protein contributes 10.5%, 9.7% and 10.4% of total energy intakes in children, women and men, respectively (23).

2.3 Micro nutrients

Vitamins and minerals are essential for sustaining the functions of body and also contribute to energy production.

Micronutrient malnutrition ‘hidden hunger’ is a global problem. It is caused mainly due to inadequate food intake, poor dietary quality, poor bioavailability (because of the presence of inhibitors, mode of preparation, and interactions), and/or the presence of infections (30). Poor diet is a common source of hidden hunger. Diets based mostly on staple crops, such as maize, wheat, rice, and cassava, which provide a large share of energy but relatively low amounts of essential vitamins and minerals, frequently result in hidden hunger.

Micronutrient intake among adolescents in developing countries is generally suboptimal (14). Although pregnant women, children, and adolescents are often cited as populations affected the most by hidden hunger, it impairs the health of people throughout the life cycle.

2.3.1 Vitamins

Dietary intake and inadequacy of Folate and vitamin B12

Folate and vitamin B12 deficiencies have long been known to have adverse effects on health, including anemia and neuropathy. Folate, a water-soluble B vitamin that is naturally found in foods such as leafy vegetables, legumes, egg yolks, liver and some citrus fruits plays an integral role in DNA, RNA and protein synthesis but the bioavailability of naturally occurring folate is less than that of folic acid, a synthetic compound that is used in supplements and in fortified foods. Evidence of inadequate folate intake by large segments of the world's population is becoming more apparent. It is caused by inadequate food intake and preparation, alcoholism, and malabsorption syndromes. folate intakes are suboptimal in the diets of many women of childbearing age, and folate intake is further limited by cooking losses and poor bioavailability estimated to be from 50% to 82% (31).

Folate deficiency exacerbates the anaemic state as it can lead to both megaloblastic and folate deficiency anaemia. Folate deficiency, if not addressed during the pre or periconceptual period, may cause irreversible fetal damage. Addressing folate deficiency beyond the middle of the first trimester of pregnancy will not correct neural tube defects that occur in the early weeks of pregnancy.

Since many adolescent pregnancies are unplanned preventing this deficiency is very important. Inadequate intake of folate is seen among adolescents in both developed and developing countries (22,32,33). Folate deficiency is widespread in Ethiopia, 46% of women of reproductive age in nine administrative regions of Ethiopia were found to have severe folate deficiency (≤ 4 ng/ml) and was related to diet which is generally poor and is likely deficient in several nutrients that interface with folate metabolism (34).

Vitamin B12 is a water soluble vitamin that is responsible for normal red blood cell formation and also maintains normal folate metabolism which is essential for cell multiplication especially during pregnancy. Since there is great tissue synthesis during the adolescent period, there is an increase requirement for vitamin B12 (35).

Vitamin B12 deficiency could occur because of vegetarianism that may be due to cultural factors or the inaccessibility of animal products or vitamin B12 malabsorption. Vitamin B12 deficiency can result in altered nucleic acid metabolism which will result in impaired cell

duplication and anaemia and also neurologic damage (demyelination) that could result in sub acute spinal cord degeneration and memory (36).

Subclinical vitamin B12 deficiency has been described in some rural populations of developing countries and has been associated with neurologic symptoms in vegans. 66.4% of high school girls of west Iran had dietary intake of vitamin b12 less than 75% of the RDA(18). In urban Cameroon, the percentage of adolescents with vitamin B12 intake below the estimated average requirement was found to be 83.9% which might be because of the low consumption of animal foods.

Inadequate intake of Vitamin C

Vitamin C is an essential nutrient that can be acquired by eating vegetables and fruits. It is needed to form collagen, the most abundant protein in the human body, which makes tendons, ligaments, skin, bone, muscle, cartilage, blood vessels, and scar tissue. Vitamin C is not only extremely important for growth and repair of body tissues, but also for healing wounds and maintaining healthy teeth and gums it also enhance the absorption of iron from the diet. Vitamin C promotes absorption of soluble non-haem iron possibly by maintaining the iron in the reduced (ferrous, Fe²⁺) form. The effect can be achieved with the amounts of vitamin C obtained in foods. However, the amount of dietary vitamin C required to increase iron absorption ranges from 25 mg upwards and depends largely on the amount of inhibitors such as phytates and polyphenonls present in the meal.

In many developing countries, shortages in the supply of vitamin C are often determined by seasonal factors (i.e., the availability of water, time, and labour for the management of household gardens and the short harvesting season of many fruits). mean monthly ascorbate intakes ranged from 0 to 115 mg/day in one Gambian community in which peak intakes coincided with the harvesting seasons of local fruits .Forty four percent of Pakistani high school students did not meet the estimated average requirements for vitamin C (37). This is also true in Brazil, among the micronutrient assessed the highest prevalence of inadequate intake was observed for vitamin c (38). In some countries with high availability of fruites almost all year around intake of vitamin C were observed to be high Dietary intake of vitamin C in west Uganda were above the recommended amount this may be because of the high consumption of Plant-based foods such as mangoes, beans and leafy vegetables (19).

2.3.2 Minerals

Dietary intake and inadequacy of Calcium

Calcium needs during adolescence are greater than they are in either childhood or adulthood because of the dramatic increase in skeletal growth. Because about 45% of peak bone mass is attained during adolescence, adequate calcium intake is important for the development of dense bone mass and the reduction of the lifetime risk of fractures and osteoporosis (30).

By age 17, adolescents have attained approximately 90% of their adult bone mass. Thus, adolescence represents a “window of opportunity” for optimal bone development and future health. The DRI for calcium for 9 to 18 year olds is 1300 mg/day. Only 19% or about 2 out of 10 adolescent girls in the US meet their calcium recommendations (22).

The intake of calcium among adolescents in both developed and developing countries is also generally suboptimal. In a Malaysian cohort study among 13 year olds showed that calcium and vitamin D were consumed the least (< 50% of the RNI), for both males and females (39). Adolescents had inadequate intake of calcium 71% in Iran (40). Intake of calcium were found to be significantly far below the RDA among adolescent girls of India (41) and also In Uganda, the average intake of calcium was only 56% of the RDA (19).

Inadequate intake of Iron

Iron is vital for transporting oxygen in the bloodstream and for preventing anaemia. For both male and female adolescents, the need for iron increases with rapid growth and the expansion of blood volume and muscle mass. The onset of menstruation imposes additional iron needs for girls. Iron needs are highest during the adolescent growth spurt in males and after menarche in females.

According to WHO it is estimated that between 10 and 15% of dietary iron is bio available, but variation within this range will depend on relative proportions within the diet of meat, phytate and other factors affecting nonhaem iron absorption.

The availability of dietary iron for absorption and utilization by the body varies by its form. Heme iron, which is found in meat, fish, and poultry, is highly bio available while nonheme

iron, found mainly in grains, is much less available. More than 80% of the iron consumed is in the form of nonheme iron. Bioavailability of nonheme iron can be enhanced by consuming it with heme sources of iron or vitamin C.

Nonheme iron interacts with dietary constituents such as polyphenols, phytates that are found in tea and coffee, dietary fibre and other inorganic elements making it less soluble and hence less available than heme iron. Because the absorption of iron from plant foods is low, vegetarians need to consume twice as much iron to meet their daily requirement (42).

Iron deficiency anaemia will result when whenever diets are low in iron-rich foods especially during periods of rapid growth, bleeding and ill health. Different studies reflect inadequate nutritional iron intake generalized malnutrition or low iron bioavailability of the diet are among the causes of anaemia in adolescents. 26.5% of Kenyan adolescent girls were anemic and it was found out that the respondents who had inadequate daily dietary iron intake were 10 times more likely to develop anaemia compared to the respondents who had adequate daily iron intake (9).

The nutritional anaemia in adolescent girls attributes to the high maternal mortality rate, the high incidence of low birth weight babies and high prenatal mortality. This phase of life is also important because the control of anaemia in pregnant women can be more easily achieved if a satisfactory iron status can be ensured during adolescence (43). A study carried out in the State of Sabah, Eastern Malaysia, reported that calcium and iron intakes for adolescents aged 15 years was lowest compared to other nutrients, at 33.4% and 47.2% of the Malaysian RNI respectively (39).

