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Nutritional Status and its Associated Factors Among Adolescents of Public Schools in Vyas Municipality, Tanahun, Nepal

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Abstract

Background: *Adolescent is a critical growth period in the human lifecycle. Nutrition is an essential component of human life as it provides energy to the body in order to perform functional activities. Nutrition is very important for everyone, but it is especially important for children because it is directly linked to all aspects of their growth and development. Good nutrition leads to good health of the adolescent.*

Methods: *A cross-sectional study was conducted in public schools of Vyas municipality among 313 adolescents (12-16 years of age). Data were collected using pre-tested structured self-administered questionnaire. Data was entered in Epi-data software and transferred into SPSS for analysis. The nutritional status was assessed by anthropometric methods (height, weight). WHO AnthroPlus Software was used to convert anthropometry data into z-score. Binary logistic regression was applied to identify the factors associated with nutritional status. Ethical approval was taken from from Institutional Review Committee of Pokhara University and written informed consent was taken from each participant.*

Results: *The prevalence of stunting and thinness were found to be 8% and 8.9% respectively. Findings from multivariate logistic regression showed that middle adolescents (AOR= 4.227, 95% CI= 1.423-12.551), roti consumption 4-7 days per week (AOR= 4.554, 95%CI= 1.289-16.089) were associated with stunting. Similarly, milk and milk products consumption 1-3 days per week (AOR= 6.978, 95%CI= 1.965-24.780) was associated with thinness.*

Conclusion: *Stunting and thinness were common among school adolescents in the study area. Age, father's education, roti consumption per week and means to come school were the factors associated with stunting. Similarly, factors like father's occupation, fish consumption and milk and milk products consumption per week were associated with thinness. Strategies to improve nutritional status of adolescents should be given much attention. Further large-scale research should be conducted for determining the situation of the district and all over the country.*

Keywords: Adolescents, Nutritional Status, Associated Factors, Nepal.

Introduction

Adolescence is a period of life ranging from 10 to 19 years old which is the transition from dependent childhood to independent adulthood [1]. Nutritional status is now recognized to be a prime indicator of the health of individuals. The enhancement of human health is the ultimate goal of nutritional assessments [2]. It is a crucial period in a person's life cycle that has a significant impact on their physical, psychological, and cognitive development [3]. Malnutrition, which includes both undernutrition and overnutrition, is one of the major health problems impacting children, particularly in low- and middle-income countries [4]. Adolescents are in a vulnerable group for malnutrition and its

consequences, because it is a dynamic period of physical growth and mental development [5].

Malnutrition continues to be a serious public health problem and has for a long time been recognized as a consequence of poverty. Early childhood malnutrition is linked to serious functional impairment in adulthood, reduced work capacity, and declining economic productivity [6]. Children with low levels of nutrition suffer from development impairments both physically and mentally. This results in low grades, low school attendance, higher unpunctuality rates and an increased ratio of diseases in school children that often go undiagnosed [7]. Adolescents' malnutrition, an alarming public health problem worldwide is imposing a great threat to the future generation via vicious cycle [8].

Many boys and girls in underdeveloped nations are malnourished when they reach adolescence, which increases their risk of illness and early death. Inadequate nutrition during this period might cause poor growth, delayed sexual maturation, loss of attention, diminished learning ability, and other problems. Adequate nutrition and healthy eating habits at this age are foundations for good health in adulthood [9].

One of the most important elements that influences all aspects of human life and defines quality of life is nutrition. It is also an important health indicator to assess the health status and morbidity pattern of any specified area and population [10]. The worldwide burden of malnutrition has major developmental, economic, social, and medical impacts that may have an influence on a single person, a family, a community, or an entire nation [11]. Malnutrition is a silent emergency and it is one of the most common causes of morbidity and mortality among children and adolescents worldwide [12].

For females, this is the period for preparation for motherhood. Because adolescent girls who are undernourished when they become pregnant are more likely to give birth to low birth weight or intrauterine growth restricted babies who are more susceptible to metabolic diseases later in life, malnutrition passes from generation to generation [13]. Malnutrition in rural areas is mostly manifested as underweight while wasting is more common in urban areas [14]. The determinants of children's nutritional status are multifactorial. Several factors contribute directly to undernutrition in children, including insufficient energy and nutrients, as well as recurrent infectious diseases (such as intestinal parasites, malaria and diarrhea) [15].

