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Modeling Dietary Diversity Practice and Associated Factors among Women of Reproductive Age in Aysaita Districts, Afar Region, Ethiopia: Community Based Cross-Sectional Study

Research Article

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Abstract

Background: Adequate and health diet during women reproductive age is essential for the health of both mother and new born. Dietary diversity is a proxy indicator of women reproductive age nutrient adequacy.

Objectives: This study was designed to assess the dietary diversity practice and associated factors among women reproductive age at Aysaita districts, Afar region, Ethiopia.

Methods: Community based cross-sectional study was conducted on randomly selected 422 women under reproductive age at Aysaita districts from February to March, 2020. Data was collected by using interviewer and 24 hours dietary recall methods. Data entered and analyzed using SPSS version-25. Ordinary logistic regression model was employed to assess factors associated with dietary diversity and potential factors were screened at $P<0.05$.

Results: The mean dietary diversity score was 4.17±1.112SD. About 13.0%, 78.5% and 8.5% of women reproductive age had low, medium and high dietary diversity practice respectively. Family size of male, family size of female, marital status, education level, house with window, having cell phone, bank, refrigerator, television and cart were significant factors associated with women dietary diversity practice at 5% level of significance. The odds of being "low dietary" instead of "high dietary" multiplies by OR=0.665 for each 1-unit increase in family size of female household. Odds of house with window is in low dietary rather than high dietary scores are OR=2.793 times estimated odds for house with no window's.

Concussions: Marital status, house with window, having cell phone, owner of bank account and refrigerator had a positive association with dietary diversity whereas family size, education level, having television and cart had a negative relation with women under reproductive age of dietary diversity.

Keywords: Women of reproductive age; Dietary diversity score; Chi-square test; Odds ratio.

Abbreviations: WRA: Women Reproductive Age; DDS: Dietary Diversity Score; OLRM: Ordinary Logistic Regression Model; OR: Odds Ratio; SD: Standard Deviation; CI: Confidence Interval; SPSS: Statistical Package for Social Science; DF: Degree of Freedom

Introduction

Dietary diversity is the number of individual food items or food groups consumed over a given period of time and an essential element of diet quality; consuming a variety of foods across and within food groups is associated with adequate intake of essential nutrients and promotes good health [1-3]. It also refers to an increase in the variety of foods across and within food groups capable of ensuring adequate intake of essential nutrients that can promote good health, and physical and mental development [4]. More specifically women in the reproductive age group and children are most vulnerable to malnutrition due to low dietary intakes, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos, infectious diseases, and care [5]. World health organization reported that the Dietary diversity can be ensured the improvement for the quality of complementary food that has been cited as one of the cost effective strategies for improving health, reducing morbidity and mortality of young children [6]. Maternal dietary diversity is a proxy indicator of maternal nutrient adequacy and improves health outcomes for both mothers and babies. Multiple micronutrient deficiencies remain a major public health concern in low-income and middle-income countries (LMICs) especially among reproductive women and an increase in dietary diversity is associated with socio-economic status and household food security [7,8].

Source of dietary was different across the world due to accessibility of agricultural outcome, socioeconomic status and cultural practice of the community. In 2010 Food and Agricultural Organization (FAO) reported that about three-quarters of diversity found in agricultural crops have been lost over the last century, and this erosion continues. About 90% of our food energy and protein comes from only 15 plant and 8 animal species, with alarming consequences for nutrition and food security [9]. In Ethiopia foods that most households consumed was cereals(barley, sorghum, wheat, rice) which is estimated to 90% of weekly consumption at least one of these cereals used in six of the last seven days. In addition, the country households were experienced 60% low dietary diversity and 40% medium diet dietary diversity scores [10,11].

A large health burden can be caused due to deficiencies of Marco and micronutrients which was imposed lost productivity, increased susceptibility to diseases, impaired growth and development whereas intake of high diverse diets has been associated with lower rates of malnutrition [12,13]. The prevalence of malnutrition among women of childbearing age were estimated as 15% are underweight and 35% are overweight approximately across worldwide [14]. The dietary diversity scores prevalence was different across regions of Ethiopia including our study area. This confirmed with study conducted in Addis Ababa which reported household had 5.9% low, 60.4% medium and 33.7% high [15], in Ahmara region 11.8% low, 67.2% medium and 21% high [11] ,South Ahmara 65.7% low and 34.3% high [16] and SNNPR 41.9% low, 48.5% medium and 9% high where High proportion of the households consumed vegetables (87.5%) and cereals (78.7%) [17]. Another study in Tanzania reported that more than 80% of the population were produce fruits and vegetables for consumption to increase dietary diversity [18,19].

