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Original Research Article

Knowledge on Nutrition and Dietary Diversity Among Community School Adolescents in Kathmandu Valley

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Abstract

Nutritional knowledge and practices among adolescents are critical to combat health problems that can continue into adulthood. The study determines the nutritional knowledge and dietary diversity and its associated factors among school adolescents of Kathmandu Valley. The study adopted a cross-sectional design of 487 school adolescents using multistage cluster sampling. Information on socio-demographic characteristics, Health Belief Model constructs, nutrition knowledge and dietary diversity were collected. Bivariate and multivariate logistic regression models were used to identify the factors associated with nutrition knowledge and dietary diversity. Nutrition knowledge and dietary diversity were found inadequate; 47.4% had adequate dietary diversity and 42.5% had adequate nutrition knowledge Variables that were significantly associated with adequate nutrition knowledge (versus inadequate) in the presence of other variables were compared to reference group included age (adjusted odds ratio [aOR]= 0.83; 95% CI = 0.71-0.96), being from ethnic groups of Janajatis (aOR=2.79; 95% CI: 1.47-5.28) and Brahmin/Chhetri (aOR=1.9; 95% CI: 1.06-3.4), belonging to nuclear family (aOR=1.75; 95% CI: 1.18-2.6), literate father (aOR=2.16; 95% CI: 0.99-4.73), perceived severity (aOR= 1.19; 95% CI: 1.06-1.33) and perceived barrier (aOR= 1.02 ; 95% CI: 1-1.05). Variables that were significantly associated with consuming adequate dietary diversity (versus inadequate) in the presence of other variables include being male (aOR=1.52;95% CI: 1.01-2.29), having literate mother (aOR=1.7;95% CI: 1.02-2.83), consuming unhealthy diet daily (aOR=4.23;95% CI: 1.85-9.67), having adequate knowledge (aOR= 2.4;95% CI: 1.59-3.63) and self-efficacy (aOR= 1.15;95% CI: 1.06-1.24). This study highlights the need for specific theories and model-based targeted interventions to encourage adolescents' healthy behavior and healthy eating.

***Keywords**:* Adolescent; dietary diversity; health belief model; Nepal; nutrition knowledge

Introduction

Adolescents constitute more than 16% (1.3 billion) of the world's population globally, with Asia being the home for more than half [United Nations Children's Fund (UNICEF, 2019)]. Adolescence is a critical phase in the life course, characterized by a transition from childhood to adulthood (Patton et al., 2016). Adolescents undergo physical growth, biological maturation, physiological and cognitive development that requires an adequate and diverse diet to ensure growth and normal pubertal development (Christian & Smith, 2018; Patton et al., 2016). The nutritional status of an adolescent plays a significant role in determining their current and future health (WHO, 2018). Despite increased nutritional needs, adolescents have been overlooked in a global context, with the majority of nutrition interventions focusing on children and mothers (Aryal et al., 2016). However, nutrition remains a driving cause contributing to the predominant causes of adolescent mortality and morbidity (Christian & Smith, 2018; Isabirye et al., 2020).

While nutrition among adolescents is overlooked, they are exposed to undernutrition (wasting, stunting, underweight, etc.), micronutrient malnutrition as well as obesity (Christian &

Smith, 2018; WHO, 2017). Globally, one-third of adolescent in the world is obese, and more than 10% is underweight in low-middle-income countries (Isabirye et al., 2020). Food knowledge and nutritious food intake remains crucial problem among adolescents (ALjaraedah et al., 2019) and is an enduring issue in Nepal (Aryal et al., 2016). Almost two-thirds of adolescents in Nepal are underweight and the proportion is higher among males (Aryal et al., 2017). In areas with suboptimal dietary intakes, anemia, and micronutrient deficiencies are high (WHO, 2018). Iron deficiency anemia was among 35%, females having double burden compared to males (Aryal et al., 2016). The double burden of malnutrition coexistence of undernutrition with overweight, obesity, or diet-related NCDs tends to affect females disproportionately (WHO, 2017).

Dietary knowledge and attitude can influence dietary practice (Fatima et al., 2019), where study findings have shown low consumption of fruits and vegetables among those who had poor knowledge about nutrition (Aryal et al., 2016). Moreover, age, sex, education level of mother, family size, socio-economic status and household food insecurity were also found to be associated with the dietary practice of adolescents (Endalifer et al., 2021; Islam et al., 2020). Furthermore, easy access to market food products, media-based advertising, unhealthy food choices in school, and peers/friends can influence the food consumption pattern of the adolescent (Chalise, 2018).