Methods

Study Design

Cross-sectional study design was used for this study.

Place and Duration of Study

The study area was Vyas Municipality, Tanahun, Nepal and the total study duration was seven months.

Sample Size and Sampling Method

The total sample size was 313. The sample size was calculated by using the formula n= z2pqN/d2(N-1)+z2pq (Where, z = 1.96, p = 51.4%(27), q = 1-p, d = allowable error and N= Total population size)

The sampling technique was multistage sampling technique. For this, following steps were followed:

Step 1: Vyas Municipality was selected purposively where list of all government schools was taken from Education Section of Vyas Municipality. Total 81 government schools were recorded.

Step 2: Required sample size was calculated.

Step 3: In first phase, out of these 81 government schools, a list was made including schools which run class 8. (40 government schools were recorded)

Step 4: 7 wards out of 14 were selected by simple random sampling (Lottery method). The selected wards were 1,2,5,7,10,11 and 13.

Step 5: After the ward decided, the school was selected randomly from the list of schools in the respective ward.

Step 6: In second phase, the total number of students in grade 8 in each selected school were listed.

Step 7: Simple Random Sampling was used to select sample.

Methods of Data Collection

Self-administered questionnaire was used for data collection. Anthropometric measurement was used for the measurement of height and weight. Questionnaires were prepared in Native language Nepali for easy to understand. Participated adolescent's height were measured by stadiometer and body weight by weighing machine.

Ethical Approval

Ethical approval for the conduction of the study was taken from Institutional Review Committee (IRC) Pokhara University. Permission to conduct study was taken from Vyas Municipality, Tanahun. Written informed consent was obtained from each participant. Withdrawal from the study was accepted anytime throughout the study. To maintain confidentiality, no personal name of the participants was taken and unique identify number was used. Collected information was used only for the purpose of the study.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Students who were willing to participate in the study.
- Students who were studying in grade 8.
- Exclusion Criteria:
- Students who were absent at the day of data collection.

Statistical Analysis and Software Used

The data was entered in Epi-data and the entered data were exported to SPSS for further analysis. Also, WHO AnthroPlus was used to convert height and weight into z-scores. Descriptive statistics such as frequency, percentage, mean, standard deviation was calculated to study the characteristics of the participants. Chi-square test was used to find the association between dependent and independent variables. Similarly, binary logistic regression analysis was applied to check the association between dependent and independent variables. In which all variables that were significant in the Chi-square test were included.

Results

Table 1 shows the socio-demographic characteristics of participants. Among the total participants, minimum age was 12 and 16 was the maximum age. Nearly equal males and females participated in the study. Most of the participants (93%) were Hindu.

More than half (52.1%) of the participants were Janajati. More than two-third (69.3%) of the participants were from nuclear family followed by joint family and a very few from extended family. Regarding the participant's father's education, nearly about half (45.4%) of the fathers had basic level education. Similarly, more than one-third (36.1%) of the mothers had informal education. In case of father's occupation, more than one-third (36.7%) were involved in foreign employment followed by agriculture and daily wages. Nearly about half (47.9%) of the mothers were housewife followed by agriculture and business.

Table 1: Socio-demographic characteristics

Variables	Number (n=313)	Percent (%)
Age (in years)		
12	57	18.2
13	106	33.9
14	87	27.8
15	48	15.3
16	15	4.8
Mean= 13.55, SD= 1.1, Minimum= 12, Maximum=16		
Sex		
Male	158	50.5
Female	155	49.5
Religion		
Hindu	291	93
Buddhism	13	4.2
Christianity	4	1.3
Islam	5	1.6
Ethnicity		
Dalit	66	21.1
Janajati	163	52.1
Madeshi	6	1.9
Muslim	6	1.9
Brahmin/Chhetri	72	23
Family type		
Nuclear	217	69.3
Joint	82	26.2
Extended	14	4.5
Father's educational status		
Illiterate	20	6.4
Informal education	104	33.2
Basic education	142	45.4
Secondary education	44	14.1
Bachelor	1	0.3
Masters and above	2	0.6
Mother's educational status		
Illiterate	59	18.8
Informal education	113	36.1
Basic education	111	35.5
Secondary education	30	9.6
Father's occupation		
Agriculture	87	27.8
Foreign employment	115	36.7
Services/Job	20	6.4
Business	39	12.5

