10.5005/jp-journals-10051-0078

ORIGINAL RESEARCH

Association between Nutritional Status and Dental Caries among 12- to 15-year-old Government Schoolchildren of Rural Areas of Udaipur, Rajasthan, India

[1]Nagesh Bhat, [2]Sakshi Chhabra, [3]Pratibha Sultane, [4]Sazid Hussain, [5]Priyanka Mishra
[6]Prachi Sharma, [7]Mandar Todkar, [8]Deekshita Patel

ABSTRACT

Introduction: The connection between the nutritional status and dental caries in children is controversial. The present study was undertaken to assess the association between nutritional status and dental caries among 12- to 15-year-old government schoolchildren in rural areas of Udaipur.

Materials and methods: A cross-sectional study was conducted among 12- to 15-year-old government schoolchildren. Multistage sampling was done and 1,520 sample size was obtained. Chi-square test was used to find association between dental caries and nutritional status. For all tests, confidence interval and p-value were set at 95% and ≤0.05 respectively.

Results: All the students were divided according to their age of 12 to 15 years. Findings between body mass index and dental caries were found to be statistically significant, with a p-value of 0.000 ($p < 0.01$).

Conclusion: Our research concluded that underweight children were found to have higher caries status than overweight subjects. Hence, it is important to screen the common health problems and the estimation of nutritional condition which should be an important part of health services in schools of rural areas. More studies and health programs should be necessary to arrange to improve the nutritional status and health of rural schoolchildren.

Keywords: Body mass index, Dental caries, Malnutrition.

How to cite this article: Bhat N, Chhabra S, Sultane P, Hussain S, Mishra P, Sharma P, Todkar M, Patel D. Association between Nutritional Status and Dental Caries among 12- to 15-year-old Government Schoolchildren of Rural Areas of Udaipur, Rajasthan, India. Int J Oral Care Res 2017;5(1):23-33.

Source of support: Nil

Conflict of interest: None

[1]Professor and Head, [2-7]Postgraduate Student, [8]Undergraduate (Final Year)

[1-3,7-8]Department of Public Health Dentistry, Pacific Dental College & Hospital, Udaipur, Rajasthan, India

[4]Department of Conservative Dentistry and Endodontics, Pacific Dental College & Hospital, Udaipur, Rajasthan, India

[5,6]Department of Public Health Dentistry, Rajasthan Dental College and Hospital, Jaipur, Rajasthan, India

Corresponding Author: Sakshi Chhabra, Postgraduate Student, Department of Public Health Dentistry, Pacific Dental College & Hospital, Udaipur, Rajasthan, India, Phone: +919829061634, e-mail: sakshichhabra1991@gmail.com

INTRODUCTION

The World Health Organization (WHO) says every human has the right to get proper and adequate nutrition, but lifestyle, misbalance in social life, industrialization, and several other factors have a negative impact on the extent of this fundamental right.[1]

Nowadays, two kinds of malnutrition are observed among people, one involved with deficiency of nutrition and other due to increased dietary intake. Modern civilization and economic development have been involved in quick changes in lifestyle and diet.[2]

The well-being of the children indicates the future health of every person. It is very important for every child to get ideal nutrition. Normal growth and development are increased by choosing food of good quality and quantity.[3]

In developing countries like India, malnutrition is a major problem, which is most vulnerable for growing children.[4]

Underweight children are mainly affected by this condition.[5-10] Malnutrition is also caused by famine and it is endemic in nature.[11]

India is ranked second by the World Bank after Bangladesh, which has the highest number of malnourished children.[12]

Dental caries is a worldwide disease. The high sugar content foods affect oral health due to improper dietary pattern in children, resulting in dental caries.[13] Dental caries is a main problem in public health,[14,15] which is eight times more common compared with asthma (second position of all the common diseases).[16]

The cases of dental caries have increased over the decades, especially in developing nations like India.[17]

The connection between nutritional status and dental caries in children is controversial. Some studies showed that no proper connection exists between the nutritional status and dental caries in overweight children,[18,19] but other studies claim that being overweight and dental caries are associated with nutritional condition of children.[20,21]

Hence, the present study was undertaken to assess the association between nutritional status and dental caries among 12- to 15-year-old government schoolchildren in rural areas of Udaipur, Rajasthan, India.

MATERIALS AND METHODS

Study Hypothesis

The main hypothesis of the study was to assess the association between nutritional status and dental caries among 12- to 15-year-old government schoolchildren in rural areas of Udaipur. The second hypothesis is to educate and create awareness regarding importance of nutrition on general and oral health.

Study Duration

The duration of the study was 2 months, i.e., August and September 2016.

Study Subjects

The present study was conducted among 12- to 15-year-old government schoolchildren of rural Udaipur.

Study Design

This study was a descriptive cross-sectional study.

Official Permission and Ethical Clearance

The study protocol was reviewed by the ethical committee of Pacific Dental College & Hospital and was granted ethical clearance.

An official permission was obtained from the District Education Officer, Udaipur.

Informed Consent

A written consent was obtained from the parents of all the children who fulfilled the eligibility criteria and were willing to participate in the survey.

Eligibility Criteria

Inclusion Criteria

- Government schoolchildren (male and female) who are in the age group of 12 to 15 years.
- Subjects willing to participate in the study.

Exclusion Criteria

- Medically compromised children and children suffering from chronic illness.

