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Nutritional Status and its Associated Factors among School going Adolescents in Nepalgunj Sub-Metropolitan City, Banke District, Nepal

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ABSTRACT

Background: Proper nutrition is required for all people to attain optimal physical and mental health. On the contrary, malnutrition affects and kills individuals of all ages globally.

Objective: This study assessed the dietary habits, nutritional status and its associated factors among school going adolescents in Nepalgunj Sub-Metropolitan City, Banke.

Methods: The study was a school based cross-sectional descriptive study using a quantitative method in all 10 randomly selected schools of Nepalgunj city. Where 297 school going adolescents within the respected area were taken as a study unit. Simple random sampling technique was adopted for sample estimation; Data was collected using a semi structure questionnaire and anthropometric instruments.

Results: The study shows the significant association between nutritional status and different variable like family type, sweets, sugar, chocolate, sweeten drinks consumption, Vitamin A rich vegetables and tubers consumption, Legumes, Nuts and Seeds consumption and individual dietary diversity with p-value (<0.05) which showed the moderate level of association.

Conclusion: In conclusion, the study reveals that most of the respondents ate four or five main meals a day, either skip breakfast or eat in-between meals. The high DDS of the respondents ensures balanced nutrition.

Keywords: malnutrition, overweight, undernutrition, Nepal

1. INTRODUCTION

Proper nutrition is required for all persons to attain optimal physical and mental health. On the contrary, malnutrition affects and kills individuals of all ages globally, particularly the impoverished and vulnerable. It continues to be a major cause of illness and impairment in children in poor countries, accounting for half of the 10.4 million yearly child fatalities [1]. Adolescence is defined as the period between the ages of 10 and 19, and it marks the shift from dependent childhood to independent adulthood. Adolescents account for 20% of the global population, with around 80% of them living in poor nations. This age is a stage of development in the lifespan that requires appropriate and proper quality diet to meet the nutrient requirements for their physical, mental, and developmental progress, as well as reproductive maturity [2]. Adolescence is a stage of rapid growth and maturation in human development that necessitates additional nutrients and energy to support growth. Focusing on the nutrition of adolescents, particularly girls, presents a unique chance to break the intergenerational cycle of malnutrition [2]. Adolescence, in other terms, is a period of strong anabolism during which the body requires more of all nutrients. Adolescence is the time when a person reaches 20% of their adult height, 50% of their adult weight, and 45% of their adult bone mass. Healthy eating habits during childhood and adolescence support the growth, development, and health at all stages of childhood and help to ward off health issues later in life [3]. Undernutrition (in terms of stunting and wasting), overweight, and obesity are the main nutritional issues facing adolescent populations around the world. During this time, there are new public health issues. Around the world, 2-3% of adolescents are obese and 10% of adolescents are overweight. The prevalence, which varies from 10% in Africa and Asia to more than 20% in the USA and Europe, is reflected in the global averages [4]. Malnutrition is a hidden emergency that is one of the leading causes of morbidity and mortality in children and adolescents worldwide. The nutrition and epidemiologic shift has its own impact on changes in food and exercise habits, resulting in the establishment of a double burden of malnutrition. Changes in dietary consumption, combined with increasingly sedentary lifestyles as a result of the food market, globalization, and expanding urbanization, have resulted in the emergence of chronic disease as a major new health issue [4]. Adolescents in Nepal cover 23.45 percent of the total population that is nearly a quarter of population [5]. According to Global Nutrition Reports 2018, one in three individuals face malnutrition, one in twenty children report feeling hungry, and one in five global deaths are linked to inadequate food. DBM is more common in LMICs (low- and middle-income nations), with a larger prevalence in the poorer LMICs [6]. According to the most recent global Demographic and Health Survey data for non-pregnant adolescent girls (15-19 years), the prevalence of thinness ranges from 2% in Europe and Central Asia (ECA) to 7% in South Asia (SA). The East Asia and Pacific (EAP) region, on the other hand, has a 4% incidence of overweight and obesity, compared to a 40% prevalence in the Middle East and North Africa (MENA) region. Anemia prevalence has remained high, affecting about 26% of adolescent girls in East and Central Africa (ECA) and 52% in West and Central Africa (WCA) [7]. According to a study conducted in Mekelle, Northern Ethiopia, the total prevalence of obesity, overweight, normal, and thinness among adolescents was 0.4, 2, 60.40, and 37.8%. Similarly, in research conducted in the Eastern Arsi Zone of the Oromia Region, stunting and thinness were found to be 20.2 and 14.8%, respectively [8]. In a newly released study, Shamim and colleagues found that more than 60% of pregnant women aged ≥19 had poor or medium dietary diversity (a score of less than 5 out of a possible 8) [9]. According to a recent study, 10% of the world's school-aged children have extra body fat; of these, 25% are obese, with a considerable risk of acquiring type 2 diabetes or heart disease in adulthood [10]. In south Asia 11% of adolescent girls aged 15-19 years old are too shorts, 39% are under weight and 55% are anemic [11]. Adolescent stunting is 32% in India, 36% in Bangladesh, and 47% in Nepal, while having a low body mass index (BMI) is 53% in India, 50% in Bangladesh, and 36% in Nepal. In Bangladesh, 25-27% of teenage females are anemic (hemoglobin 12 g/dL) and 30% are iron deficient (serum transferrin saturation [TS]