Labor/Daily wages	45	14.4
Pension	7	2.2
Mother's occupation		
Housewife	150	47.9
Agriculture	100	31.9
Foreign employment	12	3.8
Services/Job	8	2.6
Business	29	9.3
Labor/daily wages	14	4.5

Table 2 shows that about one-fifth (24.3%) of the participants lie in the fourth quintile whereas few (14.1%) of the participants lie in third quintile.

Table 2: Socio-economic characteristics

Variables	Number (n=313)	Percent (%)
Socio-economic status		
Lowest quintile	66	21.1
Second quintile	64	20.4
Third quintile	44	14.1
Fourth quintile	76	24.3
Highest quintile	63	20.1

Table 3 shows that all (100%) of the participants consumed rice daily. Regarding the consumption of roti, among 313 participants, nearly two-third (64.2%) of them consumed roti. Among those who consume roti, most of them (90.5%) consumed roti 1-3 days per week and remaining 9.5% consumed roti 4-7 days per week. All the participants were found to be consuming vegetables daily. Similarly, in the consumption of fruits, most of the participants (94.9%) were found to be consuming fruits. Among them, nearly three fourth (70.4%) of the participants consumed fruits 1-3 days per week and 29.6% consumed fruits 4-7 days per week. Likewise, nearly two-third (68.1%) of participants were found to be consuming fish. Among those who consume fish, majority (95.3%) of participants consume fish 1-3 days per week and remaining 4.7 % consumed fish 4-7 days. Regarding the consumption of meat, almost all (97.4%) of participants reported that they consumed meat. Among them, more than three-fourth (77.7%) of the participants consume meat 1-3 days per week. Among 313 participants, nearly two third (65.8%) of the participants consumed milk and milk products and the rest 34.2% did not consumed milk and milk products. Among them, more than half (52.9%) of the participants consumed milk and milk products 1-3 days per week. Regarding the consumption of egg, most of the participants (90.1%) were found to be consuming egg and least (9.9%) of the participants did not consumed egg. Among those 90.1%, more than two-third (69.5%) consumed egg 1-3 days and about one-third (30.5%) consumed egg 4-7 days per week.

Table 3: Weekly food consumption pattern

Variables	Number (n=313)	Percent (%)
Rice consumption		
Yes	313	100
Rice consumption per week		
7 days (Daily)	313	100
Roti consumption		
Yes	201	64.2
No	112	35.8
Roti consumption per week (n=201)		
1-3 days	182	90.5
4-7 days	19	9.5
Vegetables consumption		
Yes	313	100
Vegetables consumption per week		
7 days (Daily)	313	100
Fruits consumption		

Yes	297	94.9
No	16	5.1
Fruits consumption per week (n=297)		
1-3 days	209	70.4
4-7 days	88	29.6
Fish consumption		
Yes	213	68.1
No	100	31.9
Fish consumption per week (n=213)		
1-3 days	203	95.3
4-7 days	10	4.7
Meat consumption		
Yes	305	97.4
No	8	2.6
Meat consumption per week (n=305)		
1-3 days	237	77.7
4-7 days	68	22.3
Milk and milk products consumption		
Yes	206	65.8
No	107	34.2
Milk and milk products consumption per week (n=206)		
1-3 days	109	52.9
4-7 days	97	47.1
Egg consumption		
Yes	282	90.1
No	31	9.9
Egg consumption per week (n=282)		
1-3 days	196	69.5
4-7 days	86	30.5

Table 4 shows that slightly less than half (40.6%) of the participants eat four times in a day, whereas a small number (1.9%) of participants eat two times in a day.