In Ethiopia, taking into consideration the bioavailability of the dietary iron intakes at 5% the prevalence of inadequate intakes was calculated to be approximately 13% in women of childbearing age at the national level (6). The EDHS 2011 also indicated that 17% of Ethiopian women age 15-49 are anemic and it is considered to be mild. However, women in the Somali, Afar and Dire Dawa regions have a relatively high prevalence of anemia (44%, 35% and 29% respectively) which showed that anemia prevalence varies by regions. A recent unpublished study conducted in 3 districts across Ethiopia also found out that the prevalence of anemia was 29.2% among adolescent girls. It was also indicated that the prevalence of anaemia significantly varies by the level of household's food security and dietary diversity,

Prevalence of anemia among adolescents living in a household with lower dietary diversity (31.3%) was higher than those living in a household with higher dietary diversity (23.9%).

Dietary intake and inadequacy of Zinc

Zinc is associated with more than 100 specific enzymes and is vital for protein formation and gene expression. Zinc is important in adolescence because of its role in growth and sexual maturation. It is known that serum zinc levels decline in response to the rapid growth and hormonal changes that occur during adolescence. Serum zinc levels indicative of mild zinc deficiency ($<10.71 \mu\text{mol/L}$) have been found in 18% to 33% of female adolescents (44). Zinc deficiency in humans is now known to be an important malnutrition problem world-wide. It is more prevalent in areas of high cereal and low animal food consumption. The diet may not necessarily be low in zinc, but its bioavailability plays a major role in its absorption. Phytic acid is the main known inhibitor of zinc.

Zinc deficiency during growth periods results in growth failure. The physiological requirements for zinc peak during adolescence at the time of the pubertal growth spurt, which generally occurs in girls between 10 years and 15 years and in boys between 12 years and 15 years. Even after the growth spurt has ceased, adolescents may require additional zinc to replenish depleted tissue zinc pools (45).

According to the national food consumption survey of Ethiopia, The nationally weighted median intake of zinc in women of childbearing age was 7.2 mg/day (IQR: 4, 12 mg), with minimal differences across urban and rural populations. Zinc bioavailability in the diet was assumed to be low as a result of an estimated phytate to zinc molar ratio of 27 in the population of women of childbearing age, of these women, 50% were found to have an inadequate intake of zinc and in urban areas the prevalence of inadequate intakes was found out to be slightly higher (65%) (23). In Brazil, Pakistan and Iran inadequate intake of zinc was found to be 44%, 44% and 95% respectively (18,37,38).

3 Objectives

3.1 General objective

- To Estimate the prevalence of inadequate intake of macro and micro nutrient among adolescents 10-19 years of Damot Gale district.

3.2 Specific objectives

- To determine the mean energy intake of adolescents 10-19 years in Damot Gale district.
- To estimate the prevalence of inadequate intake of macro nutrients such as carbohydrate, protein and fat.
- To determine the prevalence of inadequate intake of micronutrients such as iron, calcium, zinc, folat, vitamin b12 and vitamin C.

4 Method

4.1 Study area and study period

The study was conducted in Damot Gale district from March 2017 to April 2017 which is one of the districts found in Wolayita Zone, Southern Nations, Nationalities, and Peoples' Region of Ethiopia. Damot Gale is bordered on the southwest by Sodo Zuria, on the northwest by Boloso Sore and Damot Pulasa, on the north by the Hadiya Zone, on the east by Diguna Fango, and on the southeast by Damot Weyde. The administrative centre of Damot Gale is Boditi.

Based on the 2007 Census conducted by the CSA, this district has a total population of 151,079, of whom 74,227 are men and 76,852 women adolescent girls aged 10-19 years accounts 19,529. 15.97% of its population are urban dwellers. The majority of the inhabitants were Protestants, with 69.15% of the population reporting that belief, 17.71% practiced Ethiopian Orthodox Christianity, 11.11% were Catholic, and 1.38% were Muslim.

Damot Gale district has 34 kebeles (28 highlands, 3 semi-urbans and 3 lowlands). The major economic activities are agriculture (production of legumes, root crops and some cereals – predominantly maize), and livestock rearing. Maize, enset, and root crops are majorly consumed. The average temperature ranges from 15.1 to 31 degree centigrade. This district has a history of a hail storm that destroyed not only an estimated 625 hectares of crop land but the roofs of 266 houses. The number of households affected was 1,956. Food security is fragile in this area due to a high population density with a higher than average family size, small land holdings per household, and heavy reliance on rain. 'Belg' crops in the high- and middle lands account for approximately 70% of annual production. The main crops normally produced are cereals, mainly maize, inter-cropped with haricot beans and, to a much lesser extent, sorghum, barley and teff. In the highlands, 'Belg' rains normally start in January/February after which farmers plant maize to harvest green in June/July. Thereafter the land is used to plant again profiting from the 'kremt' rains that will allow ('meher') harvesting of teff, pulses, wheat and barley in October/November. In lowland areas, the 'Belg' rains usual arrive by the end of March/ April. The timing is less crucial because the rains are used to start long maturing, but higher yielding varieties of maize to be harvested around October. Short intermediate rains (locally known as sapia rains) in the period October-December are important for clearing the land and the production of root crops, in

particular sweet and Irish potato, and cassava. These root crops play an important role in filling the gap in household cereal production during the lean season. Ensete or false banana, available throughout the year, is consumed during the lean season and to compliment low harvests from the ‘belg’ and ‘kremt’ rains

4.2 Study Design

A community based cross-sectional study design was conducted among adolescent girls (10-19 years) of Damot Gale district.

4.3 Source population

Adolescent girls 10-19 years old who are resident of Damot Gale district.

4.4 Study population

Adolescent girls 10-19 years old who are resident of the 6 selected kebeles.

4.5 Sample size

Using a single population proportion formula,

$$n_0 = \frac{Z^2 \cdot P \cdot (1-P)}{d^2}$$

Where,

n= the desired sample size

p= Prevalence of inadequate intake for protein which is 80.2% and the prevalence of inadequate intake for iron which is 86.7% taken from a study done India(46).

Z= is the standard normal score set at 1.96 (95% confidence interval)