15%). Half of all school-aged youngsters (47-54%) are vitamin A deficient [12]. Study conducted on rural adolescence of India shows that the prevalence of underweight is higher in boys i.e. (53.1%) that in girls (39.5%). The extent of stunting was higher (42.7%) among adolescents [13]. An adolescent's nutrition study done in Nepal in 2014 found that 71% of male adolescents and 59% of female adolescents were malnourished more than 43% married adolescents and 65% of unmarried adolescents were malnourished [1]. A community-based study in rural and urban areas of Morang District shows that the overall prevalence of anemia among adolescents (male, female, urban, and rural combined) was found to be very high, at 65.6% female adolescents outnumber males by more than 25% (78.3%). The distinction between rural and urban areas is significantly difference [14]. A study conducted in Dang District shows that the nutritional status of the adolescents among 510 adolescents almost three fourth (74.3%) had normal weight. Similarly, 21.8% were underweight followed by overweight and obesity that is 3.1% and 0.8% respectively [15]. A survey conducted in semi-urban community in Dukuchhap Village of Lalitpur Nepal shows that the prevalence of stunting was found out to be 36.28% more males (16.51%) than female (12.60%) was severely stunted and 21.70% of male and 22.14% of female were moderately stunted. Among total respondents, 14.4% were severely stunted and 21.9% were moderately stunted. More number of male (38.2%) were stunted than female (34.7%) [16]. A study conducted on Dang district Nepal shows that the prevalence of Overweight and Obesity was 4.25% and 2.25% respectively [17]. NDHS 2016 reports show that, half of the households in Nepal are food insecure (52%) and do not have access to food around where 20% are mildly food insecure, 22% are moderately food insecure, and 10% are severely food insecure. Province 7 has severely food insecure percentage of 13% which is second highest after province 6 [18]. This study assessed the nutritional status and its associated factor of the respondents.

2. MATERIALS AND METHODS

A school based cross-sectional descriptive study design was used to assess the nutritional status and its associated factors among high school adolescents. Data was collected in a single shot with selected participants in a selected school. The study period was for Six months starting from Chaitra 2nd week to Asoj 1st week. And data collection started from 1st week of Ashadh and was remain for 2 weeks. Individual school adolescents of class 9 and 10 of Nepalgunj sub-Metropolitan city was the sampling unit of the respective study area. The formula below was used to determine the sample size.

$n=Z^2\times\frac{p\times q}{e^2}$

Were,

n= the desired sample size

Z= the standard normal deviation at required confidence level in this case, i.e. 1.96

p= the proportion of the target population estimated to have characteristics being measured i.e. proportion of the Underweight among adolescent age (14-17 years) from Dang district i.e. 21.8% [5].

q= 1-p

e= the level of accuracy of the statistics being measured i.e. 0.05

Now,

$n=Z^2\times\frac{p\times q}{e^2} = 1.96^2 \times \frac{0.218\times 0.782}{0.05^2} = 261.96 \approx 262$

For finite population,

N =883

Sample size $(n) = \frac{n_0}{1+(\frac{n_0-1}{N})}$

$$n = \frac{262}{1+(\frac{262-1}{883})}$$

n= 202.31≈202 students

Now, adding 10% non-response

n=202*0.1+202

=222

Hence, the sample size (n) was n= 224. For the selection of required sample size, appropriate probability sampling technique was used.

Table 01: sample estimation of each selected school

SN.	Name of school	Total students		Selected grade	Sample size
1	Sun beam English medium boarding school	Grade 9	29		
		Grade 10	33	10	33
2	Nepalgunj model academy	Grade 9	40	9	40
		Grade 10	46		
3	Hope international school	Grade 9	36	9	36
		Grade 10	45		
4	Pasupati English medium boarding school	Grade 9	54	9 "B"	26
		Grade 10	79		
5	Manakamana English medium boarding school	Grade 9	20		
		Grade 10	20	10	20
6	St. Thomas English medium boarding school	Grade 9	42		
		Grade 10	41	10	41
7	United education academy	Grade 9	46		
		Grade 10	44	10	44
8	Sagarmatha boarding school	Grade 9	42	9	42
		Grade 10	32		
9	Ideal public school	Grade 9	44	9	44
		Grade 10	52		
10	Aadarsh mabi school	Grade 9	75		
		Grade 10	63	10 "A"	32
Grand total		883			358

For the Data collection tools self-administered questionnaire was used on dietary practice of adolescence, anthropometric instrument was adapted to measure weight and height. Questionnaire was developed through the reviewing of different literature and consultant with respective Supervisor.

Table 02: Data collection Tools and instruments

Tools and Instruments	Uses

Questionnaire	A well-designed and pretested set of questionnaires was used to collect information on different variables of the school going adolescents. Questionnaire was included: • Part I: Sociodemographic section • Part II: Environmental section • Part III: Lifestyle and behaviors related characteristics • Part IV: Food habit related characteristics • Individual dietary Diversity • Part V: Anthropometric measurement
Stature meter	To measure the height of participants
Weighing Scale	A digital weighing Machine measuring the weight of participants.