Table 4: Eating Pattern in 24 hours

Variables	Number (n=313)	Percent (%)
Frequency of food intake in 24 hours		
2 times	6	1.9
3 times	84	26.8
4 times	127	40.6
5 times	96	30.7

Table 5 shows that almost all (99%) of the participants reported that they never smoke, while a small number (1%) of participants reported that they smoked sometimes. In case of alcohol also, almost all (99.4%) of the participants had never consumed alcohol. Likewise, 0.6% of the participants consumed alcohol sometimes. More than half (54.3%) of the participants used to sleep for about eight hours while 45.7% used to sleep for more than eight hours. Slightly less than half (40.3%) of the participants spent 31 to 60 minutes in screen activity in a day. More than three-fourth (78.9%) of the participants reported that they come to school by walking while about one-fifth (21.1%) of the participants used bus as a means to come school. More than half (51.4%) of the participants walked 31 to 60 minutes in a day.

Table 5: Behavior related characteristics

Variables	Number (n=313)	Percent (%)
Smoking		

Yes	3	1
No	310	99
If yes, how often? (n=3)		
Sometimes	3	100
Alcohol consumption		
Yes	2	0.6
No	311	99.4
If yes, how often? (n=2)		
Sometimes	2	100
Average sleep duration		
≤ 8 hours	170	54.3
> 8 hours	143	45.7
Screen time in a day		
0-30 min	48	15.3
31-60 min	126	40.3
61-90 min	35	11.2
> 91 min		
Median=60 min, min=20 min, max=150 min	104	33.2
Means to come school		
By Bus	66	21.1
Walking	247	78.9
Walking time in a day		
0-30 min	38	12.1
31-60 min	161	51.4
61-90 min	27	8.6
> 91 min		
Median=60 min, min=30 min, max=120 min	87	27.8

Table 6 shows that most of the participants (92%) were normal, 7% were moderately stunted and only 1% were severely stunted. Similarly, in case of thinness also, most of the participants (91.1%) were normal, 5.1% were moderately thin and very few (3.8%) were severely thin.

Table 6: Nutritional status of adolescents

Nutritional status	Number (n=313)	Percent (%)
Height for age (stunting)		
Normal	288	92
Moderately stunted	22	7
Severely stunted	3	1
BMI for age (thinness)		
Normal	285	91.1
Moderately thinness	16	5.1
Severely thinness	12	3.8

Table 7 shows that age (p= 0.003) and father's education (p=0.030) were significantly associated with stunting. Similarly, father's occupation (p= 0.021) was significantly associated with thinness but rest of the socio-demographic variables had no significant association with thinness.

Table 7: Association between socio-demographic variables and nutritional status

Variables	Nutritional status Normal Stunted	Chi-square	p-value	Nutritional status Normal Thinness	Chi-square	p-value
Age						

Early adolescents	157 (96.3%)	6 (3.7%)	8.582	0.003*	151 (92.6%)	12 (7.4%)	1.047	0.306
Middle adolescents	131 (87.3%)	19 (12.7%)			134 (89.3%)	16 (10.7%)		
Sex								
Male	145 (91.8%)	13 (8.2%)	0.025	0.874	141 (89.2%)	17 (10.8%)	1.289	0.256
Female	143 (92.3%)	12 (7.7%)			144 (92.9%)	11 (7.1%)		
Religion								
Hindu	267 (91.8%)	24 (8.2%)	0.381	1 #	263 (90.4%)	28 (9.6%)	2.325	0.239 #
Non-Hindu	21 (95.5%)	1 (4.5%)			22 (100%)	0		
Ethnicity								
Janajati	148 (90.8%)	15 (9.2%)	0.683	0.408	148 (90.8%)	15 (9.2%)	0.028	0.868
Others	140 (93.3%)	10 (6.7%)			137 (91.3%)	13 (8.7%)		
Family type								
Nuclear	197 (90.8%)	20 (9.2%)	1.455	0.228	199 (91.7%)	18 (8.3%)	0.368	0.544
Joint/Extended	91 (94.8%)	5 (5.2%)			86 (89.6%)	10 (10.4%)		
Father's education								
Formal	179 (94.7%)	10 (5.3%)	4.719	0.030*	172 (91%)	17 (9%)	0.001	0.970
Informal	109 (87.9%)	15 (12.1%)			113 (91.1%)	11 (8.9%)		
Mother's education								
Formal	134 (95%)	7 (5%)	3.190	0.074	132 (93.6%)	9 (6.4%)	2.069	0.150
Informal	154 (89.5%)	18 (10.5%)			153 (89%)	19 (11%)		
Father's occupation								
Agriculture	76 (87.4%)	11 (12.6%)	3.555	0.059	74 (85.1%)	13 (14.9%)	5.320	0.021*
Non-agriculture	212 (93.8%)	14 (6.2%)			211 (93.4%)	15 (6.6%)		
Mother's occupation								
Agriculture	90 (90%)	10 (10%)	0.810	0.368	93 (93%)	7 (7%)	0.683	0.409
Non-agriculture	198 (93%)	15 (7%)			192 (90.1%)	21 (9.9%)		