Pro Forma Details

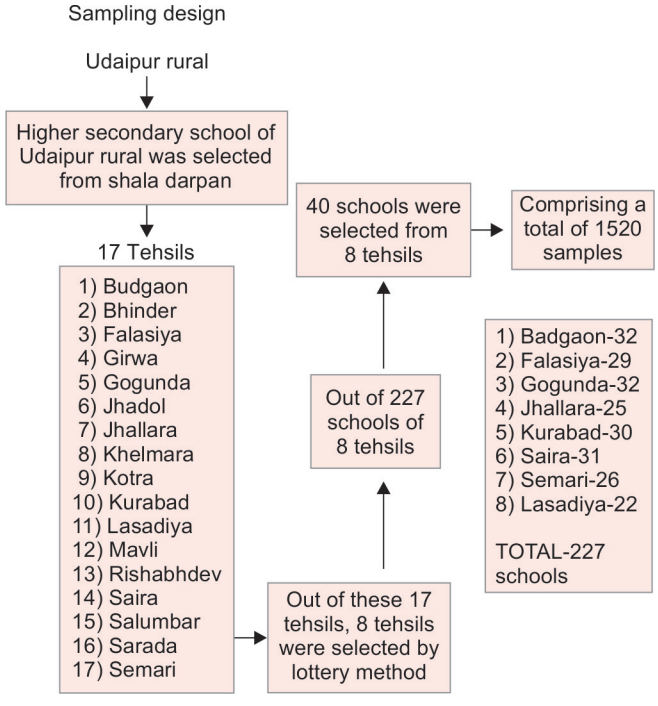
A survey pro forma designed with the help of the WHO Oral Health Assessment form[22] consisted of three sections:

1. General information – demographic data including gender, education, age, and class
2. Nutritional status – body mass index (BMI)
3. Clinical parameter – decayed, missing, and filled teeth (DMFT).

Pilot Survey

A pilot survey was carried out among 50 schoolchildren 12 to 15 years of age from two schools to determine the feasibility of the study and the time required for examination of each subject. Sample size was calculated using the standard formula with results at 95% confidence interval for which the value of $z = 1.96$, the allowable error (e) was taken as 0.05. Multistage sampling was done.

SAMPLING DESIGN



Udaipur district comprised 17 tehsils. Out of these 17 tehsils, 8 tehsils were selected by lottery method. Out of 227 schools of 8 tehsils, 40 schools were randomly selected from 8 tehsils comprising 1,520 samples.

Statistical Analysis

The recorded data were compiled and entered in a spreadsheet (Microsoft Excel 2013) and then exported to data editor page of Statistical Package for the Social Sciences version 20 (SPSS Inc., Chicago, Illinois, USA). Dependent variables to be studied were DMFT, height, and weight, and independent variables were age and gender.

Descriptive statistics included computation of percentages and frequencies. Chi-square test was used to find the association between dental caries and nutritional status. For all tests, confidence interval was set at 95% and p-value was ≤0.05.

RESULTS

Table 1 shows distribution of study subjects based on age and gender. A total of 1,520 schoolchildren from various schools in Udaipur were included in this study, out of which 822 were males and 698 were females. All the students were divided according to their ages: 12 to 15 years.

Table 2 shows distribution of study subjects based on age, gender, and BMI. Out of all the subjects, higher numbers of female subjects (29.8%) were found to be underweight than in males (19.5%) and overweight subjects were more in males (7.1%) than in females (5%). Among all the age groups, the highest number of normal weight subjects was recorded followed by underweight and overweight subjects. All the above associations were found to be statistically significant with a p-value of 0.000 ($p < 0.01$).

Table 3 shows distribution of study subjects based on age, gender, and DMFT. Decayed, missing, and filled teeth scores 1–4 were found to have the highest prevalence across all the age groups and both genders (approximately 20–25%). Other DMFT scores were found to have very less prevalence. All the above associations were found to be statistically significant with a p-value of 0.000 ($p < 0.01$). Graph 1 shows correlation between DMFT scores among 12- to 15-year-old school-going children. Graph 2 shows correlation between DMFT scores among males and females.

Table 4 shows distribution of study subjects based on BMI and DMFT. Decayed, missing, and filled teeth score 4 (29.3%) was found to have highest prevalence in underweight subjects followed by score 2 (21.2%), score 1 (20.9%), scores 3 and 5 (both 12.2%), and score 0 (4.1%). For subjects with normal BMI, score 3 (26.2%) was found to be the highest prevalence followed by score 1 (24.6%), scores 2 and 4 (20.2 and 20.4%), score 5 (4.4%), score 6 (2.8%), and score 0 (1.4%); and among overweight

Table 1: Distribution of study subjects based on age and gender (N = 1,520)

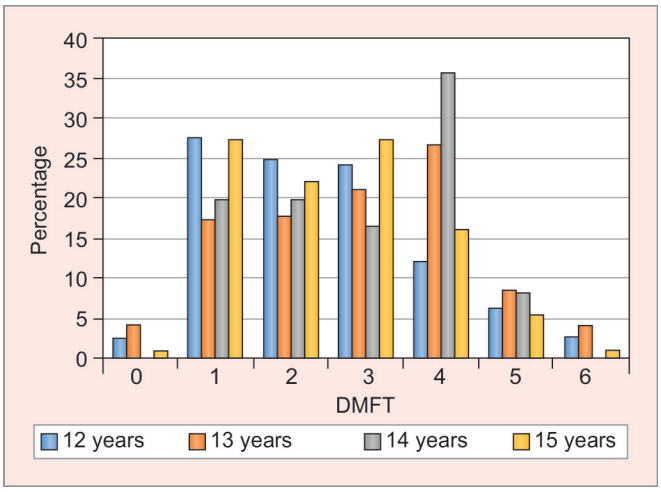
			Age (years)				
			12	*13*	*14*	*15*	*Total*
Gender	Male	N	218	188	262	154	822
		%	26.5	22.9	31.9	18.7	100.0
	Female	N	236	165	122	175	698
		%	33.8	23.6	17.5	25.1	100.0

Table 2: Distribution of study subjects based on age, gender, and BMI (N = 1,520)