The technique for data collection was a self-administered questionnaire and anthropometric measurement. Firstly, students with inclusion criteria were participate, and inform consent was taken. Then all the required information was obtained through a self-administered questionnaire and anthropometric measurement. Semi structured questionnaire was used for data collection on following variables;

- Socio Demographic characteristics
- Lifestyle-behavior and environmental related characteristics
- Food habit related characteristics
- Individual dietary diversity
- Anthropometric measurement

Standard questionnaire was used for the data collection on the minimum dietary diversity through following steps:

- Students were asked to recall the consumption of food through 24 hr. dietary recall.
- The food was categorized based on 16 standard food groups of individuals dietary diversity for students, which include [28,29].
- Total number of food groups was summed up and categorized based on following standards

Table 03: Classification of individual dietary diversity for students

Number of food group consumed in last 24 hours	Classification of dietary diversity
≤3 food groups	Low dietary diversity
4-5 food groups	Medium dietary diversity
≥6 food groups	High dietary diversity

For reliability, data was pretested on 10% of the sample size in Janaki rural municipality, which was the representative study population other than the sample. For the purpose of knowing about the problem related to sequence, meaning, components and understanding of the questions in a different section than the study area including validity of anthropometric instruments After pretesting all confusion,

inaccurate and wrong interpretation of questions was removed and data was analyzed and necessary modifications was taken. The Questionnaires and Anthropometrics instruments was pretesting in a small group of students living in the similar context of study. Self-design questionnaire or standard questionnaire adapted from the literature was converted design in the English language and then translated into simple and clear Nepali language by one person and after finalization, it was retranslated into the English language by another person for maintaining its validity and reliability without changing its standard. All the data was export from Epi-Data to SPSS. After correction, the collected data was arranged, entered, analyzed, and organized in SPSS version 22 using Descriptive statistics (frequency, proportion, mean, standard deviation) and Inferential statistics (chi-square test) and the findings was presented in the form of percentages, graphs, charts and tables according to the variables.

3.RESULTS & DISCUSSION

Table 04: Distribution of respondents by Socio-Demographic Characteristics

Variables	Frequency (n)	Percentage (%)
Age group		
13-15	238	80.1
16-19	59	19.9
Median (IQR)=15 (1)		
Sex		
Male	156	52.5
Female	141	47.5
Religion		
Hindu	271	91.2
Buddhist	9	3.1
Christian	7	2.4
Islam	10	3.3
Ethnicity		
Dalit	27	9.1
Janjati	48	16.2
Madhesi	18	6.1
Muslim	8	2.7
Brahmin	63	21.2
Chettri	106	35.7
Others (Thakuri)	27	9.1
Family Type		
Nuclear	172	57.9
Joint	107	36.0
Extended	18	6.1
Family Member		
Less than 4	144	48.5
More than 4	153	51.5
Number of Siblings		
No siblings	32	10.8
One	152	51.2
Two	65	21.9
Three	27	9.1
More than three	21	7.1
Father's Education Level		
Illiterate	8	2.7

Literate	19	6.4
Primary level (1-5)	14	4.7
Lower Secondary level (6-8)	41	13.8
Secondary level (9-12)	141	47.5
Bachelors	43	14.5
Masters	31	10.4
Mother's Education Level		
Illiterate	12	4
Literate	18	6.1
Primary level (1-5)	28	9.4
Lower Secondary level (6-8)	55	18.5
Secondary level (9-12)	138	46.5
Bachelors	28	9.4
Masters	18	6.1
Occupation of Mother		
Agriculture	20	6.7
Government service	14	4.7
Business	55	18.5
Teachers	28	9.4
Private Job	16	5.4
Housewife	159	53.5
Others	5	1.7
Birth Order in Family		
First	135	45.5
Second	112	37.7
Third	30	10.1
Fourth	20	6.7
Monthly Income of Family		
Less than 20,000	24	8.1
20,000 to 50,000	159	53.5
More than 50,000	114	38.4

Table 05: Distribution of respondents by Lifestyle and Behavior related Characteristics

Variables	Frequency (n)	Percentage (%)
Physically active in a week		
Daily	197	66.3
Less than 4 days a week	76	25.6
More than 5 days a week	24	8.1
Physical Activities*		
Walking	219	53
Running	67	16.2
Playing games	92	22.2
Others	35	8.5
How do you used to go school		
Walking	211	71
Public Vehicles	16	5.4
Private Vehicles	46	15.5
School Bus	24	8.1
Consumption Tobacco product or Smoking		
No	293	98.7

Yes	4	1.3
If yes, frequency of consumption tobacco or smoking Occasionally Rarely	 1 3	 0.3 1
Alcohol consumption Yes No	 9 288	 3 97
If yes, frequency of consumption Daily Occasionally Rarely	 1 4 4	 0.3 1.3 1.3
Item used for hand washing Hand wash Soap Water only	 96 194 7	 32.3 65.3 2.4
When do you wash your hand* After going toilet After going Shed After coming from field After coming from work Before the meal After the meal	 295 276 275 276 291 293	 99.7 93.2 92.9 93.2 98.3 99
Frequency of hand wash per day Less than 4 times More than 4 times	 50 247	 16.8 83.2
Time spends on social media Less than 2 hours More than 2 hours Unknown	 159 55 83	 53.5 18.5 27.9
Time spends on TV/Laptop/Mobile Less than 2 hour per day More than 2 hour per day	 186 111	 62.6 37.4

Table 06: Distribution of respondents by Food Habits related characteristics

Variables	Frequency (n)	Percentage (%)
Main diet at home Rice/Dal Wheat Maize	 286 7 4	 96.3 2.4 3.3
vegetarian/non vegetarian Vegetarian Eggetarian Non vegetarian	 21 4 272	 7.1 1.3 91.6
If non vegetarian, frequency of meat consumption (n=272) Daily Once a week Twice a week	 45 109 100	 16.3 39.5 36.2

