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FOOD SCIENCE & TECHNOLOGY | RESEARCH ARTICLE

Low dietary diversity and its determinants among adolescent girls in Southern Ethiopia

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Abstract: Normal growth and development of adolescent girls need a healthy diet which includes a variety of foods from different food groups. The dietary practice of adolescent girls in the study area was not assessed. The objective of this study was to assess the dietary diversity score and associated factors among adolescent girls. A community-based cross-sectional study was conducted from 30 April 2019 to 30 May 2019 in Wolaita Zone Southern Ethiopia. A multistage sampling method was used to select 843 adolescent girls. A structured 24-h dietary recall (24 HR) interview was conducted to capture detailed information about all foods and beverages consumed by the respondent in the past 24 hours, most commonly, from "sun raise on the day before interview to sunrise on the date of interview". Dietary diversity scores were calculated by summing the number of food groups consumed by the adolescent girl over the 24-h recall period. Socio-demographic, health, and sanitation-related data were collected using a structured interviewer-administered questionnaire which was developed based on a thorough reviewing of different literature. Data were entered into EPI-data version 4.4.2 and exported to SPSS for windows version 21.0 for further analysis. Multivariable logistic regression model was used to isolate independent predictors of adequate dietary diversity. P-value of less than 0.05 was considered as the

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PUBLIC INTEREST STATEMENT

Diversified diet is an indicator of a healthy diet and adequate micronutrient intake. Dietary diversity score is a proxy indicator of nutrient adequacy. So, conducting a community-based study to explore evidence on dietary diversity and its determinants among adolescent girls in all settings is very important to solve malnutrition problems and improve nutrition intervention programs among adolescent girls in southern Ethiopia.

The mean dietary diversity score of the study participants is 3.56 (±1.2). Overall 72.4% of the study participants had a low dietary diversity score. A low dietary diversity score is found to be a public health problem in the study area. Family monthly income, fathers and mothers' educational status, not taking nutrition education and decision-making power were the main predictors of low dietary diversity among adolescent girls in southern Ethiopia. The results imply the need for promoting maternal education, nutrition education, and empowering women to have decision-making power to improve the dietary diversity of girls in the study area.

level of statistical significance. The mean dietary diversity score of the study participants is 3.56 (±1.2). Overall 72.4% of the study participants had a low dietary diversity score. A low dietary diversity score is found to be a public health problem in the study area. Family monthly income [AOR (95%CI) = 15.5 (8.6–28.1)], fathers [AOR (95% CI) = 4.3 (1.8–10.6)] and mothers' educational status [AOR (95%CI) = 3.2 (1.5–6.8)], not taking nutrition education [AOR (95%CI) = 2.1 (1.4–3.1)] and decision-making power [AOR (95%CI) = 2.2 (1.5–3.3)], were the main predictors of low dietary diversity among adolescent girls in southern Ethiopia. Family monthly income and education, providing nutrition education, and decision-making power should be improved. The results imply the need for promoting maternal education, nutrition education, and empowering women to have decision-making power to improve the dietary diversity of girls in the study area. *[AOR (95% CI) = 2.45(1.02–5.86)].*

Subjects: Nutrition and Dietetics; Health Conditions; Community and Public Health Nursing

Keywords: adolescent girls; dietary diversity score and determinants

1. Background

Adolescence is defined as the age range of 10–19 years and it is a period of transition from childhood to adulthood (WHO, 2015). Adolescence is the most important period of life where growth and development are accompanied by various physical, physiological, behavioral, and social changes (Vashist & Goel, 2009).

It presents a second window of opportunity and is characterized by a rapid growth that needs adequate quantity and quality food to meet the nutrient requirement for their physical and mental development in addition to reproductive maturity (Stang & Story, 2008). Different studies indicated adolescence as a determining point for nutritional status, physical activity, and cognitive behaviors. Thus, adolescence is a life-stage offering significant potential for shaping the transgenerational effects of nutrition through the prevention of non communicable diseases (Todd et al., 2015).