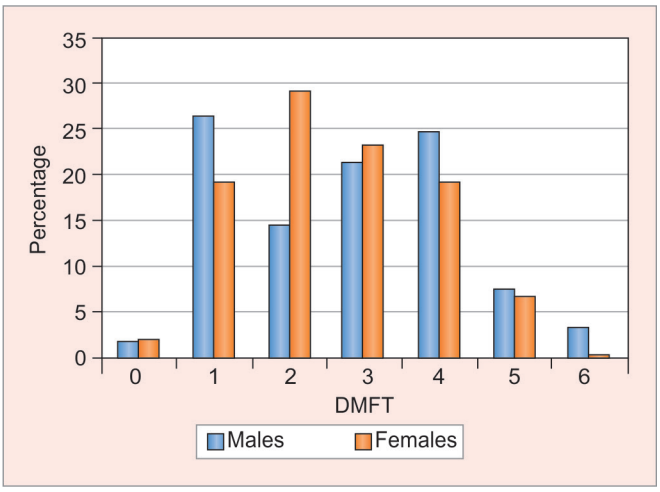
			Body mass index					
			Underweight	*Normal*	*Overweight*	*Total*	χ^2	*p-value*
Age	12	N	107	300	47	454	64.541	0
		%	23.6	66.1	10.4	100.0		
	13	N	78	244	31	353		
		%	22.1	69.1	8.8	100.0		
	14	N	76	308	0	384		
		%	19.8	80.2	0.0	100.0		
	15	N	107	207	15	329		
		%	32.5	62.9	4.6	100.0		
Gender	Male	N	160	604	58	822	22.950	0
		%	19.5	73.5	7.1	100.0		
	Female	N	208	455	35	698		
		%	29.8	65.2	5.0	100.0		

Table 3: Distribution of study subjects based on age, gender, and DMFT (N = 1,520)

			Decayed, missing, and filled teeth									
			0	*1*	*2*	*3*	*4*	*5*	*6*	*Total*	χ^2	*p-value*
Age	12	N	12	125	112	110	55	28	12	454	132.611	0.000
		%	2.6	27.5	24.7	24.2	12.1	6.2	2.6	100.0		
	13	N	15	61	63	75	94	30	15	353		
		%	4.2	17.3	17.8	21.2	26.6	8.5	4.2	100.0		
	14	N	0	76	76	63	137	32	0	384		
		%	0.0	19.8	19.8	16.4	35.7	8.3	0.0	100.0		
	15	N	3	90	72	90	53	18	3	329		
		%	0.9	27.4	21.9	27.4	16.1	5.5	0.9	100.0		
Gender	Male	N	16	218	120	176	204	61	27	822	67.479	0.000
		%	1.9	26.5	14.6	21.4	24.8	7.4	3.3	100.0		
	Female	N	14	134	203	162	135	47	3	698		
		%	2.0	19.2	29.1	23.2	19.3	6.7	0.4	100.0		



Graph 1: Correlation between DMFT scores among 12- to 15-year-old school-going children



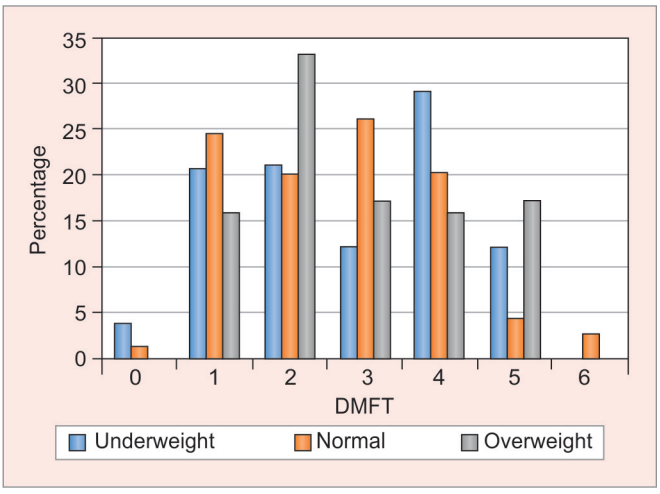
Graph 2: Correlation between DMFT scores among males and females

Table 4: Distribution of study subjects based on BMI and DMFT (N = 1,520)

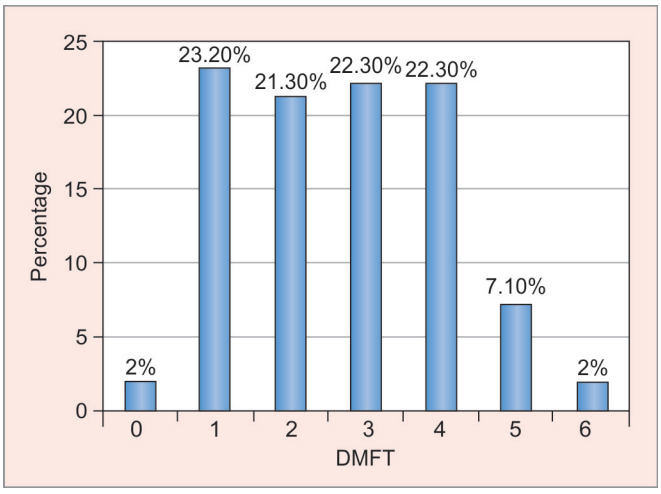
			Decayed, missing, and filled teeth									
			0	*1*	*2*	*3*	*4*	*5*	*6*	*Total*	χ^2	*p-value*
Body mass index	Underweight	N	15	77	78	45	108	45	0	368	109.403	0
		%	4.1	20.9	21.2	12.2	29.3	12.2	0	100.0		
	Normal	N	15	260	214	277	216	47	30	1059		
		%	1.4	24.6	20.2	26.2	20.4	4.4	2.8	100.0		
	Overweight	N	0	15	31	16	15	16	0	93		
		%	0	16.1	33.3	17.2	16.1	17.2	0	100.0		

subjects, score 2 (33.3%) was found to have the highest prevalence followed by scores 3 and 5 (17.2%) and scores 1 and 4 (16.1%). All the above associations were found to be statistically significant with a p-value of 0.000 ($p < 0.01$). Graph 3 shows correlation between DMFT scores and BMI. Graph 4 shows distribution of study subjects based on DMFT scores

Table 5 shows the distribution of study subjects based on dietary status. Among all age groups, it was found that most of the subjects (45.57%) take fresh fruits everyday (score – 5). Most subjects (26–33%) were found to have lemonade, coca cola, or soft drinks several times a week (score – 4). Milk with sugar was consumed by most subjects (51–57%) once a week (score – 3). For tea with sugars, it was found that most subjects (62–70%) consume it everyday (score – 5) and for coffee with sugar most subjects (76–80%) never consume it (score – 1). Among all these associations, results for coffee with sugar was found to be statistically insignificant ($p = 0.977$) while all others were significant ($p < 0.05$).