Once a month	8	2.9
Twice a month	9	3.3
Others	5	1.8
Consumption of Vegetable		
Yes	289	97.3
No	8	2.7
If yes, frequency of vegetable consumption (n=289)		
Once a week		
Less than 3 day a week	41	14.2
More than 3 day a week	37	12.8
	211	73
Consumption of fruits		
Yes	291	98
No	6	2
If yes, frequency of fruits consumption (n=291)		
Once a week		
Less than 3 day a week	72	24.7
More than 3 day a week	61	21
	158	54.3
Consumption of milk and milk product		
Yes	259	87.2
No	38	12.8
If yes, frequency of milk and milk product consumption (n=259)		
Once a week	63	24.3
Less than 3 day a week	45	17.4
More than 3 day a week	151	58.3
Consumption of eggs		
Yes	272	91.6
No	25	8.4
If yes, frequency of eggs consumption (n=272)		
Once a week		
Less than 3 day a week	106	39
More than 3 day a week	66	24.3
	100	36.8
Consumption of fish		
Yes	218	73.4
No	79	26.6
If yes, frequency of fish consumption (n=218)		
Once a week		
Less than 3 day a week	158	72.4
More than 3 day a week	30	13.8
	30	13.8
Consumption of Lentils, beans, peas or nuts		
Yes	283	95.3
No	14	4.7
If yes, frequency of Lentils, beans, peas or nuts consumption (n=283)		
Once a week	118	41.8
Less than 3 day a week	69	24.5
More than 3 day a week	96	33.7

Consumption of sugar, sweets, chocolates or sweetened drinks		
Yes	289	97.3
No	8	2.7
If yes, frequency of sugar, sweets, chocolates or sweetened drinks Consumption (n=289)		
Once a week		
Less than 3 day a week	84	29.2
More than 3 day a week	83	28.8
	122	42
Presence of Canteen at school		
Yes	276	92.9
No	21	7.1
Frequency of taking lunch at school		
Once a week	130	43.8
Less than 3 day a week	55	18.5
More than 3 day a week	112	37.7
Prefer for lunch if not preferred in school canteen		
Homemade food		
Junk food/packed or processed food	252	84.8
Food from hotel/restaurants	36	12.1
	9	3
Consumption of junk food or processed food		
Yes	284	95.6
No	13	4.4
If yes, frequency of Consumption of junk food or processed food (n=284)		
Daily	101	35.6
Once a week	84	29.6
Twice a week	76	26.8
Once a month	13	4.6
Twice a month	6	2.1
Others	4	1.4
Opinion regarding junk food		
Lacks nutrients	54	18.2
Good for health	12	4
Bad for health	120	40.4
Prefer to taste	111	37.4
Allowed junk food in school		
Yes	44	14.8
No	253	85.2
Number of meals eat per day		
2 meals	46	15.5
3 meals	150	50.5
4 meals	88	29.6
5 meals	13	4.4
Skipped any meal in a week		
Yes	169	56.9
No	128	43.1
If yes, which meal you skip (n=169)		
Breakfast	64	37.6

Lunch	23	13.5
Day snacks	44	26.5
Dinner	38	22.4
Reason for skipping meal		
Food deficient	12	7.1
For weight loss	26	15.3
For attractive figure	8	4.7
Health conscious	30	17.6
No time for meal	82	48.8
Others	11	6.5
With whom you eat food at home		
Alone	33	11.1
Whole family	204	68.7
Mother /father	32	10.8
Brother/sister	28	9.4
Sleep hour per day		
Less than 6 hours	47	15.8
6-8 hours	219	73.7
More than 9 hours	31	10.4
Availability of pocket money		
Yes	189	63.6
No	108	36.4
Weekly pocket money		
Less than 200	74	38.9
200-400	47	24.7
400-600	51	26.8
More than 600	18	9.5
Mean=357±244		

Table 07: Distribution of respondents by Knowledge related characteristics

Variables	Frequency (n)	Percentage (%)
Heard about nutrition		
Yes	284	95.6
No	13	4.4
Reason to eat nutritious food*		
Adequate physical growth	277	97.9
Adequate mental growth	269	95.1
Immunity power development	275	97.2
Source of information*		
TV	79	27.8
Radio	29	10.2
Social media	223	78.5
Books	115	40.5
Friends	122	43
Family	105	37
School	116	40.8
Others	22	7.7
Self-rated health status		
Very good	60	20.2
Good	124	41.8

Average	103	34.7
Bad	10	3.4
Self-perceive nutritional status		
Under weight	26	8.8
Normal	248	83.5
Over weight	18	6.1
Obesity	5	1.6

Table 08: Distribution of respondents by Environmental related Characteristics

Variables	Frequency (n)	Percentage (%)
Main source of drinking water at home		
Tap	73	24.6
Well	7	2.3
Hand pump	44	14.8
Jar /bottle	173	58.2
Purification of water		
Yes	237	79.8
No	60	20.2
If yes, method of purification*		
Boil	49	20.6
Filter	210	88.2
Add chlorine	10	4.2
Sedimentation	5	2.1
Others	5	2.1
Toilet at home		
Yes	297	100
Separate toilet for boys and girls at school		
Yes	297	100
Soap and water in school toilet		
Yes	252	84.8
No	45	15.2
Kitchen garden at home		
Yes	238	80.1
No	59	19.9
Illness in past 6 months		
Yes	94	31.6
No	203	68.4
If yes, type of illness		
Fever	44	46.8
Head ache	7	7.4
Stomach pain	12	12.7
Common cold	31	32.9