Adolescents undergo psychological (mental and emotional changes) and social processes (interactions, relationships, and experiences individuals have with others and their environment) of maturation from childhood to adulthood; the nutritional requirements also increase to support adequate growth and development (WHO, 2018). Focusing on the nutritional requirements can play a vital role in ensuring a healthy and productive life (Isabirye et al., 2020). Adequate nutrition through a diverse diet can reduce the likelihood of developing a deficiency or excess of any nutrient and prevent chronic diseases (Isabirye et al., 2020; Ochola & Masibo, 2014). Dietary diversity can serve as an indicator for nutrient adequacy as it indicates the extent of consumption of diverse food groups across and within several food groups over a given reference period (Belachew et al., 2013). It is recommended that adolescents should eat from a variety of food groups (grains, pulses, animal products, fruits, and vegetables), drink plenty of water, and avoid high consumption of sugars (Isabirye et al., 2020). Balanced and adequate nutrient intake can reduce adolescent morbidity and mortality and positively impact their educational outcomes and adolescent education capacity (Ochola & Masibo, 2014). Studies have investigated various factors associated with the dietary practices of adolescents. Still, limited studies have been conducted to predict dietary practice based on health promotion models such as the Health belief model (HBM) (Arash et al., 2016). The HBM is an expectancy-value model and has been used in a variety of public health settings over the years. Its core constructs include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Glanz & Bishop, 2010).

Hence, this study aims to assess the nutritional knowledge and dietary diversity among school adolescents of Kathmandu Valley, Nepal. As a result, dietary intervention based on influential HBM factors can be developed to ensure dietary change among adolescents.

Methods and Materials

Study Design

A descriptive cross-sectional study was conducted to identify the nutritional knowledge and dietary diversity among school adolescents in public schools of Kathmandu Valley.

Sampling Size and Sampling Techniques

With the standard formula, the sample size of 487 school adolescents was estimated, given that the margin of error alpha (α) = 0.05, prevalence=0.05, the confidence level = 95%, design effect=1.5, and the non-response rate = 5%. Sampling was done in two-stage cluster sampling or multistage cluster sampling. In the first stage, a list of total public schools and students of grades 8,9 and 10 of Kathmandu district was obtained from the District Education Office, and a list was created. Four schools were selected using Probability Proportionate Sampling in ENA software from the list of total public schools created. In the second stage, all school adolescents in grades 8, 9, and 10 from the selected study were recruited for the study.

Data Collection Tools and Techniques

Due to the COVID-19 lockdown, the survey was administered online; the online questionnaire was developed using Google Forms. Before the data collection, we provided clear information about the study, including its purpose, procedures, risks, benefits, and confidentiality protections to students, and consent was obtained. These online Google forms were sent to the students, and the students were asked to fill out the form, and the responses were collected online.

The survey answers were automatically collected in an Excel spreadsheet imported into the R program for data analysis. The data collection tools and methods (online data collection) were pretested before the study. The data collection tool consisted of five parts. Part I dealt with socio-demographic information, Part II dealt with the school environment and eating habits, and Part III covered nutrition knowledge, including the importance of nutrition, type of nutrients, and nutritional deficiency diseases, and adapted from studies elsewhere (Aryal et al., 2016). Further, Cronbach alpha was calculated for items of knowledge on nutrition and found to be 0.87, which was higher than the acceptable value of health setting, adequate 0.70 for most research purposes. In a health setting, knowledge of nutrition was categorized based on a composition score of seven times of knowledge, and a composite score of 75% or higher might indicate Adequate knowledge, while a score below that was considered inadequate knowledge. Part IV dealt with dietary diversity (FAO & FHI, 2016). It was calculated using the 24-hour dietary recall method, which was used to record food group consumptions (ten food groups included Grains, white roots, and tubers; Pulses: beans, peas, lentils, nuts, and seeds; Dairy; Meat, poultry, and fish; Eggs; Dark green leafy vegetables; Other Vitamin A rich fruits and vegetables; Other vegetables; and Other fruits) among adolescents in the last 24 hours preceding the study. Adequate dietary diversity was defined as consuming food items from at least five of ten defined food groups the previous day and night (FAO & FHI, 2016). Lastly, Part V consisted of the constructs of HBM (Salem & Said, 2018).

The perceived susceptibility is belief about the chances of experiencing a risk or getting a condition or disease and includes two items; the perceived severity is belief about how serious a condition and its sequelae and includes two items; the perceived benefit is belief in efficacy of the advised action to reduce risk or seriousness of impact and include eight items; the perceived barriers is belief about the tangible and psychological costs of the recommended action and have 14 items; perceived self-efficacy is confidence in one's ability to take action and include four items and cues to action is strategies to activate "readiness" and have 2 items.