Graph 3: Correlation between DMFT scores and BMI



Graph 4: Distribution of study subjects based on DMFT scores

Table 5: Distribution of study subjects based on dietary status in various age groups

		Age in years					
Dietary status	*Score*	*12*	*13*	*14*	*15*	χ^2	*p-value*
Fresh fruits	1	18 (4.0%)	14 (4.0%)	10 (2.6%)	16 (4.9%)	26.335	0.035
	2	11 (2.4%)	6 (1.7%)	7 (1.8%)	5 (1.5%)		
	3	22 (4.8%)	22 (6.2%)	32 (8.3%)	12 (3.6%)		
	4	68 (15.0%)	35 (9.9%)	45 (11.7%)	32 (9.7%)		
	5	211 (46.5%)	202 (57.2%)	192 (50.0%)	171 (52.0%)		
	6	124 (27.3%)	74 (21.0%)	98 (25.5%)	93 (28.3%)		
Lemonade, coca cola, or soft drinks	1	53 (11.7%)	50 (14.2%)	52 (13.5%)	52 (15.8%)	20.859	0.141
	2	77 (17.0%)	63 (17.8%)	79 (20.6%)	50 (15.2%)		
	3	89 (19.6%)	65 (18.4%)	86 (22.4%)	90 (27.4%)		
	4	142 (31.3%)	116 (32.9%)	105 (27.3%)	88 (26.7%)		
	5	20 (4.4%)	12 (3.4%)	15 (3.9%)	11 (3.3%)		
	6	73 (16.1%)	47 (13.3%)	47 (12.2%)	38 (11.6%)		
Milk with sugar	1	10 (2.2%)	12 (3.4%)	11 (2.9%)	10 (3.0%)	17.023	0.317
	2	7 (1.5%)	1 (0.3%)	4 (1.0%)	2 (0.6%)		
	3	233 (51.3%)	202 (57.2%)	219 (57.0%)	177 (53.8%)		
	4	102 (22.5%)	85 (24.1%)	90 (23.4%)	85 (25.8%)		
	5	95 (20.9%)	48 (13.6%)	57 (14.8%)	50 (15.2%)		
	6	7 (1.5%)	5 (1.4%)	3 (0.8%)	5 (1.5%)		
Tea with sugar	1	10 (2.2%)	5 (1.4%)	9 (2.3%)	9 (2.7%)	17.034	0.317
	2	5 (1.1%)	4 (1.1%)	1 (0.3%)	6 (1.8%)		
	3	2 (0.4%)	1 (0.3%)	0 (0.0%)	1 (0.3%)		
	4	1 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)		
	5	292 (64.3%)	246 (69.7%)	241 (62.8%)	227 (69.0%)		
	6	144 (31.7%)	97 (27.5%)	133 (34.6%)	86 (26.1%)		
Coffee with sugar	1	361 (79.5%)	282 (79.9%)	293 (76.3%)	259 (78.7%)	2.638	0.977
	2	76 (16.7%)	57 (16.1%)	74 (19.3%)	58 (17.6%)		
	3	4 (0.9%)	4 (1.1%)	6 (1.6%)	3 (0.9%)		
	4	13 (2.9%)	10 (2.8%)	11 (2.9%)	9 (2.7%)		
	5	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)		
	6	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Biscuits, cakes, and creams	1	45 (9.9%)	26 (7.4%)	41 (10.7%)	32 (9.7%)	14.734	0.256
	2	106 (23.3%)	65 (18.4%)	80 (20.8%)	84 (25.5%)		
	3	112 (24.7%)	109 (30.9%)	95 (24.7%)	91 (27.7%)		
	4	145 (31.9%)	115 (32.6%)	118 (30.7%)	88 (26.7%)		
	5	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
	6	46 (10.1%)	38 (10.8%)	50 (13.0%)	34 (10.3%)		
Cakes, sweet pies, and buns	1	53 (11.7%)	47 (13.3%)	42 (10.9%)	34 (10.3%)	8.843	0.886
	2	76 (16.7%)	53 (15.0%)	68 (17.7%)	62 (18.8%)		
	3	95 (20.9%)	73 (20.7%)	77 (20.1%)	53 (16.1%)		
	4	161 (35.5%)	119 (33.7%)	127 (33.1%)	116 (35.3%)		
	5	14 (3.1%)	15 (4.2%)	15 (3.9%)	14 (4.3%)		
	6	55 (12.1%)	46 (13.0%)	55 (14.3%)	50 (15.2%)		
Jam/honey	1	42 (9.3%)	34 (9.6%)	38 (9.9%)	34 (10.3%)	10.143	0.811
	2	102 (22.5%)	64 (18.1%)	80 (20.8%)	54 (16.4%)		
	3	101 (22.2%)	86 (24.4%)	98 (25.5%)	86 (26.1%)		
	4	151 (33.3%)	119 (33.7%)	117 (30.5%)	101 (30.7%)		
	5	1 (0.2%)	2 (0.6%)	2 (0.5%)	3 (0.9%)		
	6	57 (12.6%)	48 (13.6%)	49 (12.8%)	51 (15.5%)		
Chewing gum	1	52 (11.5%)	51 (14.4%)	48 (12.5%)	50 (15.2%)	22.195	0.103
	2	81 (17.8%)	62 (17.6%)	79 (20.6%)	49 (14.9%)		
	3	85 (18.7%)	68 (19.3%)	85 (22.1%)	92 (28.0%)		
	4	142 (31.3%)	115 (32.6%)	108 (28.1%)	91 (27.7%)		
	5	21 (4.6%)	11 (3.1%)	15 (3.9%)	11 (3.3%)		
	6	73 (16.1%)	46 (13.0%)	49 (12.8%)	36 (10.9%)		
Food containing sugar	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10.246	0.017