Table 09: Distribution of the respondents by Individual Dietary Diversity

Variables	Frequency (n)	Percentage (%)
Cereals		
Yes	292	98.3

No	5	1.7
White roots and tubers		
Yes	158	53.2
No	139	46.8
Vitamin A rich vegetable and tubers		
Yes	160	53.9
No	137	46.1
Dark green leafy vegetables		
Yes	176	59.3
No	121	40.7
Other vegetables		
Yes	257	86.5
No	40	13.5
Vitamin A Rich Fruits		
Yes	209	70.4
No	88	29.6
Other Fruits		
Yes	104	35
No	193	65
Organ Meat		
Yes	61	20.5
No	236	79.5
Flesh Meats		
Yes	106	35.7
No	191	64.3
Eggs		
Yes	141	47.5
No	156	52.5
Fish and Sea foods		
Yes	60	20.2
No	237	79.8
Legumes, Nuts and Seeds		
Yes	158	53.2
No	139	46.8
Milk And Milk Products		
Yes	197	66.3
No	100	33.7
Oils And Fats		
Yes	242	81.5
No	55	18.5
Sweets		
Yes	231	77.8
No	66	22.2
Spices, Condiments, Beverages		
Yes	199	67
No	98	33
Did you eat anything (meal or snack) OUTSIDE the home yesterday?		
Yes	166	55.9
No	131	44.1

Table 10: Distribution of respondents by Individual Dietary Diversity Score

Variables	Frequency (n)	Percentage (%)
Low dietary diversity	3	1
Medium dietary diversity	12	4
High dietary diversity	282	95

Table 11: Nutritional Status (BMI for age) of the Respondents

Variables (Nutritional Status)	Frequency (n)	Percentage (%)
Under weight (Less than 5th percentile)	45	15.2
Normal (5th -85th percentile)	210	70.7
Over weight (85th 95th percentile)	22	7.4
Obesity (more than 95th percentile)	20	6.7

Table 12: Association between Socio –Demographic and Nutritional Status (BMI for age) of school going adolescence

Socio-Demographic Variables	Nutritional Status		Chi square	P value	Cramer's V
	Normal n (%)	Malnourished n (%)			
Age group 13-15 16-19	 174 (73.1) 36 (61)	 64 (26.9) 23 (39)	3.338[a]	0.068	
Sex Male Female	 109 (69.9) 101 (71.6)	 47 (30.1) 40 (28.4)	0.111[a]	0.739	
Grade Nine Ten	 116 (75.3) 94 (65.7)	 38 (24.7) 49 (34.3)	3.293[a]	0.070	
Ethnicity Un privileged Privileged group	 65 (64.4) 145 (74)	 36 (35.6) 51 (26)	2.980[a]	0.084	
Religion Hindu Non- Hindu	 194 (71.6) 16 (61.5)	 77 (28.4) 10 (38.5)	1.156[a]	0.282	
Family type Nuclear Joint	 131 (76.2) 79 (63.2)	 41 (23.8) 46 (36.8)	5.873[a]	0.015[*]	0.141
No of Siblings Less than 3 More than 3	 22 (68.8) 155 71.4)	 10 (31.3) 62 (28.6)	0.202[a]	0.904	
Education of Father Illiterate Literate	 6 (75) 204 (70.6)	 2 (25) 85 (29.4)	0.073[a]	1.000[b]	
Education of Mother Illiterate Literate	 8 (66.7) 202 (70.9)	 4 (33.3) 83 (29.1)	0.099[a]	0.752[b]	
Father Occupation	 180 (70.6)	 75 (29.4)	0.012[a]	0.912	

Direct Income generating Indirect Income generating	30 (71.40	12 (28.6)			
Mother Occupation Direct Income generating Indirect Income generating	81 (71.7) 129 (70.1)	32 (28.3) 55 (29.9)	0.084[a]	0.772	
Birth order First/Second Third/Fourth	177 (71.7) 33 (66)	70 (28.3) 17 (34)	0.643[a]	0.423	
Monthly Income of family ≥ 50,000 < 50,000	124 (67.8) 86 (75.4)	59 (32.2) 28 (24.6)	2.000[a]	0.157	

Table 13: Association between Lifestyle and Behavioral related characteristics with Nutritional Status (BMI for age) of school going adolescence

Lifestyle related variables	Nutritional Status		Chi square	P value	Cramer's V
	Normal n (%)	Malnourished n (%)			
Used to go school By walking By vehicle	146 (69.2) 64 (74.4)	65 (30.8) 22 (25.6)	0.805[a]	0.370	
Physical activity in a week Daily Less than 4 days a week More than 4 days a week	135 (68.5) 57 (75) 18 (75)	62 (31.5) 19 (25) 6 (25)	1.341[a]	0.511	
Item used for hand washing Hand wash Soap	69 (71.9) 141 (70.1)	27 (28.1) 60 (29.9)	0.093[a]	0.760	
Smoking Yes No	2 (50) 208 (71)	2 (50) 85 (29)	0.839[a]	0.583[b]	
Alcohol consumption Yes No	6 (66.7) 204 (70.8)	3 (33.3) 84 (29.2)	0.073[a]	0.724[b]	
Frequency of hand washing in a day Less than 4 times More than 4 times	32 (64) 178 (72.2)	18 (36) 69 (27.9)	1.306[a]	0.253	
Time spends on social media Less than 2 hours	80 (69.6)	35 (30.4)	0.454[a]	0.500	

More than 2 hours	73 (73.7)	26 (26.3)			
Time spends on TV/Laptop/Mobile Less than 2 hour per day More than 2 hour per day	 126 (67.7) 84 (75.7)	 60 (32.3) 27 (24.3)	 2.131[a]	 0.146	

Table 14: Association between Food Habits related variable and Nutritional Status (BMI for age) of school going adolescence