Data Analysis

A bi-variate analysis (Chi-square test and independent t-test) examined the association between socio-demographic factors, junk food habits, school environment with nutrition knowledge, and dietary diversity among school adolescents. A p-value less than 0.05 was considered statistically significant. Logistic regression analysis was performed to examine the effects of the determinants on the outcomes. Multicollinearity was checked among the variables, and there was no considerable collinearity (variance inflation factor 1–2). Multivariate analysis with all independent variables entered simultaneously was completed to adjust for the effect of confounding, and adjusted OR and 95% CI were computed. Multivariate analysis with all independent variables entered simultaneously was conducted to compute the impact of confounders, and adjusted OR and 95% CI were calculated. The Hosmer–Lemeshow test was performed to test the goodness-of-fit of the multivariate logistic regression model which was found to be a good fit ($p>0.05$). All statistical analyses were conducted using the R program. Ethical clearance was obtained from the Institutional Review Committee of Nobel College for this study with registration number IRC318/2020.

Results

Socio-Demographic Characteristics

The mean age of the adolescents was 14.8±1.37 years. The majority of the adolescents (63.9%) were female. Half of the adolescents (50.3%) belong to upper caste groups and majority (84.6%) was Hindu. The mean family size and number of siblings were 5.69±4.32 and 2.37±1.52, respectively. Almost half the adolescents (48%) were from nuclear families, and the remaining (52%) were from joint families. Most adolescents' fathers (91.8%) and mothers (80.1%) were literate. Regarding the fathers' occupations of adolescents, 33.7% were involved in service, 33.9% were engaged in other, 24.6% were in business, and 7.8% were in agriculture. Nearly two-thirds (60.4%) of the adolescent mothers were homemakers and the remaining 15% and 12.3% were involved in business and service respectively (Table 1).

Table 1

Socio-Demographic Characteristics of the Adolescents

Characteristics	Number (N=487)	Percent
Age	14.8±1.37	
Sex		
Male	176	36.1
Female	311	63.9
Ethnicity		

Characteristics	Number (N=487)	Percent
Advantage Group (Brahmin/Chhetri)	245	50.3
Janjati	161	33.1
Others	81	16.6
Religion		
Hindu	412	84.6
Others	75	15.4
Family type		
Nuclear	232	47.6
Joint	255	52.4
Family size (Mean±SD)	5.69±4.32	
Number of siblings	2.37±1.52	
Father's Education		
Illiterate	40	8.2
Literate	447	91.8
Mother's Education		
Illiterate	97	19.9
Literate	390	80.1
Father's Occupation		
Service	164	33.7
Agriculture	38	7.8
Business	120	24.6
Others	165	33.9
Mother's Occupation		
Homemakers	294	60.4
Service	60	12.3
Agriculture	27	5.5
Business	73	15
Others	33	6.8

Nutrition Knowledge and Dietary Diversity

Table 2 shows that less than half (42.5%) had adequate nutrition knowledge and 57.5% had inadequate knowledge. Furthermore, 47.4% had sufficient dietary diversity, and the remaining 52.6% had insufficient nutritional diversity. The majority of the adolescents, i.e., 80.5%, had consumed pulses, and 78% consumed grains, white roots, and tubers. Among the animal sources, 57.5% had consumed milk and milk products, 33.5% had consumed meat, poultry, fish, and organ meat, and 22.6% reported consuming eggs. Over half (62.8%) of the adolescents reported consuming green leafy vegetables. However, fruits and vegetables rich in vitamin A were consumed by one-third (34.4%) of the adolescents.

Table 2

Nutrition Knowledge and Dietary Diversity in 24 Hours

Variable	Number (N=487)	Percent
Nutrition Knowledge		
Adequate knowledge	207	42.5
Inadequate knowledge	280	57.5
Dietary diversity		
Adequate dietary diversity	231	47.4

Variable	Number (N=487)	Percent
Inadequate dietary diversity	256	52.6
Food Groups		
Grains, white roots and tubers	380	78
Pulses (Beans, Peas and lentils)	392	80.5
Nuts and Seeds	86	17.7
Milk and milk products	280	57.5
Meat, poultry, fish and organ meat	163	33.5
Egg	110	22.6
Green leafy vegetable	306	62.8
Vitamin A rich fruits, vegetables, roots and tubers	167	34.3
Other vegetables	246	50.5
Other fruits	241	49.5
Junk food	244	50.1
Sugary foods	206	42.3
Carbonated and sugary drinks	149	30.6