(Cont'd…)

(Cont'd…)

Dietary status	Score	Age in years				χ^2	p-value
		12	13	14	15		
	2	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
	3	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
	5	382 (84.1%)	312 (88.4%)	345 (89.8%)	273 (83.0%)		
	6	72 (15.9%)	41 (11.6%)	39 (10.2%)	56 (17.0%)		
Sweets/candy	1	31 (6.8%)	18 (5.1%)	24 (6.3%)	21 (6.4%)	11.766	0.697
	2	68 (15.0%)	39 (11.0%)	47 (12.2%)	42 (12.8%)		
	3	24 (5.3%)	24 (6.8%)	22 (5.7%)	24 (7.3%)		
	4	80 (17.6%)	56 (15.9%)	69 (18.0%)	54 (16.4%)		
	5	142 (31.3%)	125 (35.4%)	140 (36.5%)	123 (37.4%)		
	6	109 (24.0%)	91 (25.8%)	82 (21.4%)	65 (19.8%)		

Table 5 shows similarity for biscuits, cakes, and creams; most subjects (26–33%) were found to consume it several times a week (score – 4). Most subjects (30.5–36%) across all age groups were found to consume cakes, sweets, pies, buns, jam/honey, and chewing gum several times a week (score – 4). For food containing sugar, almost 84 to 90% subjects were found to consume it everyday (score – 5), and most subjects (31–37%) across all age groups were found to consume sweets and candies everyday (score – 5). Except for cakes, sweet pies, buns, jam/honey, sweet, or candies, all other associations were found to be statistically significant ($p < 0.05$).

In Table 6, over 50% subjects in both genders were found to consume fresh fruits everyday (score – 5). Most subjects (29 to 30%) were found to take lemonade, coca cola, and soft drinks several times a week (score – 4). For both males and females, most subjects (54–55%) were found to have milk with sugar once a week (score – 3).

Table 6: Distribution of study subjects based on dietary status among both genders

Dietary status	Score	Gender		χ^2	p-value
		Male	Female		
Fresh fruits	1	32 (3.9%)	26 (3.7%)	8.699	0.122
	2	18 (2.2%)	11 (1.6%)		
	3	58 (7.1%)	30 (4.3%)		
	4	102 (12.4%)	78 (11.2%)		
	5	417 (50.7%)	359 (51.4%)		
	6	195 (23.7%)	194 (27.8%)		
Lemonade, coca cola, or soft drinks	1	112 (13.6%)	95 (13.6%)	0.886	0.971
	2	143 (17.4%)	126 (18.1%)		
	3	174 (21.2%)	156 (22.3%)		
	4	250 (30.4%)	201 (28.8%)		
	5	30 (3.6%)	28 (4.0%)		
	6	113 (13.7%)	92 (13.2%)		
Milk with sugar	1	23 (2.8%)	20 (2.9%)	3.735	0.588
	2	10 (1.2%)	4 (0.6%)		
	3	455 (55.4%)	376 (53.9%)		
	4	193 (23.5%)	169 (24.2%)		
	5	128 (15.6%)	122 (17.5%)		
	6	13 (1.6%)	7 (1.0%)		
Tea with sugar	1	17 (2.1%)	16 (2.3%)	7.436	0.190
	2	13 (1.6%)	3 (0.4%)		
	3	3 (0.4%)	1 (0.1%)		
	4	1 (0.1%)	0 (0.0%)		
	5	532 (64.7%)	474 (67.9%)		
	6	256 (31.1%)	204 (29.2%)		
Coffee with sugar	1	647 (78.7%)	548 (78.5%)	1.112	0.774
	2	146 (17.8%)	119 (17.0%)		
	3	9 (1.1%)	8 (1.1%)		

(Cont'd…)

(Cont'd…)

Dietary status	Score	Gender		χ^2	p-value
		Male	Female		
	4	20 (2.4%)	23 (3.3%)		
	5	0 (0%)	0 (0%)		
	6	0 (0%)	0 (0%)		
Biscuits, cakes, and creams	1	83 (10.1%)	61 (8.7%)	2.344	0.673
	2	173 (21.0%)	162 (23.2%)		
	3	215 (26.2%)	192 (27.5%)		
	4	256 (31.1%)	210 (30.1%)		
	5	0 (0%)	0 (0%)		
	6	95 (11.6%)	73 (10.5%)		
Cakes, sweet pies, and buns	1	101 (12.3%)	75 (10.7%)	3.424	0.635
	2	134 (16.3%)	125 (17.9%)		
	3	162 (19.7%)	136 (19.5%)		
	4	288 (35.0%)	235 (33.7%)		
	5	34 (4.1%)	24 (3.4%)		
	6	103 (12.5%)	103 (14.8%)		
Jam/honey	1	83 (10.1%)	65 (9.3%)	7.702	0.173
	2	164 (20.0%)	136 (19.5%)		
	3	216 (26.3%)	155 (22.2%)		
	4	259 (31.5%)	229 (32.8%)		
	5	3 (0.4%)	5 (0.7%)		
	6	97 (11.8%)	108 (15.5%)		
Chewing gum	1	107 (13.0%)	94 (13.5%)	0.775	0.979
	2	144 (17.5%)	127 (18.2%)		
	3	176 (21.4%)	154 (22.1%)		
	4	253 (30.8%)	203 (29.1%)		
	5	30 (3.6%)	28 (4.0%)		
	6	112 (13.6%)	92 (13.2%)		
Food containing sugar	1	0 (0%)	0 (0%)	0.006	0.938
	2	0 (0%)	0 (0%)		
	3	0 (0%)	0 (0%)		
	4	0 (0%)	0 (0%)		
	5	709 (86.3%)	603 (86.4%)		
	6	113 (13.7%)	95 (13.6%)		
Sweets/candy	1	45 (5.5%)	49 (7.0%)	5.623	0.345
	2	105 (12.8%)	91 (13.0%)		
	3	51 (6.2%)	43 (6.2%)		
	4	140 (17.0%)	119 (17.0%)		
	5	305 (37.1%)	225 (32.2%)		
	6	176 (21.4%)	171 (24.5%)		

Maximum subjects (64.55–68%) were found to have tea with sugar everyday (score – 5). For both males and females, most subjects (78.5%) were found to never consume coffee with sugar (score – 1). Of these associations, results for fresh fruits and tea with sugar were found to be statistically significant ($p < 0.05$).