Diversified diet is an indicator of a healthy diet and adequate micronutrient intake (G.L. Kennedy et al., 2007). Dietary diversity score (DDS) is a proxy indicator of nutrient adequacy and is calculated by summing the number of food groups consumed by the adolescent girl over the 24-h recall period (Rathnayake et al., 2012).

A diverse diet that contains at least five food groups is necessary for achieving nutrient adequacy and optimal growth and development (Vakili et al., 2013). The adequate nutrient is key and is associated with better lives and with potential intergenerational benefits (Bay et al., 2016). Physical growth and development during puberty increase requirements for energy, protein, and many vitamins and minerals, and deficiencies can lead to physiological, anatomical, and functional disturbances (Salam et al., 2016). A focus on young girls is also crucial because their health and nutritional status before as well as during pregnancy also influences fetal growth and newborn health. Adolescent health and undernutrition is an important determinant of adverse fetal/neonatal outcomes, including low births weight, preterm births, stillbirths, and excess risk of neonatal mortality (Cnattingius & Villamor, 2016).

In South-East Asia and Africa, a large number of adolescent girls suffer from chronic undernutrition and anemia, which adversely impacts their health and development, as well as their offsprings contributing to an intergenerational cycle of malnutrition (Wasnik & Rao, 2012).

A study conducted by the University of the Philippines indicated that the average DDS of the adolescents was 3.94 (Bullecer et al., 2012). Another study conducted in Adama City, Central Ethiopia indicated that from the 24-h dietary recall data the mean DDS was 4.2. In this study, from total adolescent girls, 58.8% of them did meet the minimum DDS of 5 out of 10 food groups (Roba et al., 2016). Another study conducted in Jimma Town, South West Ethiopia among school adolescent girls indicated that the DDS of adolescent girls was 4.34. From the total, 61.3% of students had dietary diversity scores of less than five (Melaku et al., 2017a). A study conducted among high school adolescent girls in Gurage Zone, Southwest Ethiopia indicated the mean dietary diversity score was 4.69. In this study, the prevalence of adolescents who consumed less than or equal to three food groups was 20% and those who consumed 3–4 food groups, 53.2% and those consumed greater than or equal to six food groups were 26.8% (Meron Worku & Wondmu, 2017).

Even though the sustainable development goals included an adolescent nutrition service which is addressing adolescent malnutrition (Assembly, 2015), the nutritional status of adolescent girls is not improving in many parts of the country. The government of Ethiopia officially launched the National Nutrition Program (NNP) in 2009, which aimed to reduce malnutrition in Ethiopia by integrating adolescents' nutrition into community-based health and development programs. The Ethiopian national nutrition program II (2016–2020) incorporated initiatives to improve the nutritional status of adolescent girls, but effectiveness of this and other interventions is unknown (Ethiopia, 2016). Additionally, the deferent studies referred to previously have focused on only school adolescent girls and none of them was conducted in southern Ethiopia. So, conducting a community-based study to explore evidence on dietary diversity and its determinants among adolescent girls in all settings is very important to solve malnutrition problems and improve nutrition intervention programs among adolescent girls in southern Ethiopia. The objective of the study was to assess community-based dietary diversity and associated factors among adolescent girls in southern Ethiopia. Figure 1, indicates the interaction of socio-demographic factors, health, and sanitation-related factors to determine the nutritional status of a community.