*p value significant at < 0.05 # Fisher Exact Test

Table 8 shows no association between socio-economic variables and nutritional status.

Table 8: Association between socio-economic variables and nutritional status

Variables	Nutritional status Normal	Stunted	Chi-square	p-value	Nutritional status Normal	Thinness	Chi-square	p-value
Wealth quintile								
Poor	89 (89.9%)	10 (10.1%)	1.217	0.544	91 (91.9%)	8 (8.1%)	0.183	0.912
Middle	103 (92%)	9 (8%)			102 (91.1%)	10 (8.9%)		
Rich	96 (94.1%)	6 (5.9%)			92 (90.2%)	10 (9.8%)		

Table 9 shows that roti consumption per week (p=0.027) was found to be significantly associated with stunting. And fish consumption (p= 0.036) and milk and milk products consumption per week (0.001) were found to be significantly associated with thinness.

Table 9: Association between weekly food consumption and nutritional status

Variables	Nutritional status Normal	Stunted	Chi-square	p-value	Nutritional status Normal	Thinness	Chi-square	p-value
Rice consumption								
Yes	288 (92%)	25 (8%)	-	-	285 (91.1%)	28 (8.9%)	-	-
Rice consumption per week								

7 days (Daily)	288 (92%)	25 (8%)	-	-	285 (91.1%)	28 (8.9%)	-	-
Roti consumption								
Yes	181 (90%)	20 (10%)	2.945	0.086	179 (89.1%)	22 (10.9%)	2.757	0.097
No	107 (95.5%)	5 (4.5%)			106 (94.6%)	6 (5.4%)		
Roti consumption per week								
1-3 days	167 (91.8%)	15 (8.2%)	6.272	0.027* #	161 (88.5%)	21 (11.5%)	0.695	0.701 #
4-7 days	14 (73.7%)	5 (26.3%)			18 (94.7%)	1 (5.3%)		
Vegetables consumption								
Yes	288 (92%)	25 (8%)	-	-	285 (91.1%)	28 (8.9%)	-	-
Vegetables consumption per week								
7 days (Daily)	288 (92%)	25(8%)	-	-	285 (91.1%)	28 (8.9%)	-	-
Fruits consumption								
Yes	273 (91.9%)	24 (8.1%)	0.069	1 #	269 (90.6%)	28 (9.4%)	1.657	0.378 #
No	15 (93.8%)	1 (6.3%)			16 (100%)	0		
Fruits consumption per week								
1-3 days	189 (90.4%)	20 (9.6%)	2.104	0.147	185 (88.5%)	24 (11.5%)	3.491	0.062
4-7 days	84 (95.5%)	4 (4.5%)			84 (95.5%)	4 (4.5%)		
Fish consumption								
Yes	197 (92.5%)	16 (7.5%)	0.205	0.651	189 (88.7%)	24 (11.3%)	4.413	0.036*
No	91 (91%)	9 (9%)			96 (96%)	4 (4%)		
Fish consumption per week								
1-3 days	189 (93.1%)	14 (6.9%)	2.355	0.167 #	180 (88.7%)	23 (11.3%)	0.017	1 #
4-7 days	8 (80%)	2 (20%)			9 (90.0%)	1 (10.0%)		
Meat consumption								
Yes	280 (91.8%)	25 (8.2%)	0.713	1 #	278 (91.1%)	27 (8.9%)	0.127	0.532 #
No	8 (100%)	0			7 (87.5%)	1 (12.5%)		
Meat consumption per week								
1-3 days	218 (92%)	19 (8%)	0.046	0.831	215 (90.7%)	22 (9.3%)	0.244	0.621
4-7 days	62 (91.2%)	6 (8.8%)			63 (92.6%)	5 (7.4%)		
Milk and milk products consumption								
Yes	190 (92.2%)	16 (7.8%)	0.040	0.842	184 (89.3%)	22 (10.7%)	2.224	0.136
No	98 (91.6%)	9 (8.4%)			101 (94.4%)	6 (5.6%)		
Milk and milk products consumption per week								
1-3 days	100 (91.7%)	9 (8.3%)	0.078	0.781	90 (82.6%)	19 (17.4%)	11.062	0.001*
4-7 days	90 (92.8%)	7 (7.2%)			94 (96.9%)	3 (3.1%)		
Egg consumption								
Yes	259 (91.8%)	23 (8.2%)	0.110	1 #	256 (90.8%)	26 (9.2%)	0.263	1 #
No	29 (93.5%)	2 (6.5%)			29 (93.5%)	2 (6.5%)		
Egg consumption per week								
1-3 days	181 (92.3%)	15 (7.7%)	0.217	0.641	174 (88.8%)	22 (11.2%)	3.086	0.079
4-7 days	78 (90.7%)	8 (9.3%)			82 (95.3%)	4 (4.7%)		