In Table 6, among both genders, biscuits, cake, and creams were found to be consumed by most subjects (30–31%) several times a week (score – 4). Similarly, chewing gum, jam/honey, cakes, sweet pies, and buns were found to be consumed by most subjects (31–35%) among both genders several times a week (score – 4). Food containing sugar was found to be consumed by almost 86% of the subjects for both genders everyday (score – 5). For both genders, sweets or candies were found to be consumed by most subjects (32–37%) everyday (score – 5). Except for jam/honey, sweets, or candies, all other associations were found to be statistically insignificant ($p > 0.05$).

In Table 7, across all age groups, 70 to 71% subjects were found to brush their teeth with toothpaste/tooth powder. Consistently, the remaining subjects (28–29%) were found to maintain oral hygiene by cleaning teeth with finger and toothpaste/tooth powder. None of the subjects (0%) were found to use chew stick as an oral hygiene practice. Almost 97 to 98% subjects across all age

Table 7: Distribution of study subjects based on oral hygiene practices in various age groups

		Age in years					
Oral hygiene practices	*Score*	*12*	*13*	*14*	*15*	χ^2	*p-value*
Toothbrush + toothpaste/tooth powder	Yes	323 (71.1%)	251 (71.1%)	271 (70.6%)	232 (70.5%)	0.062	0.996
	No	131 (28.9%)	102 (28.9%)	113 (29.4%)	97 (29.5%)		
Finger + toothpaste/tooth powder	Yes	131 (28.9%)	102 (28.9%)	113 (29.4%)	97 (29.5%)	0.062	0.996
	No	323 (71.1%)	251 (71.1%)	271 (70.6%)	232 (70.5%)		
Chew stick	No	454 (100%)	353 (100%)	384 (100%)	329 (100%)		
	Yes	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
Any other oral hygiene aid	Yes	12 (2.6%)	8 (2.3%)	14 (3.6%)	7 (2.1%)	1.978	0.577
	No	442 (97.4%)	345 (97.7%)	370 (96.4%)	322 (97.9%)		
Frequency of brushing	Once	372 (81.9%)	275 (77.9%)	308 (80.2%)	280 (85.1%)	6.221	1.101
	Twice	82 (18.1%)	78 (22.1%)	76 (19.8%)	49 (14.9%)		
	Thrice	0 (0%)	0 (0%)	0 (0%)	0 (0%)		

Table 8: Distribution of study subjects based on oral hygiene practices among both genders

		Gender			
Oral hygiene practices	*Score*	*Male*	*Female*	χ^2	*p-value*
Toothbrush + toothpaste/tooth powder	Yes	569 (69.2%)	508 (72.8%)	2.314	0.128
	No	253 (30.8%)	190 (27.2%)		
Finger + toothpaste/tooth powder	Yes	253 (30.8%)	190 (27.2%)	2.314	0.128
	No	569 (69.2%)	508 (72.8%)		
Chew stick	Yes	0 (0%)	0 (0%)		
	No	822 (100%)	698 (100%)		
Any other oral hygiene aid	Yes	24 (2.9%)	17 (2.4%)	0.337	0.561
	No	798 (97.1%)	681 (97.6%)		
Frequency of brushing	Once	673 (81.9%)	562 (80.5%)	0.457	0.499
	Twice	149 (18.1%)	136 (19.5%)		
	Thrice	0 (0%)	0 (0%)		

groups do not use any other oral hygiene aid and almost 77 to 85% of the subjects were found to brush once daily. None of these associations were found to be statistically significant ($p < 0.05$).

In Table 8, for both males and females, almost similar numbers of subjects were found to have same oral hygiene practices. Results for frequency, toothbrush with tooth paste/tooth powder, and finger with toothpaste/tooth powder were found to be statistically significant ($p < 0.5$), while for any other oral hygiene aid, it was found insignificant ($p > 0.05$).

DISCUSSION

Malnutrition is broadly identified as a major public health problem in developing nations. Developing children specifically are at maximum risk for its consequences.[23] It is estimated that 80% of the entire child population of India have high levels of oral diseases.

The most common childhood disease occurring in 50% of the first-grade students resulted in almost 52 million missed school hours.[24] Dental caries is a worldwide disease with few populace exempt from its effects. In developing nations, where fluoride is unavailable, the prevalence of dental caries increases.[17] Caries is one of the most prevalent diseases affecting the population and is continuing till now as a challenge to the medical and dental profession. Basic data on dental caries prevalence are an essential need, which improves our knowledge on dynamics of the disease and its treatment requirements and aids in considering methods and means to prevent its onset, limit its development and consequences.[25]

This study was undertaken to assess the association between nutritional status and dental caries among 12- to 15-year-old government schoolgoing children in rural areas of Udaipur. A total of 1,520 subjects aged 12 to 15 years whose parents/guardians had given an informed consent were examined.

In this study, out of 1,520 subjects, 822 were males and 698 were females. The finding was in accordance with a study done by Shailee et al[26] where they had 626 males and 385 females. Findings of Johansson et al,[27] Al-Darwish et al,[28] Sood et al,[29] Dhar et al,[30] Sudha et al,[31] and Singh et al[32] were also in agreement to our study where greater preponderance was observed for males because females were getting lesser opportunity to get proper education, mainly in rural areas, than males in developing countries like India, whereas studies by Mtaya et al,[33] Khanal and

Acharya,[34] Punitha et al,[35] and Patnaik et al[36] revealed lesser number of male subjects than females. The overall prevalence of overweight subjects was more in males (7.1%) than in females (5%), whereas underweight subjects were more in females (29.8%) than males (19.5%) and normal weight subjects were more in males than females, which was 604 (73.5%) and 455 (65.2%) respectively. All these findings were statistically significant.