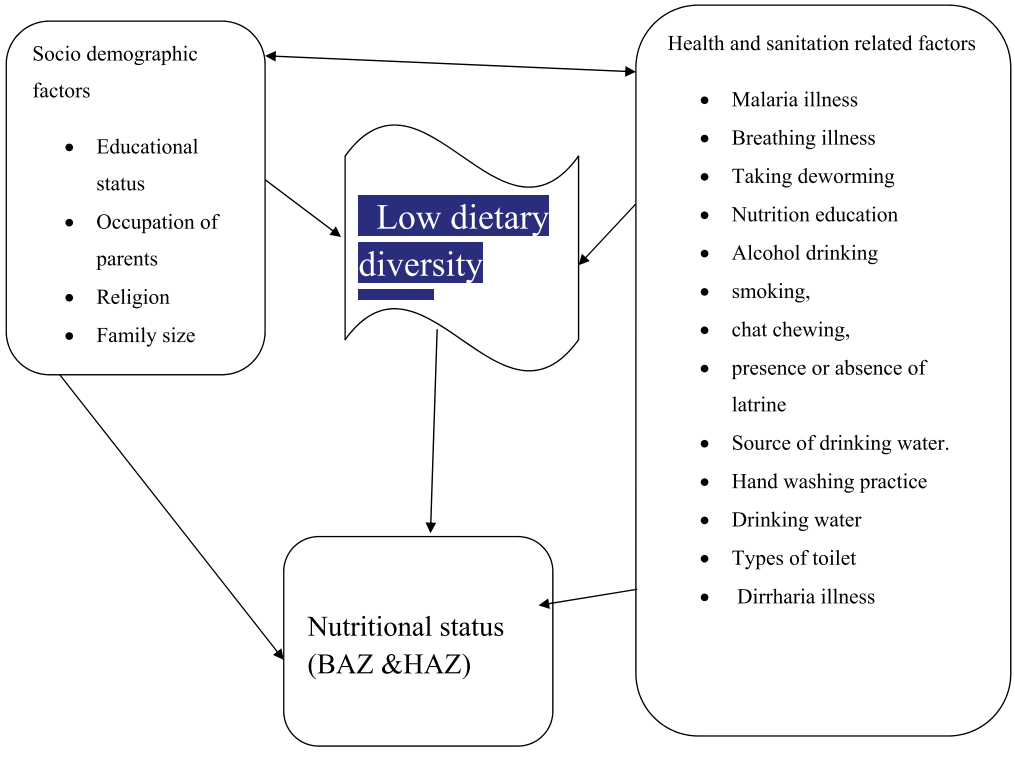

Figure 1. Conceptual Framework for dietary diversity: Reviewed from works of literature.

NB. BAZ = Body mass index—for-age z-score and
HAZ = Height—for-age z-score

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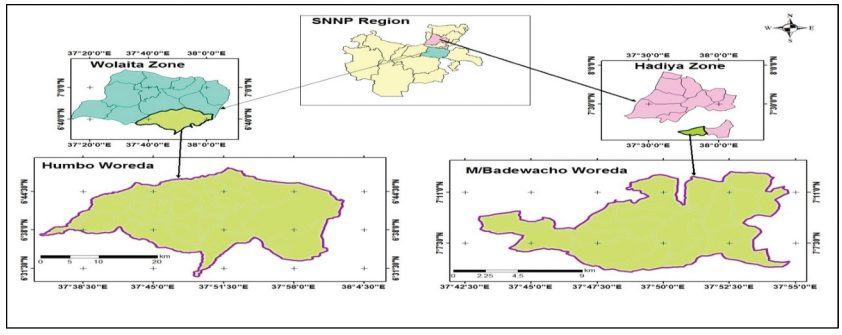

Figure 2. Map of the study area, 2019.

2. Materials and methods

2.1. Study area and design

A community-based cross-sectional study was conducted from April 30/2019 to May 30/2019 in Southern Nations, Nationalities, and Peoples' Region (SNNPR); one of the regional states of Ethiopia.

Its capital city is Hawassa and is located 278 km away from Addis Ababa. The SNNPR borders Kenya to the south, South Sudan to the west, the Gambela to the northwest, and Oromia to the north and east. There are 13 zones in SNNPR with a total population of 17,887,000.

As indicated by Figure 2, Wolaita and Hadiya Zones were selected purposefully for the study. There is no community-based research previously conducted in the study area. These zones are predominantly dependent on agriculture, practicing mixed crop-livestock production, and inhabitants live in permanent settlements. Within their landholdings, community members cultivate fruits, vegetables, roots, and tuber crops (Regional health office, 2017).