*p value significant at < 0.05 # Fisher Exact Test

Table 10 shows no association between eating pattern in 24 hours and nutritional status.

Table 10: Association between eating pattern in 24 hour and nutritional status

Variables	Nutritional status Normal Stunted	Chi-square	p-value	Nutritional status Normal Thinness	Chi-square	p-value
Frequency of food intake in 24 hours						

≤ 3 times	87 (96.7%)	3 (3.3%)	3.723	0.054	80 (88.9%)	10 (11.1%)	0.727	0.394
> 3 times	201 (90.1%)	22 (9.9%)			205 (91.9%)	18 (8.1%)		

Table 11 shows that means to come school (p=0.016) was significantly associated with stunting and there was no association between behavior related variables and thinness.

Table 11: Association between behavioral related variables and nutritional status

Variables	Nutritional status Normal Stunted		Chi-square	p-value	Nutritional status Normal Thinness		Chi-square	p-value
Smoking								
Yes	2 (66.7%)	1 (33.3%)	2.648	0.222 #	2 (66.7%)	1 (33.3%)	2.212	0.246 #
No	286 (92.3%)	24 (7.7%)			283 (91.3%)	27 (8.7%)		
If yes, how often?								
Sometimes	2 (66.7%)	1 (33.3%)	-	-	2 (66.7%)	1 (33.3%)	-	-
Alcohol consumption								
Yes	2 (100%)	0	0.175	1 #	2 (100%)	0	0.198	1 #
No	286 (92%)	25 (8%)			283 (91%)	28 (9%)		
If yes, how often?								
Sometimes	2 (100%)	0	-	-	2 (100%)	0	-	-
Sleeping time								
≤ 8 hours	154 (90.6%)	16 (9.4%)	1.027	0.311	152 (89.4%)	18 (10.6%)	1.232	0.267
> 8 hours	134 (93.7%)	9 (6.3%)			133 (93%)	10 (7%)		
Screen time in a day								
≤ 1 hour	157 (90.2%)	17 (9.8%)	1.695	0.193	158 (90.8%)	16 (9.2%)	0.030	0.863
> 1 hour	131 (94.2%)	8 (5.8%)			127 (91.4%)	12 (8.6%)		
Means to come school								
By Bus	56 (84.8%)	10 (15.2%)	5.841	0.016*	58 (87.9%)	8 (12.1%)	1.035	0.309
Walking	232 (93.9%)	15 (6.1%)			227 (91.9%)	20 (8.1%)		
Walking time in a day								
≤ 1 hour	183 (92%)	16 (8%)	0.002	0.964	183 (92%)	16 (8%)	0.550	0.458
> 1 hour	105 (92.1%)	9 (7.9%)			102 (89.5%)	12 (10.5%)		