Studies done by Sood et al[29] and Panwar et al[37] revealed higher prevalence of underweight subjects in females, which was in agreement to our study, whereas studies by Narang et al[38], Lazzeri et al,[39] and Paracha et al[40] found higher prevalence for underweight subjects in males.

Studies conducted by Sood et al,[29] Panwar et al,[37] and Chopra et al[41] revealed more number of normal subjects in males than females, which were 67 (58.3%) and 48 (41.7%), 260 (26%) and 214 (21.4%), 74 (16.1%) and 36 (10.3%) respectively, whereas studies by Narang et al,[38] Paracha et al,[40] and Lazzeri et al[39] showed results which were not in accordance with our study.

In this study, a lesser number of underweight subjects was found in 14-year-old schoolchildren, which was in accordance with the study by Lazzeri et al[39] where more number of underweight subjects was revealed in 13-year-old schoolchildren. A study by Chopra et al[41] revealed similar finding. Our study revealed higher prevalence of overweight subjects in 12-year-old age group, and no overweight subjects were present in 14-year-old age group. Studies conducted by Chopra et al[41] and Lazzeri et al[39] showed 60 (in 13-year-old age group) and 139 (in 15-year-age group), 70 (38%) and 33 (17.9%) respectively.

In this study, prevalence of normal weight subjects was higher in 14-year-old age group, which was 308 (80.2%), and lesser in 15-year-old age group, which was 207 (62.9%). A study by Lazzeri et al[39] revealed 804 (74%) in 13-year-old age group and 772 (71.6%) in 15-year-old age group. This finding was in accordance with our study. Another study conducted by Chopra et al[41] found lesser number of normal weight subjects in 15-year-old age group, whereas 12-year-old age group subjects revealed 168 (35.5%) normal weight subjects, which was not in accordance with the present study.

In our study, caries prevalence rate of 53.02% was found in 806 males, which was comparatively higher than that in females 45%. Similarly, other studies by Al-Darwish et al,[28] Dhar et al,[30] and Sudha et al[31] also found prevalence rate of caries in males and females as 185 (58.4%) and 132 (41.6%), 398 (48.13%) and 344 (45.26%), 87.20% respectively, which were higher in males. These results were in contradiction to the study conducted by Khanal and Acharya[34] where a higher prevalence rate of caries (62.7%) was found in females (84%) than in males (53.4%). All these associations were found to be significant (<0.01) except in a study by Dhar et al[30] which was found to be statistically nonsignificant.

In the present study, DMFT scores 1–4 were found to have higher prevalence than other scores in both genders. This was found to be statistically significant ($p < 0.01$). This was contradictory to the study carried out by Narang et al[38] in which DMFT score of 0 was found to have the highest prevalence in both the genders. The results were found to be statistically significant ($p < 0.01$).

In the present study, caries prevalence rates in 12- to 15-year-old age group were found to be 97.35, 95.7, 100, and 99% respectively. This was in contradiction to the previous studies conducted by Al-Darwish et al,[28] Khanal and Acharya,[34] Mahfouj and Esaid[42] wherein lower carries prevalence rate in all age groups was seen.

In this study, caries prevalence rate of 68.68% was found in 1,044 normal weight subjects, which was higher than underweight and overweight subjects. This was similar to the findings of the study conducted by Panwar et al.[37] However, in a study carried out by Parkar and Chokshi,[43] higher rate of caries prevalence was found in underweight study subjects rather than in normal weight.

In our study, wherein the dietary status of study subjects was evaluated, it was found that 28 (4%) females and 30 (3.6%) males consumed soft drinks, coca cola, and lemonade everyday. This was contradictory to the study conducted by Paracha et al[40] where dissimilar results were proposed. Our study revealed 23 (2.8%) males who never consumed milk with sugar, while 128 (15.6%) males consumed milk with sugar everyday. This was not in accordance with the study by Paracha et al[40] wherein 15 (31%) males consumed milk and dairy products daily and 23 (46%) males never consumed it. In the present study, 20 (2.9%) females never consumed milk with sugar, while 122 (17.5%) females consumed it everyday. This was not similar to the findings of the study by Paracha et al[40] wherein 26 (57%) females never consumed it and 15 (7%) females consumed it everyday. However, the results of our study were not found to be statistically significant.

It was found in our study that 32 (3.9%) males never consumed fresh fruits while 417 (50.7%) males consumed it everyday. This was in contrast to the study by Paracha et al[40] wherein seven (15%) males consumed it daily and four (8%) males never consumed fresh fruits. The results of the present study showed 26 (3.7%) females never consumed fresh fruits, while 359 (51.4%) consumed it daily. This study was in contradiction with the study done by Paracha et al[40] wherein seven (15%) females consumed it daily and four (8%) females never

consumed it. These results of our study were found to be statistically nonsignificant.

In the present study, almost 75 to 85% of the subjects across all age groups were found to brush once daily. Similar results were found in studies conducted by Shailee et al,[26] Singh et al,[32] Ingle et al,[44] and Goel et al.[45] This study revealed that 80 to 81% of the subjects both in males and females brushed their teeth once daily. This was in accordance with the other studies conducted by Shailee et al[26] and Singh et al.[32]

It was also found in our study that 70 to 71% subjects across all age groups and genders were found to brush their teeth. Consistently, the remaining subjects (28–29%) were found to maintain oral hygiene by cleaning teeth with finger and toothpaste/tooth powder and no subjects were found to use chew stick as an oral hygiene practice. Almost 97 to 98% subjects do not use any other oral hygiene aids. Similar results were found in studies conducted by Shailee et al,[26] Singh et al,[32] and Goel et al.[45]

CONCLUSION

Our research concluded that underweight children were found to have higher caries prevalence than overweight subjects. Hence, it is important to screen the common health problems and the estimation of nutritional condition which should be an important part of health services in schools of rural areas. It is possible to detect and treat appropriately the malnourished children at the earliest and reduce the prevalence of dental caries by this study. More studies and health programs should be necessary to arrange to improve the nutritional status and health of rural schoolchildren.