3. Sampling procedures

This study used multistage sampling techniques. From 13 zones in southern Ethiopia, two zones (Wolaita and Hadiya) were selected by purposive sampling. Then, from these selected zones, two districts were selected based on a simple random sampling procedure. One district was selected from each zone. These are Humbo District from Wolaita and the Misrak Badawacho District from the Hadiya. Three villages were selected from each district by a simple random method. A census of adolescent girls was conducted at these selected Villages. Listing (census) of adolescent girls age ranges within 10–19 years was established with the help of the local government administration/woreda in particular, and more importantly from health extension workers. During the listing of adolescent girls, if more than one adolescent girl is available in one household, one of them was selected by a lottery method. Eight hundred forty-three participants were allocated to these selected six villages depending on the number of adolescent girls in each village. Participants were drawn from each village-based proportional to size (PPS) sampling techniques depending on the number of adolescent girls in each village. From these lists, 843 adolescent girls were selected by the simple random sampling method. Those adolescent girls who are not eligible for the study were excluded.

4. Sample size and sampling technique

A single population proportion formula, [$n = z\frac{\alpha}{2}^2 P (1-P) / d^2$] was used to estimate the sample size. Low prevalence of dietary diversity score (46.8%) (Melaku et al., 2017b) was used to estimate the sample size as it gives a larger sample and which can be inclusive for associated factors for dietary diversity score (second objective). Considering a 95% confidence interval (CI) and d = 0.05%, the initial sample size was 383. By adding 10% for non-respondents and a design effect of 2, the final sample size was **843**. The formula for estimation of a single population was used as follows: $n = (Z_{\alpha/2})^2 * p (1-p) DE / d^2$. Where: Z = Standard normal distribution value at 95% CI = $(1.96)^2$, DE = design effect, and d = 0.05 (5% margin of error).

All adolescent girls (in school and out of school), age within 10–19 years in Wolaita and Hadiya zones of southern Ethiopia were source population for the study. The study population was randomly selected 843 adolescent girls, age within 10–19 years in two zones of Southern Ethiopia who can fulfill the inclusion criteria. All adolescent girls, age within 10–19 years in Wolaita and Hadiya zones from southern Ethiopia who have a willingness to give assent and whose guardians/parents have a willingness to provide consent to participate in the study (for participants <18 years) and those adolescents of 19 ages provided informed consent were included.

All adolescent girls age within 10–19 years in southern Ethiopia who were with a physical disability for anthropometric measurement, mental disability who are not correctly responding for an interview were excluded from the study. In addition to these pregnant adolescent girls were excluded from the study.

5. Measurement

Dietary diversity score (DDS) was used as dependent variable while the following variables were used as independent variables:

Age, educational status of the adolescents girls, family size, religion, maternal and paternal educational and occupational status, distance from health facilities, access to nutritional counseling services in health facilities, household monthly income, source of food, shortage of food, number of meals per day, alcohol drinking, smoking, khat chewing, presence or absence of latrine, source of drinking water, malaria illness, diarrhea illness, decision-making power and breathing illness.

6. Data collection

A structured 24-h dietary recall (24 HR) interview was conducted to capture detailed information about all foods and beverages consumed by the respondent in the past 24 hours, most commonly, from early morning to the early morning of the previous day. In addition to this, a food frequency questionnaire was administered to know the usual frequency of consumption of food over 24-h time period. The food frequency questionnaire contained a finite list of foods and beverages with response categories to indicate the usual frequency of consumption. According to FAO guidelines, to reflect a better quality diet, the number of different food groups consumed was calculated and used as a proxy measure of the nutritional quality of an individual dietary diversity score (IDDS)(G. Kennedy et al., 2011).

A structured interviewer-administered questionnaire was used to collect data. The questionnaire was developed based on a thorough review of different literature.

A total of eight data collectors comprising BSc holder nurses, with previous experience of data collection and who have knowledge of culture, language, and norms of the community were employed to collect data by using a pretested structured questionnaire. In addition to these two MSc in public health holder supervisors were employed to supervise the data collection process. The collection of data was at weekends for adolescent girls who are at school during weekdays. The principal investigator controlled the overall study activities on a daily basis.