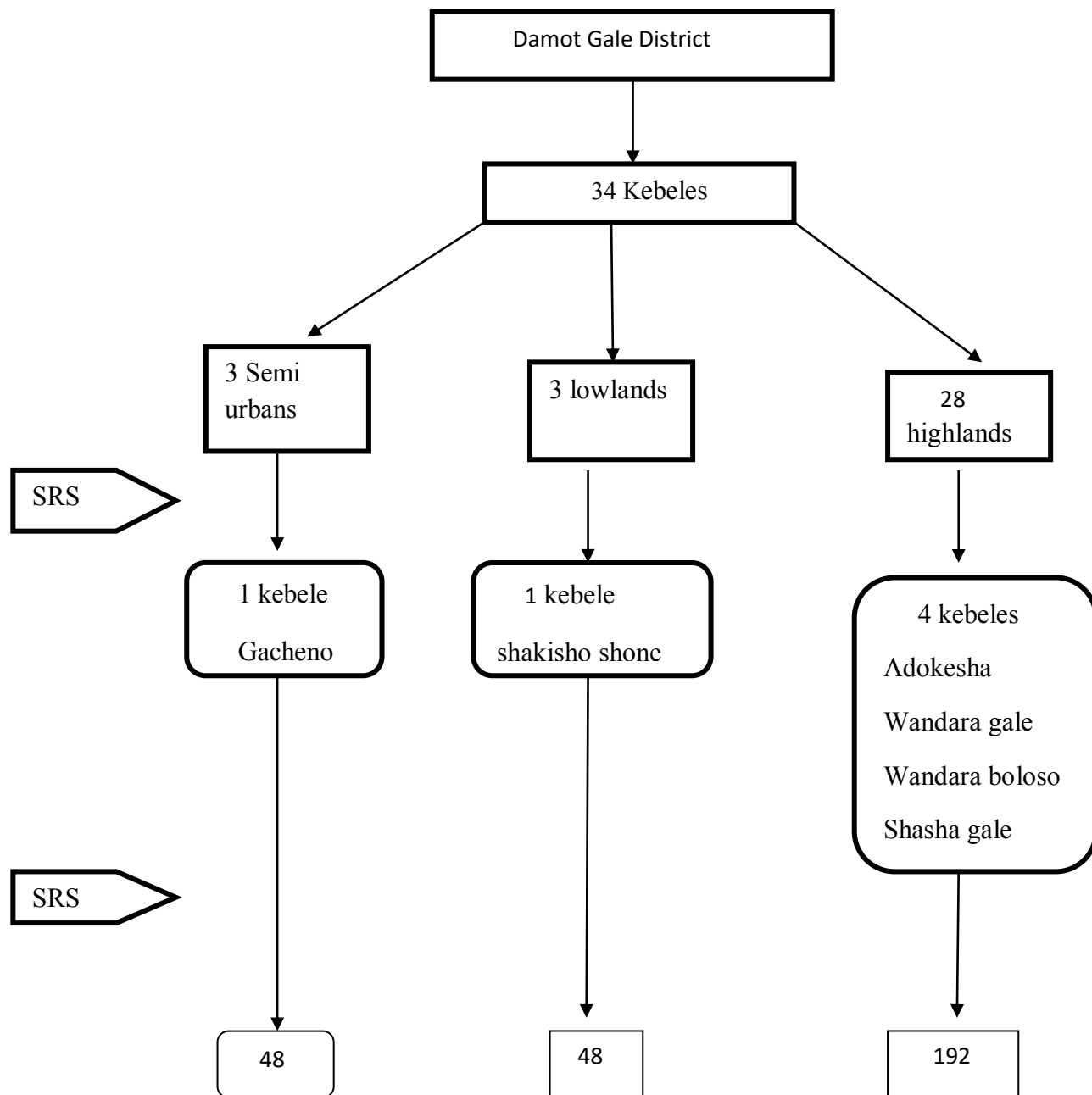
d= is the margin of error to be tolerated (5%)

Prevalence of inadequate intake for protein (India) P=80.2%	$n = \frac{(Z\alpha/2)^2 p (1-p)}{d^2}$ = 246
Prevalence of inadequate intake for iron (India) P=86.7%	$n = \frac{(Z\alpha/2)^2 p (1-p)}{d^2}$ =174

The larger sample size (246) was taken and considering 10% none response rate the final sample size will be **271**

4.6 Sampling procedure

Figure-1 shows the sampling procedure. Damot Gale district have 34 kebeles of which 3 are urban, 3 lowland and 28 highlands. Multi stage sampling technique was employed to identify study participant. From this kebeles one urban, one low land and four highland kebeles were selected randomly. The study participants were selected by using simple random sampling method from the selected kebeles. List of households that have adolescents were obtained from the health posts through the help of health extension workers.



SAS- Simple Random Sampling

Figure 1- Sampling procedure

4.7 Data collection tools and procedures

4.7.1 Data collection

Socio demographic status

Socio-demographic characteristics of the adolescents and their parents such as educational status, school enrolment, marital status, religion also household characteristics such as ownership of land, type of house and construction materials, availability of radio, television, phone, bed, and access to sanitation facility and source of water was assessed by face to face interview using a pretested questionnaire that was adopted from Ethiopian Demographic and Health Survey.

Assessments of dietary intake

An interactive, multiple-pass 24hr dietary recall questionnaire adapted and validated for use in developing countries by Rosalind S. Gibson, Elaine L. Ferguson (47) was used to collect data on dietary intake. It was translated in to the local language. This tool is a rapid, non-invasive dietary tool, with a low respondent burden and the ability to quantify daily intakes of nutrients. It is suitable for rural populations in developing countries.

4.7.2 Data collection procedures

4.7.2.1 Preparation for data collection and Calibration of equipments

Four days before interview the principal investigator visited six households to collect data on common foods eaten, ingredients and cooking method. Pictures of equipments such as bowls, spoons and cups commonly used to serve foods from the households of the study area was taken and similar equipments were purchased from the local market these were done to improve the estimation of the amount of foods or beverages actually consumed during data collection. The purchased utensils were calibrated by standard measuring cup and water by using a digital dietary scale obtained from Ethiopian public health institute. Drinking cups glasses, spoons and ladles were labelled in to three categories based on their size (large, medium and small).

More over lists of foods commonly consumed in the study area during the study period was prepared. This was done as a check list on the staple foods actually consumed. The list was read for the participant after completing dietary recall to help her recall any food that she

forgot to list. It was used as comparison with the recall to reduce memory lapses and also to describe ingredients of listed food during data collection (Annex VI).

4.7.2.2 Recruiting data collector

Six Female data collectors (since they are more familiar with food preparation and recipes than males) with previous experience were recruited. In addition we had two supervisors. Four days training was given. The training was mainly role play and on the third day demonstration on how to use the dietary weighing scale to measure foods was done after purchasing and cooking locally consumed food in the area.

Pre-test in a nearby village was done before the actual data collection to check for utensils used there. We checked whether the respondents recognize the list of staple foods and also if they were willing and able to answer the questions in the way they are asked we also checked if the questions address sensitive issues appropriately and if the respondents have the same understanding of the questions that the interviewers and researchers have. After the pre-test we added a drinking cup which was different from the size we had.

4.7.2.3 Data collection

Data collection was conducted by face to face interview with mothers or house hold members that were responsible for cooking and the adolescents themselves in their own house. Repeated interactive 24hr dietary recall was conducted using the multiple-pass technique which include,

1, **First pass**- quick list of all foods, drinks, snacks consumed from midnight of one day until midnight the following day.

2, **Second pass**- detailed and more specific descriptions of all the foods and drinks consumed, including cooking methods and brand names (where possible). The interviewer also asked if the respondent has remembered any additional items that were consumed but which were forgotten in the first pass.

3, Third pass- Estimating portion sizes

In order to accurately estimate the portion size of foods and drinks consumed , Calibrated locally available labelled cup, bowl, spoon, serving spoons, food weighing scale, salted replica of ‘*bekolo kita*’ (unleavened maize bread) which was commonly consumed food in the area at the time of the study were given for all interviewers . Moreover, the data collectors carried different sizes of locally consumed fruits and vegetables such as bananas, avocado, shallot, tomato, potato, yum to facilitate the recall.

Each participant was asked to put the amount of food that is equivalent to the actually eaten if actual food is available in the house or the salted replica on food weighing scale. If actual food is not available in the house they were asked to borrow from neighbours. Most of dietary intake was weighted at the house hold of the respondent and for shared foods the respondents were asked to estimate the portion they ate by using the equipments or salted replicas handled by the data collectors. For purchased foods, the price, brand name, name of food, and weight or size on the label was recorded together with the number of items consumed. The respondents were also asked if there was a left over and if so it was estimated.

4. **Pass four;** - The interviewer reviewed the recall to ensure that all the items have been recorded correctly. Every respondent were probed for snacks, drinks and outdoor consumption of any kind of food after they complete recall.

The interviews were conducted on all seven days of the week to capture changes in intakes across various days of the week. The dietary recall was repeated in randomly selected 20% of the households by different interviewer and in a different non consecutive day than the first. The recall was repeated to adjust for the day to day variation of nutrient intakes of the study participants. All recall days were arranged on non special occasion days like holidays or feasts.

4.8 Data quality management

Data collectors were trained on data collection procedure and tools for four days to be familiar with it and, the principal investigator and filled supervisors checked for completeness and consistency of the questionnaire immediately after interview. Pre-test was conducted on 14 adolescents who are comparable to actual study participants in one non sampled kebele.

4.9 Data Analysis procedures

The socio-demographic characteristics of adolescents and mothers was entered to epi data version 3.1 and exported to STATA 14. The data was sorted, tabulated, summarized and cleaned on STATA 14 and data analysis was carried out using this software. The normality of continuous variables was assessed by evaluating histograms, with normally distributed data presented as mean (SD) and skewed data presented as median (interquartile range (IQR; 25th to 75th).