Food Habit related variables	Nutritional Status		Chi square	P value	Cramer's V
	Normal n (%)	Malnourished n (%)			
Main diet at home Rice/dal Other than rice/dal	 201 (70.3) 8 (800	 85 (29.7) 2 (20)	 0.440[a]	 0.729[b]	
Vegetarian /non vegetarian Vegetarian Non vegetarian	 14 (66.7) 196 (71)	 7 (33.3) 80 (29)	 0.178[a]	 0.673	
Vegetable consumption Once a week Less than 3 days a week More than 3 days a week	 27 (65.9) 26 (70.3) 150 (71.1)	 14 (34.1) 11 (29.7) 61 (28.9)	 0.450[a]	 0.798	
Fruits consumption Once a week Less than 3 days a week More than 3 days a week	 50 (69.4) 42 (68.9) 114 (72.2)	 22 (30.6) 16 (31.1) 44 (27.8)	 0.316[a]	 0.854	
Milk and milk products consumption Once a week Less than 3 days a week More than 3 days a week	 44 (69.8) 32 (71.1) 106 (70.2)	 19 (30.2) 13 (28.9) 45 (29.8)	 0.021[a]	 0.989	
Eggs consumption Once a week Less than 3 days a week More than 3 days a week	 79 (74.5) 46 (69.7) 70 (70)	 27 (25.5) 20 (30.3) 30(30)	 0.691[a]	 0.708	
Fish consumption Once a week Less than 3 days a week More than 3 days a week	 111 (70.7) 20 (66.7) 23 (76.7)	 46 (29.3) 10 (33.3) 7 923.3)	 0.748[a]	 0.688	
Lentils, beans, peas or nuts consumption Once a week Less than 3 days a week More than 3 days a week	 83 (70.3) 46 (66.7) 71 (74.7)	 35 (29.7) 23 (33.3) 24 (25.3)	 1.296[a]	 0.523	
sugar, sweets, chocolate or sweeten drinks consumption Once a week	 62 (73.8)	 22 (26.2)	 5.506[a]	 0.046[*]	 0.138

Less than 3 days a week More than 3 days a week	51 (61.4) 92 (76)	32 (38.6) 29 (24)			
Lunch in school canteen Once a week Less than 3 days a week More than 3 days a week	 94 (72.3) 33 (60) 83 (74.1)	 36 (27.7) 22 (400 29 (25.9)	 3.830[a]	 0.147	
Sleeping hour per day Less than 6 hours More than 6 hours	 30 (63.8) 180 (72)	 17 (36.2) 70 (28)	 1.275[a]	 0.259	
Number of hmeals per day 2-3 meals 4-5 meals	 34 (73.9) 166 (69.7)	 12 (26.1) 72 (30.3)	 0.321[a]	 0.571	
Meal skip No yes	 90 (70.3) 120 (71)	 38 (29.7) 49 (29)	 0.017[a]	 0.897	
Pocket money No yes	 80 (74.1) 130 (68.8)	 28 (25.9) 59 (31.2)	 0.929[a]	 0.335	
Consumption of junk food No Yes	 8 (61.5) 202 (71.1)	 5 (38.5) 82 (28.9)	 0.552[a]	 0.458	
Vitamin A rich vegetables and tubers consumption No Yes	 89 (65) 121 75.6	 48 (35) 39 (24.4)	 4.050[a]	 0.044*	 0.117
Meat consumption No Yes	 168 (71.2) 42 (68.9)	 68 (28.8) 19 (31.1)	 0.127[a]	 0.721	
Legumes, Nuts And Seeds consumption No Yes	 106 (76.3) 104 (65.8)	 33 (23.7) 54 (34.2)	 3.888[a]	 0.049*	 0.114

Table 15: Association between Environmental sanitation variable and knowledge related variable with Nutritional Status (BMI for age) of school going adolescence

Knowledge regarding nutrition and Environmental Sanitation related variables	Nutritional Status		Chi square	P value	Cramer's V
	Normal n (%)	Malnourished n (%)			
Source of drinking water at home Tap Well, /hand pump Jar /bottle	 55 (75.3) 40 (78.4) 115 (66.5)	 18 (24.7) 11 (21.6) 58 (33.5)	 3.723[a]	 0.115	

Water purification No Yes	 42 (70) 168 (70.9)	 18 (30) 69 (29.1)	 0.018[a]	 0.893	
Separate toilet for boys and girls at school No Yes	 11 (57.9) 199 (71.6)	 8 (42.1) 79 (28.4)	 1.609[a]	 0.205	
soap and water available at school toilet No Yes	 30 (66.7) 180 (71.4)	 15 (33.3) 72 (28.6)	 0.418[a]	 0.518	
History of illness in past 6 months No Yes	 141 (69.5) 69 (73.4)	 62 (30.5) 25 (26.6)	 0.483[a]	 0.487	
Kitchen garden at home No Yes	 44 (74.6) 166 (69.7)	 15 (25.4) 72 (30.3)	 0.532[a]	 0.466	
Heard about nutrition No Yes	 9 (69.2) 201 (70.8)	 4 (30.8) 83 (29.2)	 0.014[a]	 0.905	
Self-rated health status Very good Good Average Bad	 40 (66.7) 91 (73.4) 74 (71.8) 5 (50)	 20 (33.3) 33 (26.6) 29 (28.2) 5 (500	 3.037[a]	 0.386	
Self-perceived nutritional status Under nutrition Normal Overweight	 16 (61.5) 177 (71.4) 17 (73.9)	 10 (38.50 71 (28.6) 6 926.1)	 1.222[a]	 0.543	

Table 16: Association between Individual Dietary Diversity and Nutritional Status (BMI for age) of school going adolescence