7. Data processing and analysis

First, the data were checked for completeness and consistency prior to data entry and cleaning. Then, data were entered into the computer using EP-data version 4.4.2 and exported to SPSS version 21.0 for further analysis. Descriptive statistics such as frequencies, proportions, and cross-tabulation were used to present the information. Before actual data analysis, missing value and outliers were checked by drawing histograms. In addition to this, multicollinearity was checked to find out a linear association among explanatory or predictor variables by using the variance inflation factor (VIF) assumptions. Multicollinearity refers to a situation in which two or more explanatory variables in a multiple regression model are highly linearly related. Multicollinearity

effect was assessed with a cutoff point of variance inflation factor (VIF) less than 10 and model robustness was also assessed using Hosmer and Lemeshow techniques.

Also, bivariate logistic was done to assess the association between independent and dependent variables. Variables that showed association (p-value ≤0.25) in the bivariate analysis were included in the final multivariable logistic regression model. We used the enter method during regression analysis. The odds ratio for logistic regression along with a 95% confidence interval was estimated. A P-value of less than 0.05 was considered as a level of statistical significance.

8. Data quality assurance

The questionnaire was prepared in English and then translated to Amharic and rendered back to English to keep the consistency of the questions. Data collectors and supervisors were trained for 4 days about the proper filling of the questionnaire. Data collectors were selected from each zone that can communicate by local language fluently and can understand the socio-cultural practice of the community. Pre-testing of the questionnaire was done on 5% adolescent girls in a similar area to the study sites to ensure the reliability of the data. Feedbacks from the pre-test were incorporated into the final questionnaire design. Principal investigators and supervisors checked on the spot and review all the completed questionnaires to ensure completeness and consistency of the information collected.

9. Ethical considerations

The study was approved by Addis Ababa University (AAU), College of Natural Sciences Research Ethics Review Committee. Official letter of cooperation was written to Wolaita and Hadiya zones, and districts of health offices. The nature of the study was fully explained to the study participants and parents/guardians. Informed verbal and written consent was obtained from parents/guardians for adolescent girls aged less than 18 years old and assent was obtained from the participant before the interview. Participants 18 years or older were asked to provide verbal and written consent. The collected data were kept confidential. The code number was given for each participant and the data were stored in a secured and password-protected database.

10. Operational definition

Adolescent girls- are girls whose ages within 10–19 years. Early adolescence (10–13 years), middle adolescence (14–16 years), and late adolescence (17–19 years)

Dietary diversity score—is defined as the number of food groups consumed over a 24-h period. Less than five food groups (DDS<5) are not diversified and greater than or equals to five food groups is diversified diets (DDS≥5) (Kennedy et al., 2010; G. Kennedy et al., 2011).

Individual dietary diversity score:—is defined as the average number of different food groups consumed by adolescent girls in the previous day and night. Less than five food groups (DDS<5) are not diversified and greater than or equals to five food groups is diversified diets (DDS≥5) (Kennedy et al., 2010; G. Kennedy et al., 2011).

11. Results

Eight hundred and twenty adolescent girls participated in the study (a response rate of 97.3%). The study participants included in this study were adolescent girls with age ranging from 10 to 19 years.

Socio-demographic characteristics of the study participants are shown in Table 1. The average age of the study participants was 14.6 ± 1.9 years and their average family size, 6.56 ± 1.83 persons, while 69.3% of the households had more than 5 family members. About three-fourth (70%) of the study participants are in 5–8 grade. Most of the study participants are protestant (77.2%). About 33.4% of the study participants are from households that have less than USD 31.25 monthly income (Table1).

The mean dietary diversity score of the study participants is 3.56 (±1.2). In this study,72.4% of the study participants had low dietary diversity scores. Also, Figure 3 indicates that 20.1% of the study participants

Table 1. Socio-demographic characteristics of adolescent girls in southern Ethiopia, 2019