Dietary diversity has a number causes, with the most potential significant cause on the malnutrition. Several previous researcher suggested some socio demographic factors and clinical factors that associated to dietary diversity among pregnant women [20-23], children under five years [24-30] and households [11,15-17,31,32], still little have been done regarding women under reproductive age which is base stage for fertility in human beings. However, A cross sectional study in Kenya reported that household gender, education level, age and family size were significantly associated with dietary diversity of women under childbearing in high agricultural potential areas [33]. In Ethiopia, Most of the women in the reproductive age group were consuming a diverse diet and those subjects with better dietary diversity score had their body mass index in the normal range [34]. Women of reproductive age (15-49) years old are particularly vulnerable because of their greater micronutrient needs [35]. In low income country like Ethiopia where resource is limited low quality, monotonous diets were the norm. large proportion of women (98.3%) based on monotonous food type whereas only 10.2% were found in the high dietary diversity score (DDS >6) means eating more than six food groups from ten in addition to very low consumption of essential micronutrients rich foods such as Vitamin A and Iron [36].

Several studies conducted using cross sectional study design in Ethiopia which did not cover whole the geographical regions and administrative city. Ethiopia has nine administrative regions and two administrative city that exercised different norm, culture and multi-ethnic

setting Some researcher used binary logistic regression and multiple regression to examine the effect of covariates on the dietary diversity practice of women which restricts the chronological order of dietary diversity (low, medium and high) among women under reproductive age when it have ordinal nature. However, this study employed ordinary logistic regression model that permit analyzing chronological prevalence of dietary diversity practice of women under childbearing age which used to examine the association between independent factors and dietary diversity score in Aysaita Districts of Afar region using community based cross-sectional study design.

Methods and Materials

Study area description

The study was conducted in Aysaita woreda in zone-1(Awsi Rasu), Afar Region north eastern Ethiopia. The zone is located in the northern part of the region and about 65km from the main town of the region (Samara) and 655km the north east of Addis Ababa the capital city of Ethiopia. This woreda is bordered by Afambo, Dubti and Awash River which separates it from Elidar of Afar Region on the South, West and north respectively whereas bordered by Djibouti government on the East. The zone is subdivided in to 13 kebeles from those 11 are rural and the remaining are urban. The woreda has latitude and longitude of 11˚34N 41˚26E and an elevation of 300m. The dominant practice of woreda was pastoral and agro-pastoral system of livestock production. The mean temperature is between 30˚C and 45˚C per annum Afar National regional state report [37]. (Figure 1) Depicted that the map of study area location.

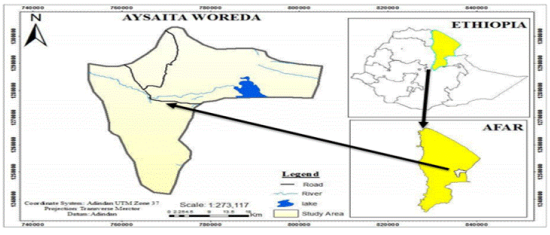

Figure 1: Changes in Mean Facial (± S.E.) Width-to-Height Ratios of Major League Baseball Players Active 1870-1989.

Study design and period

A community based cross sectional study was conducted in February to March, 2020 among women under reproductive age (15-45) years that enrolled in nutritional status and its determinants whereas women below 15 years were excluded. This makes the sample size was 422 for Women in childbearing age.

Study population, sample size and sampling procedure

The study considered all women under reproductive age found in Aysaita woreda at Afar Regional state and selects a sample following the laws of the statistical theory of sampling that help to make valid inferences about the population based on the data obtained from the sample which ascertain the degree of accuracy of the results. Single population proportion was used to compute Sample size and the total sample size required (N)= n+non-response of respondents. Assuming 95% confidence interval with 5% margin of error, $Z_{\alpha/2}$=1.96 and 10% probability for non-response rate. We obtained $n=\frac{Z^2_{\frac{\alpha}{2}} pq}{d^2}$ where p is the prevalence of the attribute (51.4%) taken from previous research done in Addis Ababa[38].

$$n=\frac{1.96^2 * 0.514 * (1-0.514)}{0.05^2}=384$$

Then, the sample (n)=384+non response rate (0.1x384)=422**.** Probability type of systematic sampling technique was used to get the study participants. The researcher was divided proportionally the sample size among the two kebeles to obtain a total number of childbearing women in the woreda and simple random sampling was employed during interview to select population size in each kebeles. Finally, the sample size was 422 in this study.

Data collection and measurements

Primary data were collected for this study using self-administrative questionnaires.in procedure we followed the Food and Agriculture organization of United Nations definition of dietary diversity score which stated it as a qualitative 24-hour recall of all the food and drinks consumed by respondents (if measured at individual level) or any other household member (if measured at household level) [39]. One day recall time is subject to less recall error than a week or month recall period which in-lined with many studies in dietary diversity [40]. Likewise, the dependent variable considered in the study was women dietary diversity score that calculated from a 24 hour recall of women's nutritional status. Based on food items consumed in the past 24 hour, women were assigned the number of food groups they used, ranging from 0 to 8 or a score of 1 was given to each food groups consumed that

attained maximum values of 8 points for women dietary diversity score. Then, according to sample of Food and Agriculture Organization [39], recommendation, women were classified into three groups:- ≤ 3 Food groups as low dietary diversity, 4-5 food groups as medium dietary diversity and ≥ 6 as high dietary diversity.