4.9.1 Compilation of food composition table

To calculate nutrient values of foods, a combination of four food composition table was used. Ethiopian food composition table was the main data source used to obtain energy and nutrient concentrations per food. Some foods consumed by the adolescents and values of folate and vitamin b12 were missing. Information on the missing foods was taken from and the USDA, West African and Tanzanian food composition tables. The nutritive values of a drink made of coffee leaves was missing so substitution of data that means estimation from similar foods in this case nutritive value of brewed coffee (bean) was done and nutritive values of mixed dishes (*injera firfir*) were calculated from recipes. To obtain gram and nutrient values of purchased food market surveillance were made in the study area after completing data collection and their nutrient labelling was used to analyze their nutrient composition.

4.9.2 Calculating nutrient content of food

The compiled food composition table was entered to software package, nutri survey to create dietary data base. Then the dietary data was entered to this software to calculate nutrient composition of the food. The data was analyzed and converted to amount of nutrient and energy intake per individual per day.

Absorption of some micronutrients, such as iron and zinc by the human body depends on their chemical forms and on the presence of antinutrients that inhibit absorption. To account for differences related to the different food sources, absorbed iron was calculated on the basis of the bioavailability factors of iron; 5% of iron bioavailability was applied because the diet of the adolescents were mainly plant based. Values of zinc were imputed as ‘unrefined’ in the IMMAP softer were to account for 15% bioavailability. We were not able to calculate phytate to zinc molar ratio since we phytate concentration of foods were not available.

4.9.3 Identifying usual nutrient intake and prevalence of inadequate nutrient intake

Second round intake assessment was done to account for usual nutrient intake. The first day 24 hour dietary recall was adjusted by using the second day recall to account for within person day to day variation of food intake by using Intake Monitoring Assessment and Planning Program (IMAPP) software. Prevalence of inadequate micronutrient intake for vitamin A, vitamin B1, vitamin B2, vitamin C, folate, calcium and zinc was analyzed for adolescents. Folate intake was expressed as dietary folate equivalent (DFE) in IMAPP software when calculating inadequacy, which accounts for differences in bioavailability between natural folate and synthetic folic acid.

Prevalence of inadequate intake was estimated by the proportion of the Adolescents with intakes that fall below the EAR (EAR cut point method) except for iron. The EAR as a cut-off point was used provided that three conditions are met: (1) intake and nutrient requirements must be independent, (2) the distribution of needs should be symmetric around the mean, EAR, and (3) The variance of the distribution of needs must be less than the variance of the usual intake distribution. For nutrients except for iron assumptions were satisfied for which allowed the use of the cut-off point.

A probability approach was used to calculate inadequate intake of iron since the symmetry of the need distribution did not occur. Individual iron requirement differs among adolescents because of menstrual blood loss. Probability approach is a statistical method for accurately establishing the proportion of people in a population who have nutrient intakes below their own individual requirements.

Inadequate intake of iron was calculated by obtaining Z value using the formula

$$Z = \frac{\text{mean observed intake} - \text{EAR}}{\sqrt{\frac{\text{SD}^2 + \text{within person SD}^2}{\text{No of recall days}}}}$$

- *Mean observed in take* was mean intake of iron in grams among the adolescents.
- *EAR* was taken from the FAO/WHO recommendation for each group of adolescent girls (early and late).
- *SDr2* is the variance of the recommended intake (we took 10% of the recommended intake).
- *SD2* is variance of intake of iron among the adolescent girls.
- *Number of recall days* was two.

After obtaining the *Z* value we found the prevalence of inadequate intake of iron from the *z* table.

4.10 Ethical consideration

Ethical clearance was sought from Addis Ababa University, College of Health Sciences School of Public Health Research and Ethics Committee. Informed verbal consent was obtained from each study participants before the interview after the detail process was explained for them along with benefits and possible risks. Any personal identification of the study participants was not recorded during data collection and all the information collected from the study participant was made confidential. Their right not to participate or withdraw from the study was told to the participants. They were kindly requested to participate by explaining the significance of the study. For those aged less than 18years, assent was taken along with permission from parents or legal guardians.

5, Result

5.1 Socio demographic characteristics

Two hundred eighty eight adolescents were interviewed along with their mothers or care givers with 100% response rate. Fifty two adolescents were interviewed again to conduct the second round of the 24 hour dietary recall. One interview were dropped because of incomplete recipe form with makes it a total of 339 interviews.

The mean age of the adolescents was 13.8 (SD 2.2) years. Almost all of the adolescents, 280(97.2%) were never married and 149 (79.26%) are currently in school of which 194(84.4%) are attending primary school. One hundred and sixty four (57%) of the respondents were protestant followed by Orthodox Christianity which accounted for 63(21.8%). Two hundred seventy three (94.8%) of the study population were from wolita ethnic group. (Table 1)

Table 1 socio-demographic characteristics of the study participants in Damot gale district, SNNP, 2017 (n=288)

Characteristics	Frequency	Percent
Respondents status		
House wife	8	2.8
Daughter	274	95.1
relative	6	2.1
Residence		
Rural	240	83.3
Semi urban	48	16.7
Respondent's age		
10-14	171	59.4
15-19	117	60.9
Education		
In school	230	79.9
Out of school	58	20.1
Highest Level of education		
Primary	243	84.4
Secondary	41	14.2
Illiterate	4	1.4

Marital status			
	Single	280	97.2
	Currently married	8	2.8
Religion			
	Orthodox Christian	63	21.9
	Protestant	164	56.9
	Muslim	8	2.8
	Catholic	26	9
	Others	27	9.4
Ethnicity			
	Wolita	273	94.8
	Hadiya	11	3.8
	Oromo	4	1.4
Occupation			
	Student	234	81.2
	Merchant	30	10.4
	Private business	17	5.9
	Housewife	6	2.1
	Other	1	0.4
Educational status of mother			
	Primary(1-8)	94	3.6
	Secondary (9-12)	11	3.8
	Collage/university	2	0.7
	Can't read and write	181	62.9
Educational status of father			
	Primary(1-8)	132	45.8
	Secondary (9-12)	24	8.3
	Collage/university	14	4.9
	Read and write	13	4.5
	Can't read and write	105	36.5

5.2 Foods and drinks consumed

Food group consumed by the adolescents in the study area is summarized in the figure below (figure-2). Plant based foods such as cereal, roots and tubers and also leafy vegetables were the most consumed. Flesh foods were the least consumed food group. Less than one percent (0.35%) of the adolescent girls consumed flesh foods. Twenty six (9%) of the adolescent's diet consisted of dairy products. Most of the adolescents 328 (96.7%) consumed coffee drinks (coffee beans and leaves) with their meals.

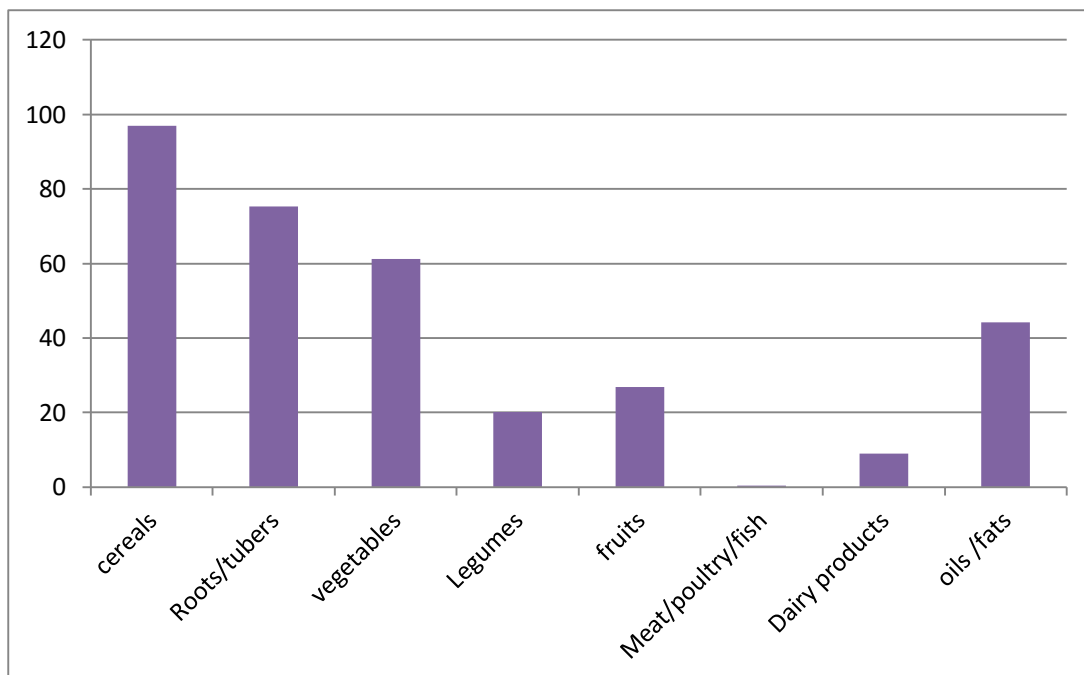


Figure 2: Proportion of food group consumed by adolescent girls of Damot gale district, SNNP, 2017