Variable	Level	n (%)
Age of participants	10–13	228(27.8)
	14–16	497(60.6)
	17–19	95(11.6)
Educational status of participants	No formal education	4(0.5)
	1–4 grade	191(23.3)
	5–8 grade	574(70.0)
	9–10 grade	45(5.5)
	11–12 grade	4(0.5)
	College and University	2(0.2)
Religion of participants	Orthodox	281(34.3)
	Protestant	533(65.0)
	Muslim	6(0.7)
Family size	<5 family member	252(30.7)
	>5 family member	568(69.3)
Monthly income of the households	<31.25USD	274(33.4)
	31.25–62.5 USD	298(36.3)
	>62.5 USD	248(30.3)
Taking nutrition education	Yes	243(29.6)
	No	577(70.4)
Decision maker for nutrition service	Father	542(66.1)
	Mother	78(9.5)
	Mother and father	200(24.4)
Educational status of the father	No formal education	81(9.9)
	1–4 grade	61(7.4)
	5–8 grade	202(24.6)
	9–10 grade	220(26.8)
	11–12 grade	71(8.7)
	College & above	185(22.6)
Educational status of the mother	No formal education	117(14.3)
	1–4 grade	81(9.9)
	5–8 grade	346(42.2)
	9–10 grade	132(16.1)
	11–12 grade	36(4.4)
	College & above	108(13.1)

are eating only from two food groups and 36.6% are eating only from 3 food groups. Only 4.8% of the study participants are consuming from six and above food groups (Figure 3).

12. Food frequency pattern of adolescent girls

All adolescent girls (100%) in the study area were consuming foods prepared with cereals, grain, and white roots and tubers more than once times per day. Only 16.0% of the participants were consuming pulses once per day. Meat, poultry, and fish are the least frequently consumed food items as only 13.4% of adolescent girls reported having consumed those two to four times per week. Dark green leafy vegetable foods were consumed less frequently in this study group as only 19.1% of the study participants consumed from this group once per day (Table 2).

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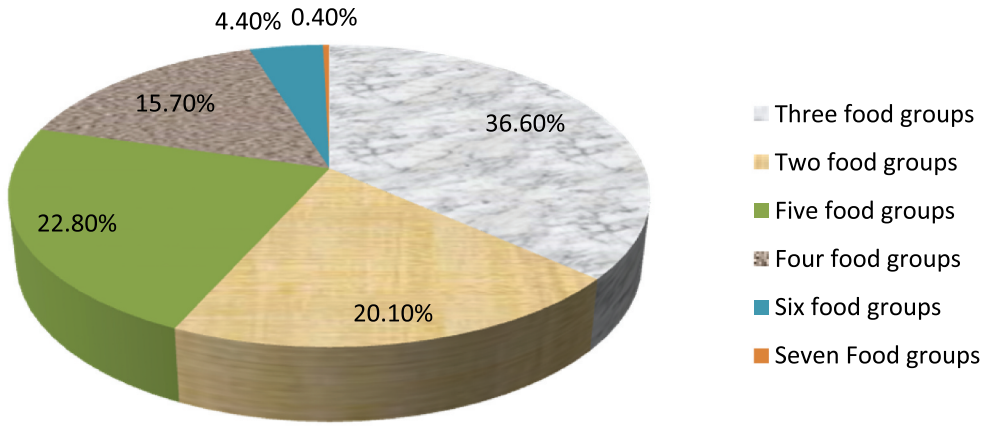

Figure 3. Distribution of dietary diversity score of the study participants.

13. Factors associated with dietary diversity

Table 3 shows association between some variables with dietary diversity score of the study participants. Dietary diversity scores of the study participants were statistically associated with families' monthly income less than USD 31.25 [AOR (95% CI) = 15.5 (8.6–28.1)] and monthly income USD 31.25–62.5 [AOR (95% CI) = 4.3 (2.9–6.5)], educational status of participant's fathers [AOR (95%CI) = 4.3 (1.8–10.6)] and mothers [AOR (95%CI) = 2.6 (1.2–5.6)], taking nutrition education [AOR (95% CI) = 2.2 (1.5–3.3)] and decision-making power of the father [AOR (95% CI) = 2.2 (1.5–3.3)] and decision-making power of the mother [AOR (95% CI) = 2.0 (1.0–3.6)].

14. Discussion

The dietary diversity score indicates the quality and adequacy of the diet that an individual consumed (Oldewage-Theron & Kruger, 2011). The present study identified the prevalence of low dietary diversity scores among adolescent girls aged 10–19 years old. About 72.4% of the study participants were not getting diversified diets. This study is almost in line with a study conducted among adolescent girls in Eastern Arsi Zone, which indicated that most of the study participants frequently consumed foods prepared from cereals and grains (Yemaneh et al., 2012).