Food groups	Nutritional Status		Chi square	P value	Cramer's V
	Normal n (%)	Malnourished n (%)			
Individual Dietary Diversity Score Low dietary diversity High dietary Diversity	 14 (93.3) 196 (69.5)	 1 (6.7) 86 (30.5)	 3.905[a]	 0.036[b]*	 0.115

4. DISCUSSION

Malnutrition remains among the most devastating problems and nearly 30% of people worldwide are suffering from one or more of the multiple forms of malnutrition. Especially these days, undernutrition among adolescents is a serious public health problem particularly in developing countries [8]. However,

previous studies in Nepalgunj sub-metropolitan city didn't show the nutritional status of adolescents at the school level. So, this study was conducted to determine the magnitude and associated factors of nutritional status among high school adolescents. In the present study the overall prevalence of underweight, normal weight, overweight and obesity is found to be (15.2%), (70.7%), (7.4%) and (6.7%) respectively. This study revealed that prevalence of under-nutrition among adolescent students was 15.2% and this finding is lower than the study in Ambo 27.5%, higher than study conducted in Addis Ababa city (13%). This might be due to the difference in socioeconomic background between the cities. Other studies in Ethiopia indicated that 37.8% were wasted in Tigray region. These findings indicated that under-nutrition is a major public health problem in majority of Ethiopian communities including urban and rural adolescents. These differences in prevalence could be associated with the sociodemographic and economic characteristics of household [2]. A similar study was conducted in southern Nigeria, over two third of the respondent (70.5%) found to be normal which is consistent with this study whereas, (14%) were overweight, (9.5%) were underweight [28]. which are differ from this study this may be due to study setting and different geographical region. Study conducted in school going adolescents in Solukhumbu, Nepal reveal that overweight and obesity is noted to be (7.35%) [32]. study from the 11 countries, the prevalence of overweight and obese girls is nearly 40% or higher, Saudi Arabia (37%), Costa Rica (38%), Uruguay (38%), Egypt (40%), Libya (42%), Kuwait (46%), Oman (42%), Solomon islands (49%), Tonga (53%), Micronesia (61%) and Kirbati (66%), the reason for girls overweight could be the, negative stigma associated with thinness, in some culture thinness is associated with being ill, whereas, obesity is associated with wealth, happiness, and good health.[33] A similar, study conducted in Kaski district of Nepal, revealed 8.1% prevalence of overweight and obesity of among higher secondary level school adolescents with 5.8% overweight and 2.3% obese. Urban respondents were found significantly more overweight/obese than village respondents (p=0.001, OR=2.360) which is consistent with this study [22]. In this study the prevalence of malnutrition found to be slighted more higher in male than female this could be the majority of male respondents. In this research study family type and nutritional status of the respondents was found to be significantly associated with each other with the p value of 0.015, which is consistent to the study conducted in dang district, showed statistically significant p = 0.001 between type of family and underweight [5]. The study done by Pal, Pari, Sinha, Prakash and Dhara, 2016 in West Bengal state, India found significant association of underweight with family type, however showed different result of that adolescents of nuclear families (family size < 4) were more likely to be under nutrition [34]. In contrast to this study that adolescent living in nuclear family had (23.8%) malnutrition and (36.8%) in joint family. In the present study findings shows that there is no significant association between age, sex, religion, ethnicity group, parent's education, family income, birth order and number of siblings. Similar study conducted in urban area of Pokhara Nepal indicate that monthly income and religion were found to be significantly associated with the dietary intake of adolescent's girls of class 9 and 10 with the p value of (<0.05). A study conducted in Germany to determine the socioeconomic association between parental position and health among adolescent found that parental socioeconomic position and educational level were associated with consumption of less energy, dense food, more fruits and vegetables, and more favorable overall dietary behavior.[35] Study conducted in Urban Sharkia Governorate, Egypt there was significant relationship between obesity and parental education, as the highest prevalence of obesity was among students with low educated parents as they are responsible for food selection for their children as well as their lifestyle activities. Whereas, most study conducted in developing countries revealed that the highest prevalence of obesity was among students with high educated parents due to parental style with low energy expenditure [21]. This information explain that the level of socioeconomic status of parents of the adolescents could be influence their nutritional status. In the present study, majority (68.5%) of respondents reported that they were regularly physical active. From the study conducted in Kinondoni revealed that the risk of being overweight and obesity was lower in