Table 12: Logistic regression analysis of factors associated with stunting

Variables	Nutritional status Normal Stunted		COR (95%CI)	AOR (95%CI)	p-value
Age					
Early adolescents	157 (96.3%)	6 (3.7%)	Ref	Ref	0.009**
Middle adolescents	131 (87.3%)	19 (12.7%)	3.795 (1.473-9.781) *	4.227 (1.423-12.551)	
Father's education					
Formal	179 (94.7%)	10 (5.3%)	Ref	Ref	0.373
Informal	109 (87.9%)	15 (12.1%)	2.463 (1.069-5.677) *	1.566 (0.583-4.205)	
Roti consumption per week					
1-3 days	167 (91.8%)	15 (8.2%)	Ref	Ref	0.019**
4-7 days	14 (73.7%)	5 (26.3%)	3.976 (1.259-12.554) *	4.554 (1.289-16.089)	
Means to come school					
By Bus	56 (84.8%)	10 (15.2%)	2.762 (1.178-6.473) *	2.219 (0.797-6.175)	0.127
Walking	232 (93.9%)	15 (6.1%)	Ref	Ref	

Table 13: Logistic regression analysis of factors associated with thinness

Variables	Nutritional status Normal	Thinness	COR (95%CI)	AOR (95%CI)	p-value
Father's occupation					
Agriculture	74 (85.1%)	13 (14.9%)	2.471 (1.123-5.437) *	2.438 (0.938-6.340)	0.068
Non-agriculture	211 (93.4%)	15 (6.6%)	Ref	Ref	
Fish consumption					
Yes	189 (88.7%)	24 (11.3%)	3.048 (1.028-9.034) *	4.427 (0.972-20.165)	0.054
No	96 (96%)	4 (4%)	Ref	Ref	
Milk and milk products consumption per week					
1-3 days	90 (82.6%)	19 (17.4%)	6.615 (1.892-23.122) *	6.978 (1.965-24.780)	0.003**
4-7 days	94 (96.9%)	3 (3.1%)	Ref	Ref	

* Significant at $p < 0.05$ from bivariable binary logistic analysis
** Significant at $p < 0.05$ from multivariable binary logistic analysis

Table 12 and 13 shows that the significant variables from chi-square were also found significant in bivariate logistic regression analysis. From, binary logistic regression, middle adolescents (AOR= 4.227, 95% CI= 1.423-12.551) had 4 times higher odds of stunting as compared to early adolescents. Similarly, the odds of stunting were higher among participants who consumed roti 4-7 days per week (AOR= 4.554, 95% CI= 1.289-16.089) as compared to those who consumed roti 1-3 days per week. Also, the odds of thinness were higher among participants who consumed milk and milk products 1-3 days (AOR= 6.978, 95% CI= 1.965-24.780) as compared to those participants who consumed milk and milk products 4-7 days.

Discussion

In this study the prevalence of stunting was 8%. This finding is similar with the study in Kerala, India where the prevalence of thinness was 8.4%, in Ghana (10.4%) [16, 17]. The study result was lower than the study conducted on Northeastern Ethiopia (26.6%), in Egypt (34.2%) in India (18%), in Adawa Town, North Ethiopia (12.2%), Uttar Pradesh, India (19.5%) and in Amhara Region, Ethiopia, it was 12.3%. Whereas the result of this study on prevalence of stunting is higher than the study conducted in Nepal (2.5%) and Addis Ababa, Ethiopia (7.2%) [5, 14, 16, 17, 2, 3, 8, 18]. This difference might be due to differences in socioeconomic status, educational status of the families, study setting and study period.

In this study the prevalence of thinness was found to be 8.9% which was just similar to the study conducted in Amhara Region, Ethiopia, where the prevalence of thinness was 9.6% and Addis Ababa, Ethiopia, where the prevalence was 9% [3, 18]. The similarities might be due to similar study design and study population. Also, similar study conducted in Nepal showed the prevalence of thinness was 10.05%, in North Ethiopia 21.4% in Uttar Pradesh, India, 26.7%, in Northwest Ethiopia 16.9% and in Sudan 15.4% where these studies have higher prevalent of thinness than that of this study [19, 17, 2, 20, 21]. The result of this study on prevalence of thinness is higher than the study conducted in Northcentral Ethiopia (4.9%), Nepal (4.48%) and Duhok district (6.2%) [11, 22, 1]. This difference might be due to the difference in the study setting, study method, seasonal variation and socioeconomic status.