The mean dietary diversity score of the study participants is 3.56 (±1.2), which is lower than that estimated by other studies in Bangladesh, Ethiopia, Iran, and Nigeria (Birru et al., 2018; Melaku et al., 2018; Organization, 2006; Vakili et al., 2013; Worku et al., 2017; Yemaneh et al., 2012). This is possible because our study was community-based which most likely included all adolescent girls.

In this study, the dietary diversity scores of the study participants' are significantly associated with family monthly income ($p < 0.001$). Adolescent girls who were from families who had less than 31.25 USD monthly incomes are 15.5 times more likely to have low dietary diversity scores than those who are from families whose monthly income is more than 62.5 USD. This implies that low income can affect the purchasing power of the family and this can lead to less access to food choice (Fisher, 2006; Kaufman et al., 1997). Similar findings were reported from the study conducted at Somali Regional State-Ethiopia (Engidaw et al., 2018), Ahvaz-Iran (Vakili et al., 2013), Nigeria (Ogechi & Chilezie, 2017), and Gurage Zone-Southwest Ethiopia (Worku et al., 2017) which indicated that poor economic status of the family was statistically associated with a low dietary diversity score of adolescent girls.

Low educational status of the participant's fathers is significantly associated with a low dietary diversity score of adolescent girls. Adolescent girls who are from a family whose fathers have no formal education are 4.3 times more likely to have low dietary diversity score and adolescent girls who are from families whose fathers have completed only 1–4 grades are 2.14 times more likely to have low dietary diversity scores than adolescent girls whose fathers have completed college and university. Similarly, in this study, the low educational status of the participant mothers is significantly associated with a low

Table 2. Food frequency pattern of adolescent girls in southern Ethiopia, 2019

%	Grains, white roots, and tubers	Pulses	Nuts and seeds	Dairy products	Meat, poultry, and fish	Eggs	Dark green leafy vegetables	Vitamin A-rich fruits and vegetables	Other vegetables	Other fruits	Fats and oils	Sweets and soft drinks
More than once per day	100	1.7	0.2	3.3	0.2	0.2	5.1	1.2	2.9	2.4	16.7	0.7
Once per day		16.0	6.2	10.5	3.4	3.8	19.4	13.0	17.6	12.9	19.9	7.9
5–6 times per week		27.0	9.9	20.2	3.5	5.9	31.2	23.4	34.8	25.1	15.4	12.4
2–4 times per week		31.2	18.8	29.4	13.4	25.6	30.9	37.0	28.8	41.0	14.4	22.0
Once per week		22.6	28.8	30.2	55.6	50.2	11.0	21.5	15.4	17.7	31.2	64.9
Never		1.6	36.1	6.3	23.8	14.3	2.4	3.9	0.6	0.9	2.4	0.7
Total	100	100	100	100	100	100	100	100	100	100	100	100

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Table 3. Association between some variables with dietary diversity score of adolescent girls in Southern Ethiopia, 2019