Factors Associated with Nutrition Knowledge

Table 3 shows the association between socio-demographic characteristics of adolescents, dietary habits, constructs of HBM and nutrition knowledge. In multivariate analysis, the factors that were significantly associated with knowledge after controlling for other factors include age, ethnicity, type of family, education of father, perceived severity and perceived barrier ($p<0.05$). One-unit increase in age yields lower odds of having adequate knowledge [aOR=0.83(95% CI: 0.71-0.96)]. The odds of adolescents having adequate knowledge among Janajati was more than two times [aOR=2.79(95% CI: 1.47-5.28)], and Brahmin/Chhetri was more than one time [aOR=1.9(95% CI: 1.06-3.4)] compared to Dalit/Muslim group. The results revealed that adolescents from nuclear families were nearly two times more likely to have adequate knowledge than those from joint families (adjusted odds ratio [aOR=1.75(95%CI: 1.18-2.6). Additionally, having a literate father increased the likelihood of adolescents having adequate knowledge twice compared to those with an illiterate father (aOR=2.16, 95% CI: 0.99-4.73).

Moreover, the study found that two key factors, perceived severity, and perceived barrier, were associated with nutrition knowledge. Increasing one unit in perceived severity increased the odds of having adequate knowledge (aOR=1.19, 95% CI: 1.06-1.33, $p<0.05$). Similarly, rising one unit in perceived barrier also yielded higher odds of having adequate knowledge (aOR=1.02, 95% CI: 1.00-1.05, $p<0.05$). In summary, the results suggest that adolescents from nuclear families and those with literate fathers are likelier to possess adequate knowledge of nutrition. Additionally, higher perceived severity and perceived barriers are associated with increased odds of having sufficient knowledge. The overall predictive capacity of the model was statistically significant, indicating its ability to explain and predict factors related to nutrition knowledge among adolescents.

Similarly, adolescents from nuclear families were nearly twice [aOR=1.75(95% CI: 1.18-2.6)] more likely to have adequate knowledge than those from joint families. Likewise, a literate father was two times [aOR=2.16(95% CI: 0.99-4.73)] more likely to have adequate knowledge than an illiterate father. Perceived severity and perceived barrier were associated with nutrition knowledge. One-unit increase in perceived severity [aOR= 1.19 (95% CI: 1.06-1.33)] and perceived barrier [aOR=1.02 (95% CI: 1-1.05)] yields higher odds of having adequate knowledge [aOR=0.83(95% CI: 0.71-0.96)].

Table 3

Factors Associated with Knowledge of Nutrition in Multivariate Logistic Regression

Characteristics	Nutrition Knowledge			Test stat (P-value)	COR (95% CI) P-value	AOR (95% CI) P-value
	Inadequate Number (n=280, 57.5%)	Adequate Number (n=207, 42.5%)	Total Number (N=487)			
Age*				2.82(.005)		
Mean (SD)	15(1.4)	14.6(1.4)	14.8(1.4)		0.83 (0.72,0.95) .013	0.83 (0.71,0.96) .013
Sex				2.44(.118)		
Male	93(52.8)	83(47.2)	176 (36.1)			
Female	187(60.1)	124(39.9)	311 (63.9)			
Ethnicity				6.87(.032)		
Advantage Groups	132 (53.9)	113 (46.1)	245 (50.3)		2.03 (1.19,3.49) 0.031	1.9 (1.06,3.4) 0.005
Janajati	91 (56.5)	70 (43.5)	161 (33.1)		1.83 (1.03,3.23) 0.002	2.79 (1.47,5.28) 0.005
Others	57 (70.4)	24 (29.6)	81 (16.6)		1	1
Religion				4(0.045)		
Hindu	229 (55.6)	183 (44.4)	412 (84.6)		0.59 (0.35,0.99) 0.045	0.68 (0.36,1.27) 0.225
Others	51 (68)	24 (32)	75 (15.4)		1	1
Type of family				10.1(0.001)		
Nuclear Family	116 (50)	116 (50)	232 (47.6)		1.8 (1.25,2.59) 0.005	1.75 (1.18,2.6) 0.005
Joint Family	164 (64.3)	91 (35.7)	255 (52.4)			
Family size*				0.45(0.65)		
Mean (SD)	5.8 (4.8)	5.6 (3.5)	5.7 (4.3)			
Number of children*				2.3(0.022)		
Mean (SD)	2.5 (1.6)	2.2 (1.4)	2.4 (1.5)		0.87 (0.77,0.98) 0.01	0.93 (0.81,1.07) 0.316
Father's education				4.02(0.045)		
Illiterate	29 (72.5)	11 (27.5)	40 (8.2)			
Literate	251 (56.2)	196 (43.8)	447 (91.8)		2.06 (1,4.22) 0.045	2.16 (0.99,4.73) 0.047
Mother's education				3.57(0.059)		
Illiterate	64 (66)	33 (34)	97 (19.9)			
Literate	216 (55.4)	174 (44.6)	390 (80.1)			
Father's Occupation				1.6(0.66)		
Service	92 (56.1)	72 (43.9)	164 (33.7)			
Agriculture	24 (63.2)	14 (36.8)	38 (7.8)			
Business	65 (54.2)	55 (45.8)	120 (24.6)			