The present study revealed that age, father's education, roti consumption per week and means to come school were significantly associated with stunting and father's occupation, fish consumption and milk and milk products consumption per week were significantly associated with thinness. A study conducted in Northeastern Ethiopia showed that age was significantly associated with stunting [5]. It might be due to similarities in age group of study population. In this study, the odds of stunting were 4.2 times higher among middle adolescents as compared to early adolescents, this finding is supported by a study from Nepal [22]. A study conducted in Northeastern Ethiopia showed that early adolescents were 1.96 times more likely to develop stunting as compared to late adolescents which is contrast with our study [5]. Difference in dietary habits, cultural practices and food availability among the population studied can contribute to variations in nutritional outcomes.

Our study had shown significant association between father's education and stunting. This study shows that the prevalence of stunting was higher among those adolescents whose father had informal education. Also, similar study conducted in Sudan found that father's education was associated with stunting, where the prevalence of stunting was more among those adolescents whose father education was above secondary level [21]. While, in contrast a study conducted in Egypt, West Bengal, India found that educational status of father was not associated with stunting. This might be due to difference in rural and urban setting for study [14, 23].

This study showed the association between roti consumption per week and stunting. In this study the prevalence of stunting was 8.2% among those who consumed roti 1 to 3 days per week and 26.3% among those who consumed roti 4 to 7 days per week. Whereas no association was seen between other variables of weekly food consumption and stunting. A study conducted in Pokhara, Nepal shows that, fruits consumption per week was found to be significantly associated with nutritional status [13]. In a similar study conducted in Egypt also showed association between daily fruit consumption and stunting but this study re-

vealed that there was no association between fruits consumption per week and nutritional status [14]. Our study had shown significant association between means to come school and stunting. In this study, the prevalence of stunting was higher among those who come to school by bus. No any supportive literature which showed the association and relationship was found for comparison of this result.

This study found that there was association between father's occupation and thinness. A similar study conducted in Central Ethiopia showed significant association between occupational status of father and thinness, where adolescent girls from daily laborer fathers were twice more likely to be thin compared to those adolescent girls from merchant fathers [9]. A study conducted in Sudan, Northwest Ethiopia showed that father's occupation was not associated with thinness which is contrast to the result from this study [20, 21].

The present study reported that significant association was found between fish consumption and thinness. While, in contrast a study in Nepal found fish consumption was not associated with nutritional status [13]. In this study the prevalence of thinness was 11.3% among those who consumed fish whereas 4% among those who do not consume fish. Likewise, this study showed that milk and milk products consumption per week was associated with thinness. In this study, the odds of thinness were 6.97 times higher among adolescents who consumed milk and milk products 1-3 days per week as compared to adolescents who consumed milk and milk products 4-7 days per week. But a study conducted in Nepal showed no significant association between milk and milk products consumption per week and nutritional status [13]. This study revealed there was no significant association between eating pattern in twenty-four hour and thinness [22]. While, in contrast a study conducted in Nepal showed that eating pattern in twenty-four hour was significantly associated with thinness.

Study Limitations

This study also has a few limitations that must be mentioned. First, due to cross-sectional study design causal relationship between independent and dependent variables cannot be established. Second, there might be a recall bias, especially for information related to their food intake, physical activity. Third, the findings of this study cannot be generalized to the adolescents of larger area because the study was conducted among public school-going adolescents in Vyas municipality only.

Conclusion

Stunting and thinness were common among school adolescents in the study area. Factors like age, father's education, roti consumption per week and means to come school were found to be significantly associated with stunting. Similarly, factors like father's occupation, fish consumption and milk and milk products consumption per week were found to be significantly associated with thinness.

Conflict of Interest

The authors have no conflict of interest to declare.

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