school adolescents who walked to from schools [36]. majority of the respondents in this study were not smoking cigarette and consuming alcohol. However, few of them had ever smoking and taken alcohol occasionally which is consistent to the study conducted in undergraduate students in private university in Southern Nigeria [28]. it shows that habits of taking cigarette and alcohol was not a common practice among adolescent. Similarly, study conducted in school adolescent in Edo state Nigeria conclude physically active days, BMI and fruit plan tree at home were associated with the healthy dietary pattern at p value less than 0.05 [30]. Which was different from the current study. In the current study it was found that (26.3%) of respondent who had screen time of more than 2 hour were malnourished. This is consistent with study from previous, revealed that Children who exceeded the recommended screen time of less than equal to 2 hour a day on weekends were 3 times more likely to be OW/OB than those who met the recommendation. Educated mothers have a higher chance of employment resulting in lesser time to monitor their children's physical activities or sedentary behaviors like watching TV, which in turn, significantly increases their BMI [24]. In this study there was significant association between nutritional status and food habits related variable like, sugar, sweets, chocolate or sweeten drinks consumption with the p value of (0.046), Vitamin A rich vegetables and tubers consumption with the p value of (0.044), Legumes, Nuts and Seeds consumption with p value of (0.049). A similar study conducted from Pokhara revealed that Fruits consumption per week was found to be significantly associated with nutritional status. Participants who consumed fruits more than 4 days per week were 2.5 times more likely to be normal (OR 2.500; 95%CI 1.194-5.233; P=0.013) [35]. nearly half of the adolescent found to consume legumes as well other protein rich food sources may increase underlying disease burden from undernutrition and micronutrient deficiency. In this study adolescent consuming sweets, sugar and chocolate were very high i.e. (97.3%) which is similar to the study conducted among adolescents in Ghana i.e. 90.2% [37]. The high consumption of sugar drinks and soda may lead to increase in the prevalence of obesity and cardiovascular disease. However, Meat consumption per week, Egg consumption per week, Fish consumption per week, Vegetable consumption per week and Milk and milk product consumption per week has no association with nutritional status. Consumption of junk food was found very high among adolescents in this study among them 35.6% reported to consume it daily. Junk food consumption has been identified as a risk factor for obesity and overweight in adolescent good taste, advertising, easy availability of fast foods, and marketing are found to be associated with consumption of junk food [38]. A study conducted on urban Nepal revealed that Children who consumed processed meat and its products, (such as sausages, ham, roasts) snacks, (such as potato crisps, chips) and confectionaries (such as sweets and ice cream) more than twice a week were Almost 3 times more likely to be overweight or obese than those who consumed less than twice a week [24]. In current study there was no association found between skipping meal and malnutrition. Majority of the respondent skip breakfast and day snacks while minority of them sometime skip dinner and lunch. A similar study conducted in Southwest Nigeria revealed that there was no association between breakfast skipping and being overweight/obese; however, this study demonstrated a significantly higher mean of BMI among those who skipped breakfast compared to those who ate breakfast [19]. the reason for skipping breakfast by adolescence can be because of consumption is less popular among the Nepalese population. Daily pocket money was associated with junk food patterns in the study conducted in Pokhara, Nepal. Adolescents who got to school with higher pocket money can purchase sweets, snacks and soft drinks. Similar study findings were observed from the study of Ghana [39]. the respondent had knowledge about the word nutrition and its importance toward maintaining a healthy life but this is not found interpreted into their nutritional status, knowledge regarding nutrition is important because it has positive impact on healthy food choice and good health. In this study there was significant association between the BMI and individual dietary diversity score of the respondent with the p value of 0.036. A similar study conducted in a private university in southern Nigeria revealed that three hundred and ninety-two (49.0%) of the

respondents had a high dietary diversity, 212 (26.5%) had a low dietary diversity and 196 (24.5%) had a medium dietary diversity, overweight and obese respondents were more among those who had a medium dietary diversity, 36 (18.4%) and 16 (8.2%), respectively, however, this finding was not statistically significant (p = 0.057) [28]. in our study majority of the respondent had a higher dietary diversity score which is consistent with this study. The meal pattern of the respondents also shows that majority of them consumed more of foods belonging to the cereals, roots and tubers, fruits, meats, oils and fats groups and less of foods belonging to the vegetables and eggs group. This may affect the availability of the nutrients (i.e., minerals and proteins) inherent in these food groups, to the respondents. The DDS of the respondents shows that more of them ate more than six food groups, which makes available necessary nutrients for optimal health. The dietary diversity of the respondents may be a reflection of better knowledge of basic nutritional values of the different food groups. High dietary diversity includes food from many food groups (≥6) which makes available balanced nutrients for optimal health. The high DDS of the respondents indicates their consumption of wide varieties of food which ensures availability of useful and balanced nutrients. This guarantees optimal nutrition which has a positive impact on their nutritional and health status.

5. CONCLUSION

The research was conducted among 297 school going adolescents in private school of Nepalgunj sub-metropolitan city Banke district, Nepal. The aim of study was to assess the nutritional status and its associated factors among school going adolescents through the anthropometric measurement BMI for age. The anthropometric results show the prevalence of underweight, overweight and obesity. The present study shows the overall prevalence of underweight, normal weight, overweight and obesity is found to be (15.2%), (70.7%), (7.4%) and (6.7%) respectively. The study shows the significant association between nutritional status and different variable like family type, sweets, sugar, chocolate, sweeten drinks consumption, Vitamin A rich vegetables and tubers consumption, Legumes, Nuts and Seeds consumption and individual dietary diversity which showed the moderate level of association. Likewise, age, sex, religion, parent's education, number of siblings, birth order, pocket money, physically activity, family income, junk food consumption, sleeping hour, screening time and other food consumption were not associated with nutritional status. The finding revealed that there were high consumption of sweets, carbohydrate drinks and junk or processed food among school going adolescents. These food preferences have increased the propensity of influencing the burden of overweight and obesity. The DDS (dietary Diversity Score) of the respondent shows that majority of them ate more than six food groups. In conclusion, the study reveals that most of the respondents ate four or five main meals a day, either skip breakfast or eat in-between meals. The high DDS of the respondents ensures balanced nutrition. BMI of the respondents indicate that majority of them had a normal BMI.

AUTHOR CONTRIBUTION STATEMENT

Purna Bhandari: Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, Drafting the work or reviewing it critically for important intellectual content; AND Final approval of the version to be published, and Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Data Availability: The datasets and information used in this study are publicly available from the sources cited within the article. No proprietary or restricted data were used.

Trial Registration: Trial registration is not applicable to this study, as it does not involve clinical trials, human participants, or experimental interventions.

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Supplemental Material

No supplementary files, datasets, figures, or additional materials are associated with this study. Any information necessary to understand and evaluate the work is included in the main article.