Characteristics	Nutrition Knowledge			Test stat (P-value)	COR (95% CI) P-value	AOR (95% CI) P-value
	Inadequate Number (n=280, 57.5%)	Adequate Number (n=207, 42.5%)	Total Number (N=487)			
Others	99 (60)	66 (40)	165 (33.9)			
Mother's Occupation				6.03(0.197)		
Housewife	177 (60.2)	117 (39.8)	294 (60.4)			
Service	36 (60)	24 (40)	60 (12.3)			
Agriculture	17 (63)	10 (37)	27 (5.5)			
Business	34 (46.6)	39 (53.4)	73 (15)			
Others	16 (48.5)	17 (51.5)	33 (6.8)			
Junk food as alternative				6.24(0.013)		
No	161 (53.1)	142 (46.9)	303 (62.2)			
Yes	119 (64.7)	65 (35.3)	184 (37.8)		1.61 (1.11,2.35) 0.013	1.32 (0.87,2.01) 0.194
Junk food intake in past 7 days				1.07(0.585)		
Never	89 (61)	57 (39)	146 (30)			
1-6 times	172 (56.2)	134 (43.8)	306 (62.8)			
Daily	19 (54.3)	16 (45.7)	35 (7.2)			
Perceived susceptibility*				0.04(0.97)		
Mean (SD)	5.5 (1.6)	5.5 (1.6)	5.5 (1.6)			
Perceived severity*				5.4(<0.001)		
Mean (SD)	6.8 (2.4)	7.9 (2.2)	7.3 (2.4)		1.25 (1.15,1.36) 0.003	1.19 (1.06,1.33) 0.002
Perceived benefit*				4.5(<0.001)		
Mean (SD)	35.2 (11.1)	39.5 (9)	37.1 (10.5)		1.04 (1.02,1.06) 0.002	1.01 (0.97,1.03) 0.612
Perceived barrier*				3.15(0.002)		
Mean (SD)	46.2 (10.9)	49.2 (10)	47.5 (10.6)		1.03 (1.01,1.05) 0.02	1.02 (1,1.05) 0.018
Self-efficacy*				3.8(<0.001)		
Mean (SD)	13.4 (4.5)	14.8 (3.6)	14 (4.2)		1.09 (1.04,1.15) 0.03	1.03 (0.95,1.11) 0.503
Cue to action*				3.8(<0.001)		
Mean (SD)	6.5 (2.4)	7.3 (2)	6.9 (2.2)		1.17 (1.07,1.28) 0.001	1.01 (0.87,1.15) 0.924

*Independent T-test

Factors Associated with Dietary Diversity

Table 4 shows the association between socio-demographic characteristics of adolescents, dietary habits, constructs of HBM, nutrition knowledge and dietary diversity. In multivariate analysis, the factors significantly associated with dietary diversity are sex, education of the mother, frequency of junk food consumption in a week, self-efficacy, and knowledge ($p<0.05$). The odds of consuming minimum dietary diversity among males was almost two times higher [aOR=1.52(95% CI: 1.01-2.29) p=0.045] than female adolescents. Similarly, those with literate mothers had nearly two times [aOR=1.7(95% CI: 1.02-2.83) p=0.04] of consuming minimum dietary diversity than those with illiterate mothers. With regards to the frequency of consumption of junk food in a week, those who consumed junk food daily were four times [aOR=4.23(95% CI: 1.85-9.67) $p<0.001$] more likely to consume dietary diversity compared to those who never consume junk food. Regarding knowledge level, adolescents having adequate knowledge were more than two times [aOR=2.4(95% CI: 1.59-3.63) $p<0.001$] consuming dietary diversity than adolescents with inadequate knowledge. Self-efficacy was found to be associated with dietary diversity. One-unit increase in self-efficacy yields higher odds of consuming minimum dietary diversity [aOR=1.15(95% CI: 1.06-1.24) $p<0.001$].