Based on the reviewed literature and the aims of current study we considered socio-demographic characteristics of women under reproductive age such as gender, household head, family size of male, family size of female, age, religion, educational status, relationship with child, ever attended school, occupation, ethnicity, number of room in house, kind of house, house window, having electric power, marital status of the household head were considered as independent variables. Moreover, women were interviewed they had their own radio, mobile, bank account, refrigerator, television and cart to know they are accessible with such technological device in-lined to dietary diversity.

Operational definitions

- Dietary diversity can be defined as the number of different food groups consumed by an individual over 24-hours.
- Food groups are a collection of foods that contain a similar mix of nutrients.
- Inadequate dietary diversity: When women have low dietary diversity related to the standard recommendations**.**

Minimum dietary diversity is the consumption of four or more food groups from the seven defined food groups for higher dietary quality and to meet basic nutritional needs [41].

Healthier consumption pattern is consumption pattern with higher factor loading for food items strongly recommended by WHO to be consumed by women, particularly all the five major food groups (vegetables, fruit, meat, milk (dairy) and egg).

Household is an individual who comprise a family unity and who live together under the same roof.

Household size is the number of a person living together in one house.

Statistical data analysis

In current study, data were entered in Excel and exported to SPSS version-25 for further analysis. Frequency and percentages of each variable was calculated and displayed using tables. Descriptive measures for continuous variables were calculated and their normality distributions were checked. Chi-square test of association and ordinary logistic regression were employed to assess the potential determinants of dietary diversity of women and predict the dietary diversity score.

Chi-square test of association

In the chi-square test, the null hypothesis makes a statements concerning how many cases are to be expected in each category if the null hypothesis if correct. It is based on the differences between the observed and the expected value of each category. The chi-square statistic is defined as:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \quad [1]$$

Where O_i is the observed number of cases in category i, and E_i is the expected number of cases in category i. The chi-square test used in this study to know the association between socio-demographic variables, food groups and dietary diversity of women. In addition, goodness of model also checked by applying chi-square test.

Logistic regression

Regression is a statistical procedure which attempts to predict the values of a given variable, (termed the dependent, outcome, or response variable) based on the values of one or more variables (called independent variables, predictors, or covariates). Regression analysis is model building for the relationship between a dependent and one and/or more independent variables. In the regression if the response variable is continuous we can use the usual linear regression model whereas when the response variable is discrete, taking on two or more possible values the appropriate regression model is logistic regression which was proposed as alternative method in the late 1960s and early 1970s [42]. The problem of non-normality and heteroscadasticity lead to the model estimation method to be maximum likelihood after natural logarithm transformation of the odd ratio of the response because in logistic the relationship between the response with the set of explanatory variables is not linear hence the procedures used in the linear regression is extended to logistic regression. Logistic regression models are classified according to the type of categories of response variable as follows:-binary logistic regression

model, multinomial logistic regression model and ordinal logistic regression models [43]. The binary logistic regression model is used to model the binary response variable, whereas the multinomial logistic regression is a simple extension of the binary logistic regression model where the response variable has more than two unordered categories. Ordinal logistic regression models are used to model the relationship between independent variables and an ordinal response variable when the response variable category has a natural ordering, this employed in current study.

Ordinary logistic regression

Ordinal logistic regression is an extension of binary logistic regression for analyzing ordinal response variable having more than two categories by considering the ordering of the response variable categories. This model is used to describe the relationship between an ordered categorical response (dependent) variable and one or more explanatory (independent) variables. There are different types of ordinal logistic regression models, the most commonly used are: the adjacent-category, the continuation-ratio, the proportional odds models, the unconstrained partial-proportional odds model, the constrained partial-proportional odds model [43].

Proportional odds model

Proportional Odds Model is used for modeling the response variable that has more than two levels with K set of explanatory variables by defining the cumulative probabilities, cumulative odds and cumulative logit for the J-1 categories of the response, this model simultaneously use all cumulative logits. A random sample is drawn from the joint distribution of (Y, X'), where Y is an ordinal response and X'=(X_1, X_2 - - -, X_n) is a vector of independent variables. Let $\pi_j(X')$ denote the classification probabilities Pr(Y=j/X') of response variable Y,j=1,2, - - -, k at any value X'=(X_1, X_2, - - -, X_n) for a set of explanatory variables X_1, X_2, - - -, X_s. The cumulative probability can be given as:- $\pi_j(X) = p(Y \le j / X) = P_1 + P_2 + P_3 + \ldots + P_j.$ for j=1,2, - - -,J-1. $\Pi_j(X)$ is the probability of being at or below category j given that k set of predictors [43]. The odds of the cumulative probabilities of the response variable for the J-1 categories:-

$$odds\left[\pi_j(X)\right] = \frac{\pi_j(x)}{1-\pi_j(x)}, j = 1,2,\ldots,J-1. \quad [2]$$