5.3 Nutrient intake of adolescent girls

As shown in table 2, the mean energy intake was 1452.7 (SD356.3) kcal per day. The mean intake of carbohydrate was 305.6 (SD 72.4) grams which accounted for about 80% of the total diet. The mean intake of protein among the adolescents was 33.57 (SD 13.3) grams which was around 10% of their diet. Median Total fat intake was 13.4(8.8, 19.8) grams that accounted for 8% of their diet.

The median intake of vitamin A (retinol) was 1953 (99.1, 2737.9). The median intake of vitamin C was 10.9 (6.8, 16.9) mg. The median intake of folate and iron was 234 (191, 309) mcg and 41.5(25.7, 87.6) respectively. For calcium and zinc median intake was 396.5(253.7, 550) mg and 10(7, 13) mg respectively. (Table 2)

Table2 Nutrient intake of adolescents of Damot gale district SNNP, 2017

Nutrient	Mean	SD	Median	IQR(25th to 75th)
Energy (Kcal)	1452.7	356.3	----	----
Protein (gram)	35.7	13.3	----	----
Fat (gram)	-----	-----	13.3	(8.8, 19.8)
Carbohydrate (gram)	305.6	72.4		
Dietary fiber (gram)	18.6	8.4	----	-----
Vitamin A(retinol mcg)	----	----	1952.8	(99.1, 2737.9)

5.4 Prevalence of inadequate intake of nutrients among female adolescents

Table 4 shows the prevalence of inadequate nutrient intakes, which corresponds to the proportion of individuals with usual intake below the EAR established for each nutrient, is presented in table 4. The prevalence of inadequate intake for protein was 60.9 percent. Inadequate intake for vitamin B1 and B2 was 93.7%, 86.9% respectively. Concerning folate and vitamin c prevalence of inadequacy was 83.9% and 98.8% respectively.

Table 3 Means, standard deviations, reference intakes and estimated prevalence of inadequate intakes among adolescents adolescent girls (10-19Yrs) of Damot gale district, 2017

Nutrient	Mean	SD	EAR	Prevalence of inadequate intake (%)
Protein(g)	35.7	5	38	60.9
Vitamin B1 (mg)	0.4	0.3	0.9	93.7
Vitamin B2 (mg)	0.7	0.3	0.9	86.9
Folate (mcg)	262	113	330	83.9
Vitamin C(mg)	13	11	56	98.8
Calcium(mg)	432	230	1100	98.4
Zinc (mg)	11	5	11	57.9
Vitamin B12	0.1	0.5	2	98.8

We calculated the prevalence of inadequacy of iron for early adolescents (10-14 years) and late adolescents (15-19 years) separately and found out to be 82% and 53% respectively.

6, Discussion

This community based study aimed at identifying the prevalence of inadequate intake for macro and micro nutrients among adolescent girls of demote gale district. A multiple pass 24hour dietary recall was conducted among adolescent girls of 10-19 years. The result indicated a high prevalence of inadequacy for both macro and micro nutrients among the adolescent girls in the study area.

This study showed that cereals (mainly maize) and roots/tubers (“enset”, potato, sweet potato and yum) were highly consumed food groups among the adolescent girls these food groups are the main sources of carbohydrate and fiber. The Ethiopia National Food Consumption Survey in 2013 indicated that Roots and tubers (“enset”, potato, sweet potato, taro, cassava, yam and “anchote”) contributed higher proportions of foods consumed by Women and children in SNNP than in other regions. Consumption of flesh foods was found out to be very low in this study which is also comparable to the Ethiopia National Food Consumption Survey. Consumption of any flesh foods among children across different regions were less than 1%(48)

The mean intake of energy was 1452.7 Kcal which is far below the average recommended intake by FAO/WHO(49) . In this study we did not compare the energy intake with the EAR. This is basically because requirements are dependent on energy expenditures, which were not collected in this study. We found out that carbohydrate consumption accounted a higher share of the adolescent girls’ diet. Similar to the energy intake, protein intake among the adolescents was very low compared to the recommend adolescents. The consumed food group result indicated that the major sources of protein among adolescents were from plant sources, with low biological value. The median intake of fat among the adolescents was 13.3 grams and the major source of fat in their diets was vegetable oil (palm oil). The intake of fat among the adolescents were lower than other studies conducted in low and middle income countries(21, 39) this might be because most of the cooking method since most of the foods consumed by the adolescent girls of Damot gale district were steamed or boiled than fried.

The contribution of macronutrients to total energy intake observed in the adolescents studied was found to be higher than acceptable limits set by the US Institute of Medicine for carbohydrate. It was below the limit for protein and fat. The recommendation states that contribution of macro nutrients for total energy intake should vary between 45% and 65% for

carbohydrates, 10% to 30% for proteins and 25% to 35% for lipids, for the population of 4 to 18 years old(50). Our study indicated that carbohydrate, protein and fat contributed 80, 10, 8% to the total energy intake of the adolescent girls respectively. Except for carbohydrate, these finding was lower than the Ethiopian national food consumption survey conducted in 2013 which revealed that Carbohydrate contributes 67.2%, 73.5 %, and 68.1% of the total energy intake in children, women and men respectively. Fat contributes 23%, 16.5%, and 20.7% of total energy intake in children, women and men, respectively. Protein contributes 10.5%, 9.7% and 10.4% of total energy intakes in children, women and men, respectively(6). This may not be a perfect comparison as the current study has only dealt with adolescents.

For all micro nutrients under this study, it was found out that prevalence of inadequacy were high among the adolescent girls.

Inadequacy for vitamin C was found out to be 98.8% this is because of consumption of citrus fruits and other vitamin C rich foods were very low. In this study 26.8% of the participants consumed fruits (mango, banana, Avocado) and only one adolescent consumed a citrus fruit this finding is more or less consistent with other studies done in low and middle income countries(18, 39). The inadequacy of vitamin B12 was 98.8% among the adolescents which was also true in urban Cameroon where the percentage of adolescents with vitamin B12 intake below the estimated average requirement was found to be 83.9%, which might be because of the low consumption of animal foods which was also indicated in this study. The prevalence of inadequate intake of folate was found out to be 83.9% among the adolescent girls which might be because of the major staple food in the study area was maize and plant based foods was less consumed. The study conducted among women of reproductive age in nine administrative regions of Ethiopia found out that women in southern part of Ethiopia where the staple foods were Maize and fermented enset products had higher levels of folate deficiency (34). Despite the fact that many girls reported consuming beans and indigenous vegetables like kale regularly; the portion sizes were seemingly inadequate to meet the folate requirements. We also observed foods consumed in the study area were highly cooked that substantial amounts of folate may be lost during cooking.

Calcium was one of the nutrients with the highest prevalence of inadequacy (98.4%) this might be because of the low consumption of dairy products which are the main sources of calcium in this study we found out that only 9% of the adolescent's diet consisted of dairy products. This study is aligned with studies done in both developed and developing countries

(22, 23, 39-41) were the prevalence of calcium inadequacy was high. Bearing in mind the profound skeletal development during adolescence, the low intake of nutrients involved in this process, such as calcium becomes an important finding. Besides, there are evidences on the role of adequate calcium intake during adolescence in preventing bone mass losses in women during post menopause(51).