Table 4

Factors Associated with Dietary Diversity in Multivariate Logistic Regression

Characteristics	Dietary Diversity			Test stat (P-value)	COR (95% CI) P-value	AOR (95% CI) P-value
	Inadequate Number (n=256, 52.6%)	Adequate Number (n=231, 47.4%)	Total Number (N=487)			
Age*				1.81(0.071)		
Mean (SD)	14.9 (1.4)	14.7 (1.3)	14.8 (1.4)			
Sex				3.95(0.047)		
Male	82 (46.6)	94 (53.4)	176 (36.1)		1.46 (1,2.11) 0.045	1.52 (1.01,2.29) 0.045
Female	174 (55.9)	137 (44.1)	311 (63.9)			
Ethnicity				0.12(0.942)		
Advantage groups	128 (52.2)	117 (47.8)	245 (50.3)			
Janajati	84 (52.2)	77 (47.8)	161 (33.1)			
Others	44 (54.3)	37 (45.7)	81 (16.6)			
Religion				0.42(0.517)		
Hindu	214 (51.9)	198 (48.1)	412 (84.6)			
Others	42 (56)	33 (44)	75 (15.4)			
Type of family				4.72(0.03)		
Nuclear Family	110 (47.4)	122 (52.6)	232 (47.6)		1.49 (1.04,2.12) 0.005	1.13 (0.76,1.69) 0.55
Joint Family	146 (57.3)	109 (42.7)	255 (52.4)			
Family size*				0.4(0.691)		
Mean (SD)	5.8 (4.5)	5.6 (4.1)	5.7 (4.3)			
Number of children*				1.49(0.137)		
Mean (SD)	2.5 (1.6)	2.3 (1.4)	2.4 (1.5)			
Father's education				0.12(0.734)		
Illiterate	20 (50)	20 (50)	40 (8.2)			
Literate	236 (52.8)	211 (47.2)	447 (91.8)			
Mother's education				4.19(0.041)		
Illiterate	60 (61.9)	37 (38.1)	97 (19.9)			
Literate	196 (50.3)	194 (49.7)	390 (80.1)		1.61 (1.02,2.53) 0.042	1.7

Characteristics	Dietary Diversity			Test stat (P-value)	COR (95% CI) P-value	AOR (95% CI) P-value
	Inadequate Number (n=256, 52.6%)	Adequate Number (n=231, 47.4%)	Total Number (N=487)			
						(1.02,2.83) 0.04
Father's Occupation				7.54(0.056)		
Service	75 (45.7)	89 (54.3)	164 (33.7)			
Agriculture	25 (65.8)	13 (34.2)	38 (7.8)			
Business	61 (50.8)	59 (49.2)	120 (24.6)			
Others	95 (57.6)	70 (42.4)	165 (33.9)			
Mother's Occupation				5.78(0.216)		
Housewife	167 (56.8)	127 (43.2)	294 (60.4)			
Service	29 (48.3)	31 (51.7)	60 (12.3)			
Agriculture	11 (40.7)	16 (59.3)	27 (5.5)			
Business	34 (46.6)	39 (53.4)	73 (15)			
Others	15 (45.5)	18 (54.5)	33 (6.8)			
Junk food as alternative				0.02(0.892)		
No	160 (52.8)	143 (47.2)	303 (62.2)			
Yes	96 (52.2)	88 (47.8)	184 (37.8)			
Junk food intake in past 7 days				31(<0.001)		
Never	105 (71.9)	41 (28.1)	146 (30)			
1-6 times	137 (44.8)	169 (55.2)	306 (62.8)		3.16 (2.06,4.83) <0.001	3.14 (1.97,5) <0.001
Daily	14 (40)	21 (60)	35 (7.2)		3.84 (1.78,8.27) <0.001	4.2 (1.85,9.67) <0.001
Perceived susceptibility*				1.8(0.072)		
Mean (SD)	5.6 (1.6)	5.3 (1.5)	5.5 (1.6)			
Perceived severity*				3.6(<0.001)		
Mean (SD)	6.9 (2.5)	7.7 (2.2)	7.3 (2.4)		1.15 (1.07,1.25) 0.005	0.97 (0.87,1.08) 0.568
Perceived benefit*				4.5(<0.001)		
Mean (SD)	35.1 (11.1)	39.3 (9.2)	37.1 (10.5)		1.04 (1.02,1.06) 0.003	1.01