The logarithm of the odds first j-1 cumulative probabilities

$$\ln(odds\left[\pi_j(X)\right]) = \ln\left(\frac{\pi_j(x)}{1-\pi_j(x)}\right), j = 1,2,\ldots,J-1. \quad [3]$$

The relationship between the response variable and the set of predictors is not linear in ordinal logistic regression model. The logistic regression function uses the logit transformation of $\pi_j(X)$ cumulative probabilities of the response,

$$\tau_j(X) = p(Y \le j / X) = \frac{\exp(\alpha_j - (\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k))}{1 + \exp(\alpha_i - (\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k))} \quad [4]$$

Likewise the transformation of equation [4] to the logit for the matter of interpretation ordinal logistic regression result can be as follows:-

$$\log it\left[P(Y \le j / X\right] = \alpha_j - \sum_{j=1}^{J-1} \beta_j X_j, j = 1,2,\ldots,J-1. \quad [5]$$

Equation [5] is called the proportional odds model (POM) to predict cumulative logits across J-1 response categories. This model estimates ln (Odds) of being at or below the j^{th} category and assume that there is a linear relationship between the logits and the parallel regression lines and hence, this model estimates simultaneously multiple equations of cumulative probability. The model is solved for each category of the dependent variable except the last category.

In the model each logit has its own α_j term called the threshold value and their values do not depend on the values of the independent variables and the β_k's are the logistic regression coefficients and the estimated values of these parameters show the direction and the strength of the relationship between the explanatory variables and the logit (log odd) of the dependent variable. The result is interpreted as the effect (more likely and less likely) of the estimated category of the independent variables relative to the reference category on the log odds being in higher levels of the categories of the dependent variable.

Wald test for a single predictors

The Wald test is used to see the significance of a single explanatory variable in the model. The Wald test statistic is the square of the ratio of the estimated coefficient to its

standard error and is defined as: $W=\left[\frac{\hat{\beta}}{SE(\hat{\beta})}\right]^2$ Under the null hypothesis H_0: $\beta_i = 0$, i= 1,2, - - -, k and W has a chi-square distribution with one degree of freedom.

Goodness-of-fit measures

In this study the goodness of fit measure was used to assess how well a model fit the data. To check the goodness of fit Pearson chi-square and deviance goodness of fit were employed which compare the observed and expected values having chi-square distribution with n-p degrees of freedom. Both goodness-of-fit statistics should be used only for models that have reasonably large expected values in each cell. The model fit the data well when the test value of Statistic is small and the observed significance level being large. The researchers fail to reject the null hypothesis that the model fits the data well when the observed significance level for the statistic is large since good models have large observed P-values.

Results

Demographic and socio-economic characteristics of women of reproductive age factors

A total of 422 sampled women under reproductive age (WRA) of dietary diversity at Aysaita districts, Afar regional state were used. Of the total about 222(52.6%) of them were lived in 01 Kebele and the remaining 200(47.4%) were lived in 02 Kebele, The summarized WRA of dietary diversity information in (Table 1) reveals that the proportion of household headship with respect to their gender categories of male and female headship were 87.4% and 12.6% respectively. The distribution of WRA based on their relationship with their child shows that 401(95.0%) were biological from their mother and the rest 21(5%) child were do not give birth from their mother.

Most of the women (83.6%) were not attended school in the districts. Similarly, the distribution of women's education level revealed that 361(85.5%) had no education, 21(5.0%) primary school, 17(4.0%) secondary school and the remaining 23(5.5%) were higher education. Regarding marital status of women about 23(5.5%) single, 369(87.4%) married, 22(5.2%) divorced and the rest 8(1.9%) were widowed as indicated in (Table 1).

The study revealed that there was an association between the dietary diversity practice of women and their predictors. As a result of chi-square test of association showed kebela, household head, relationship with your child, attending school, marital status, education level, current occupation, kind of house, house with window, electric power, having mobile phone, bank account number, refrigerator, Television and cart were statistically significant relationship with dietary diversity of women at 5% level of significance. This implies the presence those factors have effect to change the status of dietary diversity practice for women in the reproductive age Table 1.