Prevalence of inadequacy for iron was 82% and 53% for adolescents 10-14 years (non menstruating) and 15-19 years respectively this was calculated considering 5% bioavailability This finding is higher than the Ethiopian national nutritional survey done in other age groups which was 13% in women of childbearing age at the national level.

Adolescents from low income countries experience monotonous or less diversified types of diets dominated by cereals, whole grains, roots and tubers this plant based staple foods which are unrefined are rich in phytates that can bind and significantly reduce the absorption of non-hem iron by forming insoluble Fe complexes(52). Unleavened bread made of unrefined maize flour was commonly consumed among the adolescents of the study area Cereals, such as whole-maize flour; contain 1–2% phytic acid. In addition of being a good source of heme iron which have high bioavailability, the protein in meat, fish and poultry can enhance absorption of Fe from non haem sources by forming soluble Fe complexes another promoter of non haeam iron is vitamin c from in fruits and vegetables by unknown clear mechanism carotenoides are also important in increasing absorption of non haem iron from plant based diets. Some study found out that the addition of vitamin A to a breakfast meal prevented the inhibiting effect of simultaneously consumed coffee, tea, and phytates on iron absorption. Iron absorption from nonenriched maize bread was 3.0 and 6.0% in normal and iron deficient subjects, whereas the iron absorption from maize bread with 1000 IU of vitamin A/100 g flour (300 g retinol/ 100 g flour) was 6.4 and 11.0% in normal and iron-deficient subjects, respectively(53). In our study we found out that the diets of the adolescents were dominated by unrefined cereals, root and tubers where as consumption of animal products, vitamins C reach fruits and vegetables and also carotenoids were very low. Most of the adolescents consumed coffee drinks with their meals coffee is high in Phenolic compound which have marked iron-binding properties and inhibit it's absorption In addition calcium also interferes with Fe absorption which was not a concern in this study since consumption of milk and milk products which are high sources of calcium were very low.

In conclusion, our study showed that the intake of both Macro and micronutrients among adolescents is very low resulting in a higher prevalence of inadequacy.

This study has a number of limitations that need to be considered when interpreting the results obtained. First, since this study was cross sectional we only assessed the dietary intake in the lean session which may not represent intakes of other seasons. Second, the self-report of dietary intake may have resulted in recall errors. Which we tried to minimize by using a multiple pass method that is suitable for probing. The Dietary intake was assessed using a single day recall which may over estimate nutrient intake. Third, when calculating for inadequate intake for iron the exact variance of recommended intake was not found so we took 10% of the recommendation.

The strengths of the study include the use of previous experienced data collators who worked on dietary assessments, familiar with the techniques, with the local diet. Second, piloting was done to identify utensil commonly used, the common types of foods consumed and recipes. Third, we used salted replica of stable foods and we equipped each data collector with calibrated utensils locally used. This helps us to improve the portion size estimation. Forth, we distributed the study samples across the days of the week in order to adjust for day to day variability of diet. Fifth, repeated measurements among 52 samples were conducted. This helped us for the adjustment of with in person variation of dietary intake using the IMAPP software.

Recommendation

To ministry of agriculture

Ethiopian ministry of agriculture should encourage and support farmers to increase productions by promote cultivation of crops, fruits and vegetables that are adaptable to the climate. This is helpful to diversify dietary intake.

To ministry of health

Since the requirement for most micro nutrients may not be met through improving dietary intake, the Ethiopian ministry of health should consider supplementing adolescent girls with micronutrients identified as inadequate.

To researcher

Further dietary intake studies on adolescent girls that evaluate the dietary intake in different seasons and also with more recall days will be helpful to see the dietary inadequacy clearly. Furthermore we recommend researchers to conduct biochemical studies on the adolescents to evaluate the level of micro nutrient deficiencies.

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Annex I

Information sheet

Hello my name is i am one of the interviewers of the study conducted by Addis Ababa university school of public health regarding dietary intake of adolescents 10-19 years of age. You're selected for this study by chance because you are an adolescent or you have an adolescent child. You will participate if you give me your consent after understanding the purpose of the study after reading the following notes.

- The purpose of the study is to evaluate whether adolescents get enough amount of macro and micro nutrients from their diet.
- If you agree to participate in the study I will conduct an interview about your socioeconomic status and your/ your Childs's dietary intake of the previous day.
- The result of this study will help policy makers for decision making regarding adolescent nutrition so that you/ your child will get benefit from the intervention in the future.
- The interview might take 30-40 minutes and there is no risk or discomfort while participating and also there is no payment for your participation.
- Your participation is voluntary and you can skip any question that you don't want to answer and also you can ask any questions you have.
- The record of this study will be kept private. Any personal information about you will not be recorded and all the information you provided is strictly confidential.
- You can contact the principal investigator for any question or concern you have.

Name of the principal investigator _____

Phone no _____

Annex II:

Information sheet in local language

የመረጃ መስጫ ቅጽ

ይህ ቅጽ ለጥናቱ ተሳታፊዎች መረጃን ከመቀበል በፊት የሚነበብ ቅጽ ነው።

ስሜ _____ ይባላል። በ አዲስ አበባ ዩንቨርሲቲ በ ህብረተሰብ ጤና አጠባበቅ ትምህርት ክፍል ለሚሰራው ስለ ዕድሜያቸው ከ 10-19 አመት ለሆኑ ልጆች ከምግብ የሚያገኙት ንጥረ ነገሮችን በተመለከተ ለሚሰራው ጥናት የመረጃ ሰብሳቢ ነኝ። እርስዎ በዚህ ጥናት ተሳታፊ እንዲሆኑ ተመርጠዋል። ይህም እድሜው/ዋ ከ 10-19 አመተ የሚሆን ልጅ ስላሉት ነው። ጥናቱ ውስጥ የሚሳተፉት የሚከተለውን መረጃ ከሰማቹህ ና ከተስማማቹ ብቻ ነው።

1. የጥናቱ ዋና ዋና አላማ: የዚህ ጥናት ዋና አላማ እድሜያቸው ከ 10-19 አመት ከሆኑ ውስጥ ምን ያህሉ ከምግባቸው በቂ ንጥረ ነገሮችን የሚያገኙ እንደ ሆነ ለማጥናት ነው።

2. እኔ የምጠይቅዎት ነገሮች: ጥናቱ ውስጥ ለመሳተፍ ከተስማሙ ከ 30-45 ደቂቃ ያህል ከ እርስዎ ጋር ቃለመጠይቅን አካሄዳለሁ። ቃለመጠይቁ ስለ እርስዎ፣ ስለ ቤቶዎ፣ ስለ ልጅዎ ና ስላ ልጅዎ የትላንት አመጋገብን ያካትታል። ተሳትፎዎ በጣም ይደገፋል።

3. የጥናቱ ጥቅምና ችግር: የዚህ ጥናት ውጤት መንግስትን ና ሌሎች ጤና አጠባበቅ ላይ የሚሰሩ አካላት ታዳጊወጣቶች ምግብ/አመጋገብ እገዛን በተመለከተ ፖሊሲ እንድ ቀርፀ ይረዳል። ከሚቀረፀው ፖሊሲ ልጅዎን ሊጠቀም ይችላል። ቃለመጠይቁ ከ 30-45 ደቂቃ ልወሰድ ችላል። ጥናቱ ውስጥ በመሳተፍዎ የሚከፈሉት ክፍያ የለም። እንድሁም ለቃለመጠይቁ ከምናጠፋ ግዜ በቀር የምትፈሩት አደጋ ወይም ችግር አይኖርም።

4. ሚስጥራዊናት: እርስዎ የሰጡን መረጃ ሁሉ በሚስጢር ይያዛል። አንድም የግልዎ መረጃ አይጻፍም። ለዝህ ጥናት እርስዎ የሰጡት መረጃ በግል ይያዛል። የጥናቱን ውጤት ለሌሎች አካላት ገለጻ በምናደርግበት ግዜ እንኩዋን እርስዎን እንድያውቁ የምያስችል መረጃ አይጻፍም። ለጥናቱ የተሰበሰበ መረጃ ቁለፍ ባለው ፋይል ውስጥ ይቀመጣል። ከአጥኚው በቀር ሌላ ሰው ልያገኘው አይችልም።

5. ተሳትፎዎ ፍቃደኝነት ላይ የተመሰረተ ነው: ጥናቱ ውስጥ ተሳትፎዎ ፍቃደኝነት ላይ የተመሰረተ ስለሆነ ጥናቱ ውስጥ ለመሳተፍም ሆነ መመለስ የማይፈልጉትን ጥያቄ ለመመለስ አይገደዱም።

የምትጠየቁት ጥያቄ ካልተመቻች ላለመመለስ መብት አለው። □□□□ □□□□ □□□ □□□□□
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Annex III

Consent form

The selected participant have listen the information sheet carefully while the data collector read it. I understood the purpose, benefit, what is required from me and the consequences of the study on me if I take part in the study. I understood that my personal information; like name will not be registered and all answers given by me should not be transferred to the third party without my permission. I also understand that I can decide whether or not to take part in the study or even withdraw from the study at any time.