Variables	Level	<5DDS N (%)	≥5 DDS N (%)	Crude OR (CI)	Adjusted OR (CI)
Monthly income in USD	<31.25	256(31.2)	18(2.2)	19.4(11.3–33.3)**	15.5(8.6–28.1)***
	31.25–62.5	233(28.4)	65(7.9)	4.9(3.4–7.1)***	4.3(2.9–6.5)***
	>62.5	105(12.8)	143(17.4)	1	1
Educational status of the father	No formal education	72(8.8)	9(1.1)	6.8(3.2–14.4)***	4.3(1.8–10.6)**
	1–4 grade	49(6)	12(1.5)	3.5(1.7–6.9)***	2.14(1.97–4.73)**
	5–8 grade	166(2.0)	36(4.4)	3.9(2.5–6.2)***	3.0(1.74–5.2)***
	9–10 grade	157(19.1)	63(7.7)	2.2(1.4–3.2)***	1.5(0.91–2.44)
	11–12 grade	50(6.1)	21(2.6)	2.0(1.1–3.6)***	1.52(0.79–2.92)
	College & above	100(12.2)	85(10.4)	1	1
Educationalstatus of Mother	No formal education	98(12.0)	19(2.3)	6.7(3.6–12.5)***	3.2(1.5–6.8)**
	1–4 grade	63(7.7)	18(2.2)	4.5(2.4–8.7)***	2.6(1.2–5.6)*
	5–8 grade	255(31.2)	91(11.1)	3.6(2.3–5.7)***	2.3(1.3–3.9)**
	9–10 grade	100(12.2)	32(3.9)	4.1(2.3–7.0)***	2.6(1.4–4.8)**
	11–12 grade	31(3.8)	5(0.6)	8.1(2.9–22.3)***	5.3(1.8–15.4)*
	College & above	47(5.7)	61(7.4)	1	1
Taken nutrition Education	Yes	150(18.3)	93(11.3)	1	1
	No	444(54.1)	133(16.2)	2.1(1.5–2.9)***	2.1(1.4–3.1)***
Decision maker for nutrition service	Father	417(50.8)	125(15.2)	2.3(1.6–3.2)***	2.2(1.5–3.3)***
	Mother	58(7.1)	20(2.5)	2.0(1.1–3.5)*	2.0(1.0–3.6)*
	Mother and father	119(14.5)	81(9.9)	1	1
Family size	less than 5	172	80	1	1
	Greater than 5	422	146	1.34(0.97–1.86)	1.36(0.94–1.97)
Age of participants	10–13 years	175	53	0.83(0. 46–1.49)	0.63(0.33–1.203)
	14–16 years	343	154	0.56(0.33–1.95)	0.53(0.293–0.95)
	17–19 years	76	19	1	1

1 = reference category, **p-value* < 0.05, ***p-value* < 0.001 and ****p-value* < 0.0001, CI = confidence interval, OR = odds ratio

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dietary diversity score of adolescent girls. Adolescent girls who are from families whose mothers have no formal education are 3.2 times more likely have low dietary diversity score and adolescent girls who are from a family whose fathers have completed only 1–4 grades are 2.6 times more likely to have low dietary diversity scores than adolescent girls whose fathers have completed college and university. Awareness and knowledge that can improve food selection and eating behavior. In addition to this educated family has a better economic status which can lead to a quality diet. Similar findings were reported by studies conducted in Iran, Nigeria, northern Ethiopia, and Gurage-Ethiopia (Desta et al., 2019; Jemal & Awol, 2019; Nachvak et al., 2017; Ogechi & Chilezie, 2017; Wachs et al., 2005; Worku et al., 2017).

Not taking nutrition education is significantly associated with a low dietary diversity score of adolescent girls in southern Ethiopia. Adolescent girls who are not taking nutrition education are 2.1 times more likely to have a low dietary diversity score than those who are taking nutrition education. The decision-making power for nutrition service is statistically associated with a dietary diversity score of the study participants. Adolescent girls from the family whose decision-maker is a father were 2.2 and mother are 2.0 times more likely to have a low dietary diversity score than the adolescent girls who are from the family in which nutrition decisions are made by both father and mother.

Improving the awareness level towards nutrition improves dietary diversity scores. This finding is supported by studies conducted previously in different parts of Africa and Ethiopia (Kuchenbecker et al., 2017; Murendo et al., 2018; Negash et al., 2014; Tamiru et al., 2016; Yoon et al., 2000).

15. Conclusions

Low dietary diversity score is found to be a public health problem in the study area. Low family monthly income, low fathers' educational status, low mothers' educational status, not taking nutrition education and reliance on single parent decision on nutrition are the main predictors of low dietary diversity scores among adolescent girls in southern Ethiopia.

Recommendation: At all levels, adolescent girls' nutrition education should be given due emphasis to improve the dietary diversity of adolescent girls as they are tomorrow's mothers who are very important to break the intergenerational cycle of malnutrition. In addition to this, income-generating activities should be implemented to improve the economic status of the household as it affects the dietary diversity score of adolescent girls. Decision-making within the household should be implemented jointly (by both mother and father) to improve the ability to efficiently utilize resources among the household member.

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All relevant data are within the paper and its Supporting information file. English Version Questionnaire and information sheet.docx

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