Table 1: Demographic and socio-economic characteristics of women of reproductive age at Afar region, Aysaita districts

Variable	Categories	Count (%)	Chi-square (P-value)
Kebela	01 Kabela	222(52.6)	104.521(0.000)*
	02 Kabela	200(47.4)	
Household head	Male headed	369(87.4)	20.206(0.000)*
	Female headed	53(12.6)	
Relationship with your child	Biological mother	401(95.0)	11.955(0.003)*
	Did not give birth	21(5.0)	
Attended School	Yes	69(16.4)	65.921(0.000)*
	No	353(83.6)	
Marital Status	Single	23(5.5)	27.258(0.000)*
	Married	369(87.4)	
	Divorced	22(5.2)	
	Widowed	8(1.9)	
Education Level	No education	361(85.5)	71.987(0.000)*
	Primary school	21(5.0)	
	Secondary school	17(4.0)	
	Higher education	23(5.5)	
Current Occupation	Daily laborer	17(4.0)	72.553(0.000)*
	Farmer	3(0.7)	
	Government employer	18(4.3)	
	House wife	369(87.4)	
	Merchant	15(3.6)	
Religion	Orthodox	16(3.8)	9.038(0.060)
	Muslim	405(96.0)	
	Protestant	1(0.2)	
Ethnicity	Amahara	28(6.7)	8.370(0.398)
	Tigray	3(0.7)	
	Oromo	4(0.9)	
	Afar	386(91.5)	
	Welayta	1(0.2)	
Kind of House	Finished floor	84(19.9)	42.928(0.000)*
	Rudimentary	338(80.1)	
House of Window	Yes	370(87.7)	17.128(0.000)*
	No	52(12.3)	
House of Electricity	Yes	370(87.7)	17.128(0.000)*
	No	52(12.3)	
Radio	Yes	220(52.1)	7.644(0.022)*
	No	202(47.9)	
Mobile phone	Yes	257(60.9)	40.755(0.000)*
	No	165(39.1)	
Bank account	Yes	244(57.8)	50.087(0.000)*
	No	178(42.2)	
Refrigerator	Yes	109(25.8)	85.975(0.000)*
	No	313(4.2)	
Television	Yes	137(32.5)	49.603(0.000)*
	No	285(67.5)	
Cart	Yes	29(6.9)	12.999(0.002)*
	No	393(93.1)	

Measures of central tendency for continuous variables

The mean age of the women under reproductive age was 36.53±7.667 standard deviation. In regard to family size in male and female, the average size was approximately 3 people, with 2.28±1.138 SD and 2.04±0.914 SD with the range of 0-5 and 1-5 family size was presented respectively. The average number of room in house used for WRA was 1.20±0.400 SD with the range of 1-2 room(s) per household Table 2.

Table 2: Descriptive Statistics for continuous variables of WRA at Afar region, Aysaita districts

Variable	Minimum	Maximum	Mean	SD
Age	15	49	36.53	7.667
Family size of male	0	5	2.28	1.138
Family size of female	1	5	2.04	0.914
No. of room in your house	1	2	1.20	0.400
Dietary diversity score	1	8	4.17	1.112

Distribution of 24 hours dietary diversity score of the women reproductive age

Out of 14 food groups, the study found the mean of DDS was 4.17±1.112 SD with scores ranging from 1 to 8 food groups (Table 2). Based on the categories developed, about 13.0% of the participants were in the low diversity category (≤3 food groups), 78.5% of respondents had a medium dietary diversity score (4-5 food groups) and 8.5% of the participants were in the high diversity category (≥6 food groups).

The most commonly eaten food groups were grains 100% and vegetables and beans or peas were the second and the third most eaten food groups of 90.5% and 78.0% were presented respectively. Notably, the vegetables or roots and other types of meat or poultry were minimally consumed 2(0.5%) and 3(0.7%). Likewise, meat made from animal organs, fish or sea food whereas fresh or dried and nuts or seeds were totally not consumed food groups (Figure 2). As the test result revealed in Table 3, one sample t-test shows that all food groups were statistically significant (P<0.05).

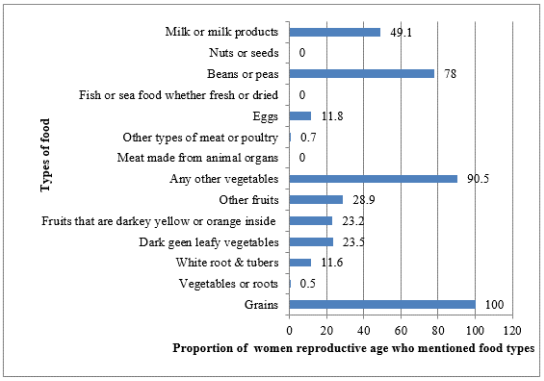

Figure 2: Proportion of types of foods they use to make their diet more diversified.

Proportion of women under reproductive age who used food types

Grains were every day consumed food groups among the fourteen food groups in 24 hours prior to the data collection day. Any other vegetables were the most consumed food groups among the fourteen food groups in 24 hours prior to the data collection day.