My name is..... and I agree to participate in the study.

Sign.....

Annex IV:

Consent form in Amharic

የስምምነት ቅፅ

እኔ የጥናቱ ተሳታፊ ሆኜ የተመረጥኩ የመረጃ ቅፅ ሲነበብ በጥንቃቄ አዳምጫለሁ። የጥናቱን ዋና አላማ፣ ጥቅም ላይ ማውሰድ እና ችግር እንደሆነኝ ከእኔ ምን እንደሚጠበቅ ተረድቻለሁ። የግሌ መረጃ እንደማይጻፍና እኔ የሰጠውሃቸው መረጃዎች ለሦስተኛ ሰዓት ተላልፈው እንደማይሰጡ ተረድቻለሁ። ጥናቱ ወስጥ ለመሳተፍ መወሰን እንደምችል ማረጋገጥ ግዜ ጥናቱን አቁምርቼ መተወ እንደምችልም ተረድቻለሁ። ስለህም ጥናቱ ወስጥ ለመሳተፍ ተስማምቻለሁ። ይህንንም በፍርማዬ አረጋግጣለሁ።

የተሳታፊው ፍርማ _____

Annex V socio-demographic questionnaire

No	Questions	coding	skip
101	Respondent's status	Spouse of head.....1 Daughter.....2 Other (specify).....	
102	In what month and year were you born?	Month..... don't know..... Year..... don't know	
103	How old are you now?years	
104	What is the highest level of school you attended?	Primary(1-8).....1 Secondary (9-12).....2 College/university.....3 Read and write.....4 Illiterate.....5	
105	Are you currently in school?	Yes.....1 No.....2	
106	What is your marital status?	Single.....1 Married.....2 Separated.....3 Divorced.....4 Widowed.....5	
107	What is your religion?	Orthodox Christian.....1 Muslim.....2 Protestant.....3 Catholic.....4 Other specify.....	
108	To what ethnic group do you belong to?	Oromo.....1 Amhara.....2	

		Wolita.....3 Silte.....4 Gurage.....5 Tigray.....6 Other specify.....	
109	What's your occupation	Farmer.....1 House wife.....2 Student.....3 Government Employee.....4 Private.....5 Merchant.....6 Daily labourer.....7 Unemployed.....8 Other specify.....	
111	Educational status of the Mother	Primary(1-8).....1 Secondary (9-12).....2 College/university.....3 Read and write.....4 Illiterate.....5	
112	Educational status of the father	Primary(1-8).....1 Secondary (9-12).....2 College/university.....3 Read and write.....4 Illiterate.....5	
113	No of people currently living in your house	-----	
Questions about housing condition			
114	Will you please describe your family	We live in a house we own.....1	

	household living structure?	We live in part of the house we own...2 We rent a house.....3 We rent part of a house.....4 We live in a dormitory.....5 Other specify _____	
115	Main construction material used in exterior walls	Natural walls.....1 No walls.....2 Canel/trunks/bamboo.....3 Dirt.....4 Rudimentary walls.....5 Bamboo/wood with mud.....6 Stone with mud.....7 Uncovered adobe.....8 Plywood.....9 Card board.....10 Reused wood.....11 Finished walls.....12 Cement.....13 Store with live/cement.....14 Bricks.....15 Covered adobe.....16 Wood planks/shiges.....17 Other specify _____	
116	Main construction material used for the roof	Natural roofing No roof.....1 Thatch/leaf/mud.....2 Rudimentary roofing Rustic mat/plastic sheet.....3 Reed/bamboo.....4 Wood planks.....5 Card board.....6	

		Finished roofing Corrugated iron/metal.....7 Wood.....8 Asbestos/cement fiber.....9 Cement/concrete.....10 Roofing/shingles.....11 Other specify.....	
117	Main construction material used for the floor of your house	Natural floor Earth/sand.....1 Dung.....2 Rudimentary floor Wood planks.....3 Bamboo.....4 Finished floor Polished wood.....5 Vinyl or asphalt.....6 Ceramic tiles.....7 Cement.....8 Carpet.....9 Other (specify).....	
118	Can you please tell me if your house have	Electricity.....1 Clock.....2 Radio.....3 Television.....4 Mobile phone.....5 home phone.....6 refrigerator.....7 chair.....8 Bed with cotton, sponge mattress...9 Electric mitad.....10 None.....11	

119	What's the main source of drinking water for the member of your household	Pipe water inside dwelling....1 Piped to yard.....2 Public tap.....3 Protected well/spring.....4 Unprotected well/spring.....5 Protected Dug well.....6 Unprotected dug well.....7 Borehole in the yard.....8 Public borehole.....9 Surface water(pond, lake, river, stream).....10 rain water.....11 bottled water.....12 Other specify.....	
120	What is the main source of water for other purpose in your household like for cooking and washing	Pipe water inside dwelling....1 Piped to yard.....2 Public tap.....3 Protected well/spring.....4 Unprotected well/spring.....5 Protected Dug well.....6 Unprotected dug well.....7 Borehole in the yard.....8 Public borehole.....9 Surface water(pond, lake, river, stream).....10 rain water.....11 bottled water.....12 Other specify.....	
121	What kind of toilet dose your household	Flush latrine.....1	

	have	Flush to swear system.....2 Flush to septic tank.....3 Flush to pit latrine.....4 Flush to some were else.....5 Flush to don't know were.....6 Pit latrine.....7 Traditional pit latrine.....8 Pit latrine with slab.....9 Pit latrine without slab.....10 Ventilated improved pit latrine...11 Bucket toilet.....12 Composting toilet.....13 No facility/bush/woods.....14 Other specify.....	
122	What type of fuel does your household mainly use for cooking? (multiple answer is possible)	Electricity.....1 Natural gas.....2 Bio gas.....3 Kerosene.....4 Wood.....5 Charcoal.....6 Straw/shrubs/grass.....7 Animal dung.....8 Agricultural crop.....9 Other(specify).....	
123	Dose any member of the house hold own the following (multiple answer is possible)	Bicycle.....1 Motor cycle.....2 Animal drawn cart.....3 Car/truck.....4	
124	Does the household own any live stock,	No.....1	

	herds, other farm animals or poultry	Yes.....2	
125	How many of the following animals do you keep	A, milk cows, oxen or bulls __ __ B, chicken __ __ C, goats __ __ D, sheep __ __ E, horses, donkey or mule __ __ F, camels __ __ G, beehives __ __	

Annex IV Dietary assessment questionnaire

24 hour dietary recall quick food list record form

Now I would like to ask you about some liquids, solid or semi-solid food that you (your child) may have had yesterday during the day or at night.

Questioner ID _____	sex _____
House No _____	age: _____
Interviewer sign _____	date of intake _____
Supervisor sign _____	date of interview: _____

Occasion	Place eaten	Food or Drink	Description and cooking method	Amount eaten	Weight equivalent	Food code
Morning before breakfast						
breakfast						
After breakfast						
lunch						
After lunch						
Snack						
After snack						
dinner						
Over night						
Other						

Description of foods and ingredients.