Characteristics	Dietary Diversity			Test stat (P-value)	COR (95% CI) P-value	AOR (95% CI) P-value
	Inadequate Number (n=256, 52.6%)	Adequate Number (n=231, 47.4%)	Total Number (N=487)			
						(0.98,1.04) 0.391
Perceived barrier*				0.62(0.538)		
Mean (SD)	47.2 (10.2)	47.8 (11.1)	47.5 (10.6)			
Self-efficacy*				6.1(<0.001)		
Mean (SD)	12.9 (4.4)	15.2 (3.7)	14 (4.2)		1.15 (1.1,1.21) <0.001	1.15 (1.06,1.24) <0.001
Cue to action*				4.3(<0.001)		
Mean (SD)	6.5 (2.3)	7.3 (2.1)	6.9 (2.2)		1.2 (1.1,1.3) <0.001	0.95 (0.83,1.09) 0.446
Knowledge on Nutrition				29(<0.001)		
Inadequate	177 (63.2)	103 (36.8)	280 (57.5)			
Adequate	79 (38.2)	128 (61.8)	207 (42.5)		2.78 (1.92,4.03) <0.001	2.4 (1.59,3.63) <0.001

Discussion

This study aimed to assess the nutritional knowledge and dietary diversity among Kathmandu Valley school-going adolescents and its associated factors comprising socio-demographic characteristics, school-related factors, and constructs of HBM. The study found that nutrition knowledge and minimum dietary diversity were not satisfactory, as less than half of adolescents had adequate nutrition knowledge (42.5%) and consumed adequate dietary diversity (47.4%). The adequate nutrition knowledge among adolescents was comparatively higher compared to recent studies conducted in Croatia (28.2%) and the United Arab Emirates (14%); however, it was lower compared to the survey conducted in Bangladesh, (Kundu et al., 2020) where half the adolescents had adequate knowledge. Likewise, the minimum dietary diversity was higher than the reports of other countries, including Ethiopia (41.2%) (Roba et al., 2016) and West Bengal (45.5%) (Mukherjee et al., 2018). However, the result was slightly lower than Bangladesh's (58%) and Eastern Uganda's (54.68%) (Isabirye et al., 2020).

Consistent with numerous studies, socio-demographic factors were found to be associated with the dietary practice and nutrition knowledge of adolescents (Belachew et al., 2013; Chalise, 2018; Chen et al., 2019; Endalifer et al., 2021; Ferris et al., 2017; Islam et al., 2020; Lassi et al., 2017; Madjdian & Bras, 2016; Neff et al., 2009; Rathi et al., 2017; Rezali et al., 2015; Sharma et al., 2019). Age, ethnicity, type of family, and father's education were associated with nutrition knowledge. The knowledge of nutrition was found to be decreasing with increasing age. Studies have provided substantial evidence that older adolescents had higher levels of nutritional knowledge, primarily attributable to increased understanding of school adolescents when they were more trained and educated (Chalise, 2018; Lassi et al., 2017). However, some studies also revealed no association between age and nutritional knowledge (Naeeni et al., 2014). In our research, the knowledge on nutrition was lower in older adolescents. This may be due to the fact that when adolescents get older, they are more likely to ignore their behaviors and ignore the knowledge. Parental control and guidance decrease with growing age, resulting in increased independence on food choices. Adolescents often overlook nutrition knowledge and are likely to indulge in unhealthy food habits under the influence of peers and advertisements (Chalise, 2018; Lassi et al., 2017).

Knowledge of nutrition was higher among upper caste groups and Janajatis than the so-called lower caste groups and adolescents with educated fathers. In developing countries, providing adequate nutrition is an issue that has deep roots in the domains of gender, race, ethnicity, class, and education (Neff et al., 2009). Ethnicity and socioeconomic status are interlinked, and the advantaged groups are usually from the higher status and more superior to the lower caste (Subedi, 2016). Adolescents from poor socioeconomic backgrounds have poor nutrition knowledge (Sharma et al., 2019). The higher education level of parents and the availability and affordability of healthy food can determine nutrition knowledge and practice (Chen et al., 2019). Moreover, studies revealed that racial and ethnic discrimination increases the risk of poor health and wellbeing and low knowledge and knowledge on disease. Furthermore, parents influence their child’s nutrition knowledge and establish healthy eating practices and lifestyle patterns by setting parental rules (Chen et al., 2019; Ferris et al., 2017).

Adolescents from nuclear families had more knowledge of nutrition than those from joint families. In nuclear families, adolescents get more time, care, and priority from their parents compared to joint families with many family members. These findings were supported by bivariate analysis, where the knowledge of nutrition decreases by increasing the number of siblings. The parents get to spend more time with their children and care for their nutritional needs. Poverty has increased with increased family size (Madjdian & Bras, 2016; (Chen et al., 2019). A joint family is bound to experience financial burden compared to the nuclear family (Madjdian & Bras, 2016). The affordability and availability of food can highly influence dietary practices, ultimately resulting in decreased nutritional literacy.