The majority of women reproductive age was 382(90.5%) responded that they ate foods prepared from any other vegetables. The minority of women reproductive age were 2(0.5%) and 3(0.7%) responded that they ate foods prepared from vegetables or roots and other types of meat or poultry. While, meat made from animal organs, fish or sea food whereas fresh or died and nuts or seeds were totally not consumed food groups.

Table 3: Proportion of WRA consuming items from 14 foods groups over the previous 24 hours

Food group	Categories	Frequency (%)	Mean ± SD	One sample t- test (P-value)
Grains	Yes	422(100.0)	1.00±0.000	-
	No	-		
Vegetables or roots	Yes	2(0.5)	2.00±0.069	446.715(0.000)*
	No	420(99.5)		
White root and tubers	Yes	49(11.6)	1.88±0.321	88.634(0.000)*
	No	373(88.4)		
Dark green leafy vegetables	Yes	99(23.5)	1.77±0.424	61.272(0.000)*
	No	323(76.5)		
Fruits that are dark yellow or orange inside	Yes	98(23.2)	1.77±0.423	61.604(0.000)*
	No	324(76.8)		
Other fruits	Yes	122(28.9)	1.71±0.454	54.805(0.000)*
	No	300(71.1)		
Any other vegetables	Yes	382(90.5)	1.09±0.293	41.663(0.000)*
	No	40(9.5)		
Meat made from animal organs	Yes	-	2.00±0.000	-
	No	422(100.0)		
Other types of meat or poultry	Yes	3(0.7)	1.99±0.084	364.598(0.000)*
	No	419(99.3)		
Eggs	Yes	50(11.8)	1.88±0.324	87.711(0.000)*
	No	372(88.2)		
Fish or seafood whereas fresh or dried	Yes	-	2.00±0.000	-
	No	422(100.0)		
Beans or peas	Yes	329(78.0)	1.22±0.415	35.659(0.000)*
	No	93(22.0)		
Nuts or seeds	Yes	-	2.00±0.000	-
	No	422(100.0)		
Milk or milk products	Yes	207(49.1)	1.51±0.501	41.433(0.000)*
	No	215(50.9)		
Dietary Diversity (Dependent variable)	≤3	55(13.0)		
	4-5	331(78.5)		
	≥6	36(8.5)		

The majority of women reproductive age was 382(90.5%) responded that they ate foods prepared from any other vegetables. The minority of women reproductive age were 2(0.5%) and 3(0.7%) responded that they ate foods prepared from vegetables or roots and other types of meat or poultry. While, meat made from animal organs, fish or sea food whereas fresh or died and nuts or seeds were totally not consumed food groups.

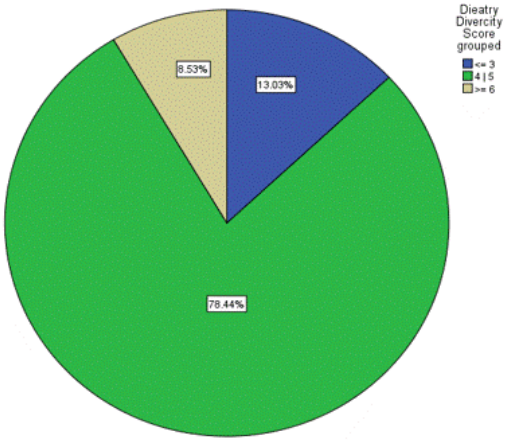

Figure 3: Proportion of dietary diversity of women reproductive age.

From the total of 422 dietary diversity of women reproductive age participants about 55(13.0%) were group under low diversity category (≤3 food groups), 331 (78.5%) were medium diversity category (4-5 food groups) and 36(8.5%) were high diversity category (≥6 food groups) Figure 3.

Results of ordinary multivariate logistic analysis

In this study, ordinary logistic regression model (OLRM) was utilized to handle the effect of the dietary diversity among women reproductive age (15-49) years. This model some time called with Base-Line Cumulative Logit (BCL) or Cumulative Logit Models (CLM), can have quantitative and qualitative predictors, intercept terms, etc. Multi-category logit models, Y has J categories, J>2. Extensions of likelihood ratio test for nominal and ordinal Y assume a multi-nominal distribution for Y.

OLRM was applied to explore the net effect of demographic and socio-economic variables on dietary diversity scores among women reproductive age committed by intimate family. The deviance Chi-square test $G^2 = (D = 763, P = 1.000)$ depicts significance value of 1.00 which is greater than 0.05, this implies that the model adequately fits the data (Table 4). Therefore, one can conclude that there is no statistically significant difference between the observed number and the number predicted by the OLRM adopted in this study. The Cumulative Logit Model (CLM) has form: $\text{logit}[P(Y \le j)] = \alpha_j + \beta_j x_j$; where, j=1,2, 3; i=1,2,3,4.