Food or drink	Description and cooking Method	Amount prepared (using equipment)	Amount t eaten (using equipmen t)	Weighed equivalent (in gram)
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method			

	List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
Probe for alcohol: 1. Yes 2. No	Probe for sickness: 1. Yes 2. No If yes, did sickness affect appetite? 1. Yes 2. No If yes, how? 1. Increase 2. Decrease			
Was food intake unusual? 1. Yes 2. No If yes, how was it unusual?	Probe for tablets: 1. Yes 2. No If yes Iron 2. Vitamins 3. Other supplements 4. Anti-malaria			
Was it a feast day? 1. Yes 2. No Was it a market day? 1. Yes 2. No Was it a fasting day? 1. Yes 2. No				

1: □□□□□□□□ □□□□□□

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<p>101</p>	<p>□□□□ □□□</p>	<p>□□□ □□□.....1</p> <p>□□□□□□ □□□□.....2</p> <p>□□ □□.....3</p> <p>□□□ □□.....4</p> <p>□□ □□ □□□□_____</p>	
<p>102</p>	<p>□□□□□ □□□</p>	<p>□□□.....1</p> <p>□□□.....2</p> <p>□□□□ □□□.....3</p>	
<p>103</p>	<p>□□□(□□□□)</p>	<p>_____ □□□</p>	
<p>104</p>	<p>□□□□□</p> <p>□□□□□</p> <p>□□□□□ □□□</p>	<p>□□□□□ □□□.....1</p> <p>□□□□□ □□□.....2</p> <p>□□□ □ □□ □□□.....3</p> <p>□□□□ □ □□□.....4</p> <p>□□□□□.....5</p>	
<p>105</p>	<p>□□□□ □□□</p> <p>□□□□ □□</p> <p>□□?</p>	<p>□□.....1</p> <p>□□□□□.....2</p>	
<p>106</p>	<p>□□□□□□</p> <p>□□□ □□</p> <p>□□□□□?</p>	<p>□□□□.....1</p> <p>□□□□□.....2</p> <p>□□□□□.....3</p> <p>□□□□.....4</p>	

		□□□□□.....5	
107	□□□ □ □□□□□?	□□□ _____	
108	□□□□□□ □□□□?	□□□□.....1 □□□□□□.....2 □□□□□□□.....3 □□□□.....4 □□(_____)	
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ከዚህ በመቀጠል በትናንትናው እለት ቀንም ሆነ ማታ የልጅዎ የተመገበውን/የጠጣውን ጠንካራ፣ ፈላጎት ለስላሳ ምግቦችን በዝርዝር አጠይቆታለዉ።

የቃለመጠይቁመለያ: _____ የቤት ቁጥር: _____ የመረጃስብብሳቢፊርማ: _____ የተቆጣጣሪፊርማ: _____						
				እድሜ: _____ ምግብ-የተበላበትቀን: _____ ቃለመጠይቁ የተሰራበት ቀን: _____		
ምግብ- የተበላበት ጊዜ	ምግብ- የተበላበ ት ቦታ	ምግብ ወይም መጠጥ	የምግብ ዝርዝር ና አስራር	የተበላው መጠን	የተበላው መጠን ግራም	የምግብ ኮድ
ከቁርስ በፊት						
ቁርስ						
ከቁርስ በሃላ						
ምሳ						
ከምሳ በሃላ						
መክሰስ						
ከመክሰስ በሃላ						
እራት						
ለሊት						

2. የምግብና ወህዶች ገለፃ ፎርም

አሁን ደግሞ ከላይ የዘረዘሩልን ምግቦች የአባላታዎ ዘዴያቸው፣ ወህዶችና የወህዶችን መጠን፣ አይነትና ልጅዎ ምን ያህል አንደበላ/ጠባቸ በዝርዝር ይነግሩኛል።

የምግብ/መጠጥ ዝርዝርና አይነቱ	የምግብ/መጠጥ ገለፃና የአባላታዎ ዘዴ (ይህን መረጃ ለመሰብሰብ ወህዶች፣ የወህዶችን አይነትና መጠን እና የአባላታዎ ዘዴውን በጥልቁ ይጠይቁ)	ምግብ የተዘጋጀ መጠን በመለክያ	ልጅቷ የበላችው መጠን (በመለክያ)	የተበላው መጠን (በግራም)
	<p>ወህዶችና የአባላታዎ ዘዴ:</p> <p>የወህዶች ዝርዝርና መጠናቸው (በመለክያ/ግራም)</p>			
	<p>ወህዶችና የአባላታዎ ዘዴ:</p> <p>የወህዶች ዝርዝርና መጠናቸው</p>			
	<p>ወህዶችና የአባላታዎ ዘዴ:</p> <p>የወህዶች ዝርዝርና መጠናቸው</p>			

	<p>ወህዶቹ ና የአበሳሰል ዘዴ:</p> <p>የወህዶቹ ዝርዝር ና መጠናቸው.</p>			
	<p>ወህዶቹ ና የአበሳሰል ዘዴ:</p> <p>የወህዶቹ ዝርዝር ና መጠናቸው (በመለክያ/ግራም)</p>			
<p>1. የነዚህ ምግቦች አመታገብ ያልተለመደ ነው? (የግብዣ/ድግስቀን፣ የገበያቀን፣ የግምቀን)</p> <p>አዎ.....1</p> <p>አይደለም.....2</p>		<p>5. ልጅዎ መዳኒት ወስዳ ነበር? አዎ.....1</p> <p>አይደለም.....2</p> <p>አዎ ከሆነ →</p> <p>ምን ዓይነት መዳኒት ነው የወሰደችው? አይረገግ.....1</p> <p>ቫይታምን.....2</p> <p>የወባ መዳኒት.....3</p> <p>ሌላ(ግለፅ).....</p>		
<p>2. ታሞክረዋል? አዎ.....1</p> <p>አይደለም.....2</p>				
<p>3. ህመሙ የአመጋገብ ሁኔታ ቀይሮ ነበር? አዎ.....1 አዎ ከሆነ →</p> <p>አይደለም.....2</p>				
<p>4. እንዴት ነው የቀየረው? ጨመረ.....1</p> <p>ቀነሰ.....2</p>				

Annex VI- Recipe of foods consumed by adolescent girls of Damot Gale district

No	List of foods	Ingredients
1	Injera (Ethiopian flat pancake) 1	Nech Teff (100%)
2	Injera 2	Key Teff (100%)
3	Injera 3	Teff (50%), Maize (50%)
4	Injera 4	Sorghum (60%), teff (40%)
5	Injera 5	Teff (50%), Maize (25%), cassava (25%)
6	Nifro 1	Maize, beans
7	Nifro 2	maize
8	Kita (unleavened bread) 1	Maize flour
9	Kita 2	Maiz flour, wheat flour
10	Kita 3	Maize flour, sorghum flour
11	Kita 4	Sorghum flour
12	Kita 5(qocho)	False banana
13	Kita 6(sareta)	False banana, wheat flour
14	Genfo (porridge) 1	Unrefined barley flour, butter, red paper
15	Genfo 2	Refined barley flour, butter, red paper
16	Genfo 3	Refined false banana (bulla), butter, red paper
17	Bread 1	Unrefined wheat flour
18	Bread 2	Store bought
19	Data	Chile, galic, herbs
20	fosesse	Kidney beans, maize, data
21	bilando	Refined false banana, kidney beans
22	bachira	False banana, butter, data
23	Gomen wot (stew made from boiled kale)	Kale, shallot, garlic, green paper, oil
24	Atikilt	Cabbage, shallot, oil
25	Dinch wot(steaw made from potato)	Potato, shallot, garlic, chilli powder, oil
26	Misir kikwot(stew made from lentil split)	lentil split, shallot, garlic, chilli powder, oil
27	Shiro wot1(broad bean sauce)	Broad bean flour, shallot, garlic, oil
28	Shioro wot 2	pea flour, shallot, garlic, oil
29	spaghetti	shallot,oil,tomato,garlic,spice
30	Fruits(Banana, mango, Avocado)	