Similarly, sex, mother's education and junk food practice were found to be associated with dietary diversity among adolescents. This study found that the practice of consuming minimum dietary diversity was higher among males compared to females. A nationwide study has also reported similar findings for male adolescents, with 48% consuming minimum dietary diversity, and was found to be less in female adolescents at 43% (MoHP et al., 2018). Moreover, various studies verified being female was associated with inadequate dietary diversity (Belachew et al., 2013; Endalifer et al., 2021). However, it contradicts the study done in Malaysia [OBJ] and India [OBJ], where males had inadequate dietary diversity. In our research, the school adolescents are from government public schools; they come from rural parts and usually have lower socio-economic status. In rural parts of Nepal, gender discrimination still prevails as a major problem that offers males a higher number of children in society compared to females (Subedi, 2016). So, their parents give males more priority for better nutrition than females (Madjdian & Bras, 2016).

The dietary diversity was also associated with the education level of mothers, where adolescents with literate mothers demonstrated better practice. Studies conducted in Bangladesh (Islam et al., 2020)and Ethiopia (Endalifer et al., 2021) had similar findings. As the education level increases, mothers have more chances of being informed about healthy dietary habits. Moreover, they can influence the nutritional habits and food choices of adolescents (Endalifer et al., 2021). Mothers are generally involved in household activities to apply their knowledge of healthy food preparation. Study findings suggest that educated mothers have a better financial position, which increases their chances of fulfilling basic needs properly (Endalifer et al., 2021).

In this study, adolescents with adequate nutrition knowledge were positively associated with adequate dietary diversity. Increased knowledge regarding the diet-disease relationship can influence nutritional and lifestyle habits that lead to diversified food intake (Endalifer et al., 2021; Milosavljević et al., 2015). However, knowledge of nutrition alone may not be adequate for adolescents to follow proper dietary practices. The positive attitude and behavior change toward healthy eating early in childhood contributes tremendously to adopting healthy food habits when they grow old (Kigaru et al., 2015). A study also confirms that connecting knowledge and practice in nutrition education is a daunting challenge and needs a change in attitude and behavior (Kigaru et al., 2015).

The constructs of HBM were also associated with adolescents' nutrition knowledge and dietary diversity. Perceived severity and perceived barrier were associated with nutrition knowledge, consistent with studies showing the association of perceived severity with behavior

intention and dietary practice (Arash et al., 2016; Kim et al., 2012). Understanding the perceived severity of the consequences increases the adolescent's health knowledge resulting in inadequate knowledge. Similarly, perceived barriers, such as awareness of potential negative aspects of a particular health action, affect nutrition knowledge (Glanz & Bishop, 2010).

Self-efficacy was found to be associated with dietary diversity. Similar findings were suggested from other studies conducted in Canada (Deshpande et al., 2009) and Iran (Hosseini et al., 2017), which showed a significant relationship between self-efficacy and healthy eating behavior. Self-efficacy is an individual's perception of the ability to perform an assigned behavior. Self-efficacy can also be used to predict the nutritional behavior of an individual. This can be further utilized in developing targeted interventions to promote a diversified diet.

The study had few limitations. The data was collected through a 24-hour dietary recall method, which may be prone to recall bias and may not reflect the nutritional patterns of adolescents. The cross-sectional nature of the data limits the determination of the associations reported in this study.

Conclusion

Adolescents from Kathmandu Valley have inadequate nutrition knowledge and are at risk of low dietary diversity. Age, ethnicity, type of family and father's education were associated with nutrition knowledge; and sex, mother's education, junk food practice and knowledge were found to be related to dietary diversity among adolescents. associated HBM construct's perceived severity and perceived barrier were found to be associated with nutrition knowledge. Moreover, self-efficacy was associated with dietary diversity. Policymakers and researchers can benefit from this research by gaining valuable insights into the current status of nutritional knowledge and dietary diversity among school adolescents in Kathmandu Valley. This information can aid in designing targeted interventions based on the Health Belief Model to promote healthy eating behaviors among adolescents, potentially reducing health problems that can persist into adulthood. Further studies using models and theories should be done to predict knowledge and behavior.

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Author's Contribution

AM: Conception of the study, Design of the study, analysis of data, interpretation of data, drafting, and approval of the final version of the manuscript. SK: Conception of the study, analysis, and interpretation of data, revised the manuscript critically and approved the final version.

Conflict of Interest

The authors declare that they have no competing interests. Data will be available upon a reasonable request from the corresponding author.

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