The contingency table data so can test goodness of fit. The deviance is the likelihood ratio test statistics for testing that all parameters not in the model equal to zero. Deviance= G^2 =299.617, df=763, P-value=1.000 for H_0: model holds with linear trends for all explanatory variables.

The explanatory variables can be both qualitative and quantitative variables in this model where last categories of the qualitative variables were taken as reference category to interpret the findings of the analysis. In this analysis there were included two quantitative and eight qualitative variables were statistically significant (P<0.05), where at least one of their categories could negatively or positively influence dietary diversity among women reproductive age. The significant explanatory variables suggested by the model are family size of male, family size of female, marital status, education level, window, cell phone, bank, refrigerator, television and cart (P<0.05).

The estimated odds of being "low dietary" instead of "high dietary" multiplies by [OR=0.576, 95% CI: (0.377, 0.879)] for each 1-unit increase in family size of male household. The odds of being "low dietary" instead of "high dietary" multiplies by [OR=0.665, 95% CI: (0.448, 0.988)] for each 1-unit increase in family size of female household. The estimated odds of a married status response is in low dietary rather than high dietary diversity scores are [OR=294195.561, (CI: 1.669, 51842701505)] times estimated odds for windowed response. The odds of

Table 4: Multivariable analysis of dietary diversity of WRA at Afar region, Aysaita districts

Variables	Categories	$\hat{\beta}$	S.E($\hat{\beta}$)	Wald	Df	P-Value	Exp($\hat{\beta}$)	95% C.I for Exp($\hat{\beta}$)	
								Lower	Upper
F. Size Male		-0.552	0.216	6.548	1	0.011*	0.576	0.377	0.879
F. Size Female		-0.408	0.202	4.065	1	0.044*	0.665	0.448	0.988
Marital Status (Windowed (Ref.))	Single	18.203	853.490	0.000	1	0.983	80438220.46	0	0.000
	Married	12.592	6.163	4.174	1	0.041*	294195.561	1.669	51842701505
	Divorce	-2.897	1.744	2.760	1	0.097	0.055	0.002	1.684
Education (Higher ed. (Ref.))	No education	-2.736	1.365	4.018	1	0.045*	0.065	0.004	0.941
	Primary school	-3.632	1.255	8.382	1	0.004*	0.026	0.002	0.309
	Secondary school	-3.717	1.256	8.763	1	0.003*	0.024	0.002	0.285
Window	Yes (No((Ref.))	1.027	0.458	5.035	1	0.025*	2.793	1.138	6.853
Cell phone	Yes (No((Ref.))	2.996	0.573	27.370	1	0.000*	20.005	6.507	61.503
Bank account	Yes (No((Ref.))	4.255	0.745	32.604	1	0.000*	70.457	16.359	303.445
Refrigerator	Yes (No((Ref.))	2.464	0.853	8.343	1	0.004*	11.752	2.208	62.545
Television	Yes (No((Ref.))	-3.386	0.867	15.238	1	0.000*	0.034	0.006	0.185
Cart	Yes (No((Ref.))	-7.171	1.076	44.425	1	0.000*	0.002	0.001	0.006
Pearson Test		Chi-square			Df			Sig.	
		1983.645			763			0.000*	
Deviance Test		299.617			763			1.000	

DF: Degree of Freedom; CI: Confidence Interval; REF: Reference Category*: Significant at 5% level of significance; F: Family

an education level is in low dietary rather than high dietary diversity scores are [OR_1=0.065, OR_2=0.026 and OR_3=0.026] times estimated odds for higher education.

The estimated odds had a window's response is in low dietary rather than high dietary scores are [OR=2.793, (CI: 1.138, 6.853)] times estimated odds for had no window's response. The odds had a cell phone's is in low dietary rather than high dietary scores are [OR=20.005, (CI: 6.507, 61.503)] times estimated odds for had no cell phone's. The odds had a bank account's is in low dietary rather than high dietary scores are [OR=70.457, (CI: 16.359, 303.445)] times estimated odds for had no bank account's. The estimated odds had a refrigerator's for household user is in low dietary rather than high dietary scores are [OR=11.752, (CI: 2.208, 62.545)] times estimated odds for had no refrigerator's for household user. The odds had a television's access is in low dietary rather than high dietary scores are [OR=0.034, (CI: 0.006, 0.185)] times estimated odds for had no television's access. The estimated odds had a cart's response is in low dietary rather than high dietary scores are [OR=0.002, (CI: 0.001, 0.006)] times estimated odds for had no cart's response Table 4.

Discussion

In the current study, about 13.0% of the women reproductive age had consumed ≤3 food groups (low diversity diversity), 78.5% of WRA had consumed 4-5 food groups (medium dietary diversity) and whereas 8.5% of the WRA had consumed ≥6 food groups (high diversity diversity) in the last 24 hours. This prevalence was higher than the study done in Laikipia, Kenya (61%)[21], and higher than studies done in South Africa (25%) [44] and Gondar, Ethiopia (16.2%) [45]. This discrepancy might be due to difference in study period, geographical area, and/or socio-cultural factors.

In this study, almost all or 100% and 90.5% of the women reproductive age had consumed grains, and vegetables respectively in the previous 24 hours and 0.5% of them had not consumed vegetables or roots products in the previous 24 hours. This finding is almost consistent with the finding of other studies conducted in Laikipia, Kenya [21], and Southern Ethiopia [45]. Furthermore, many studies in developing countries have documented that their dietary sources are mainly cereal based [46].

The variables such as family size of male, family size of female, marital status, education level, window, cell phone, bank account, refrigerator, television and cart also showed a strong association in the ordinary logistic regression model analysis. This finding is also supported by studies elsewhere [20]. This might be related to personal income because dietary diversity increases as asset levels increases [45].

Reproductive age among women who had cell phones in lower dietary diversity rather than higher dietary diversity were more than twenty times more likely than their counterparts who did not have phones. This finding is supported by studies done in South Gondar, Ethiopia [20].

The odds who had a television's is in low dietary rather than high dietary are [OR=0.034, (CI: 0.006, 0.185)] times estimated odds who had not television'. This might be attributed to access to information through local broadcasting media, which broadcasts nutrition and health messages as a means of advocating. Having a bank account/savings is also significantly associated with dietary diversity. The odds who had a bank account's is in low dietary rather than high dietary diversity are [OR=70.457, (CI: 16.359, 303.445)] times estimated odds who had no bank account's. This is consistent with a study conducted in Limpopo Province, South Africa where households with low dietary diversity were also the most impoverished, and fewer households had money in a savings account [47], and scores for dietary diversity have been shown to be linked to socioeconomic characteristics [19]. The estimated odds had a refrigerator's for household user is in low dietary rather than high dietary scores are [OR=11.752, (CI: 2.208, 62.545)] times estimated odds for had no refrigerator's for household user. The estimated odds had a window's response is in low dietary rather than high dietary scores are [OR=2.793, (CI: 1.138, 6.853)] times estimated odds for had no window's response. The estimated odds had a cart's response is in low dietary rather than high dietary scores are [OR=0.002, (CI: 0.001, 0.006)] times estimated odds for had no cart's response.

The estimated odds of being "low dietary" instead of "high dietary" multiplies by [OR=0.576, 95% CI: (0.377, 0.879)] for each 1-unit increase in family size of male household. The odds of being "low dietary" instead of "high dietary" multiplies by [OR=0.665, 95% CI: (0.448, 0.988)] for each 1-unit increase in family size of female household. The odds of an education level is in low dietary rather than high dietary diversity scores are [OR_1=0.065, OR_2=0.026 and OR_3=0.026] times estimated odds for higher education. Note that educated and family size of

women assign a significantly more substantial proportion of their household food budget to nutritious foods [48, 49]. This is mainly because educated and family size of women tends to have greater awareness and understanding of nutritional health benefits [50]. Moreover, an educated and family size of women is an empowered of women.

The estimated odds of a married status response is in low dietary rather than high dietary diversity scores are [OR=294195.561, (CI: 1.669, 51842701505)] times estimated odds for windowed response. The studies of scores for dietary diversity have been shown to be linked to socioeconomic characteristics [51].

Conclusions

The mean dietary diversity score among women reproductive age was 36.53 and 13.0%, 78.5% and 8.5% of women reproductive age had low, medium and high dietary diversity practice was presented respectively. Almost all eaten food groups were grains 100% and vegetables and beans or peas were the most commonly eaten the second and third most eaten food groups of 90.5% and 78.0% were presented respectively. Notably, the vegetables or roots and other types of meat or poultry were minimally consumed 0.5% and 0.7%. Likewise, meat made from animal organs, fish or sea food whereas fresh or dried and nuts or seeds were totally not consumed food groups. Hence, family size of male and female, marital status, education level, having cell phone, bank account, refrigerator, television and cart were strongly associated with dietary diversity practices of women under reproductive age at Aysaita districts of Afar Regional state, Ethiopia.

Limitations of the study

In this study there are some limitations. Food availability in the household might vary with the seasons which affect dietary diversity and the assessment of dietary intake depends on the 24-hour recall method, which may not accurately reflect their past feeding experience. Moreover, the nature of this study was a cross-sectional design, which does not show the cause and effect relationship.

Ethical Approval and Consent to Participate: Viral Consent with Department of Statistics, Haramaya University, Ethiopia.

Availability of Data and Materials: The primary source of data was collected on women reproductive age between 15-49 years old at Aysaita districts, Afar regional state, Ethiopia.

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Author Contributions: WS developed the original draft preparation, validation, conceptualization; Both AA & WS were participated in data collection and data management. AA was analysis data, interpretation and report writing.

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