REFERENCES

1. 2019. [cited 2018 Aug 13]. Available from: http://web.Worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:20916955- Page Pk: 146736-piPK-146830-thesitePK: 223547, 00.html.
2. Jamelli SR, Rodrigues CS, de Lira PI. Nutritional status and prevalence of dental caries among 12-year old children at public schools: a case–control study. Oral Health Prev Dent 2010 Jan;8(1):77-84.
3. Peña M, Bacallao J. Malnutrition and poverty. Ann Rev Nutr 2002 Feb;22:241-253.
4. Behrman, RE.; Kliegman, RM.; Jenson, HB.; editors. Nelson's textbook of pediatrics. 16th ed. Philadelphia (PA): Saunders; 2000. p. 32-50.
5. Rajvir, B. Text book of Public Health and Community Medicine. 1st ed. New Delhi: Department of Community Medicine, AFMC, Pune in collaboration with WHO India Office; 2009.
6. Tripathi MS, Sharma V. Assessment of nutritional status of preschoolers in slum areas of Udaipur city. Indian J Public Health 2006 Jan-Mar;50(1):33-34.
7. International Institute for Population Sciences (IIPS) and Macro International. 2007. National Family Health Survey (NFHS-3) 2005–06. Mumbai: IIPS. Int J Basic Appl Med Sci 2012;2(3):109-115.
8. Mandal GC, Bose K, Bisal S. Thinness among rural children in Bengal. Indian J Pediatr 2009 Aug;76(8):817-819.
9. Ahmad E, Khan Z, Khalique N, Amir A, Khalil S. A study of utilization of integrated child development services in 1–5 years old children registered with rural health training center, Jawan, Aligarh, UP. Indian J Prev Soc Med 2005 Jul-Dec;36(3-4): 137-142.
10. Chakraborty S, Gupta SB, Chaturvedi B, Chakraborty SK. A study of protein energy malnutrition (PEM) in children (0 to 6 year) in a rural population of Jhansi district (U.P). Indian J Community Med 2006 Oct-Dec;31(4):164-168.
11. Shakur MS, Melek MA, Bano N, Rahaman M, Ahmed M. Serum and hair zinc in severely malnourished Bangladeshi children associated with or without acute lower respiratory infection. Indian J Pediatr 2009 Jun;76(6):609-614.
12. Garg SK, Singh JV, Bhatnagar M, Chopra H. Nutritional status of children (1-6 yrs) in slums of Ghaziabad city. Indian J Community Med 1997 Jan;22(2):70-73.
13. Oliver RC, Holm Pederson P, Loe H. The correlation between clinical coring, exudates measurements and microscopic evaluation of inflammation in the gingiva. J Periodontol 1985;56:293-296.
14. Benjamin BM, Russel AL, Smiley RD. Periodontal disease in rural children. J Periodontol 1957;28:286.
15. Benzian H, Monse B, Heinrich-Weltzien R, Hobdell M, Mulder J, van Palenstein Helderman W. Untreated severe dental decay: a neglected determinant of low Body Mass Index in 12-year-old Filipino children. BMC Public Health 2011 Jul;11(1):558.
16. US Department of Health and Human Services. Oral health in America: a report of the surgeon general. Rockville (MD): US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; 2000. NIH Publication no 00-4713.
17. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. Public Health Nutr 2004 Feb;7(1A): 201-226.
18. Chen W, Chen P, Chen SC, Shih WT, Hu HC. Lack of association between obesity and dental caries in three-year-old children. Zhonghua Min Guo Xiao Er Ke Yi Xue Hui Za Zhi 1998 Mar-Apr;39(2):109-111.
19. Macek MD, Mitola DJ. Exploring the association between overweight and dental caries among US children. Pediatr Dent 2006 Jul-Aug;28(4):375-380.
20. Palmer CA. Dental caries and obesity in children: different problems, related causes. Quintessence Int 2005 Jun;36(6): 457-461.
21. Kantovitz KR, Pascon FM, Rontani RM, Gavião MB. Obesity and dental caries – a systematic review. Oral Health Prev Dent 2006 Feb;4(2):137-144.
22. World Health Organization. Oral health surveys basic methods. 5th ed. Geneva: World Health Organization; 2013.
23. Joseph B, Rebello A, Kullu P, Raj VD. Prevalence of malnutrition in rural Karnataka, South India: a comparison of anthropometric indicators. J Health Popul Nutr 2002 Sep;20(3):239-244.
24. World Health Organization. Information series on school health document eleven, oral health promotion: an essential element of health promoting school. Geneva: World Health Organization; 2003.

25. Munjal V, Gupta A, Kaur P, Garewal R. Dental caries prevalence and treatment needs in 12 and 15-year-old school children of Ludhiana city. Indian J Oral Sci 2013 Jan;4(1): 27-30.
26. Shailee F, Sogi GM, Sharma KR, Nidhi P. Dental caries prevalence and treatment needs among 12 and 15 year school children in Shimla city, Himachal Pradesh, India. Indian J Dent Res 2012 Sep-Oct;23(5):579-584.
27. Johansson I, Holgerson PL, Kressin NR, Nunn ME, Tanner AC. Snacking habits and caries in young children. Caries Res 2010 Nov;44(5):421-430.
28. Al-Darwish M, El Ansari W, Bener A. Prevalence of dental caries among 12–14 year old children in Qatar. Saudi Dent J 2014 Jul;26(3):115-125.
29. Sood S, Ahuja V, Chowdhry S. Reconnoitring the association of nutritional status with oral health in elementary school-going children of Ghaziabad City, North India. J Indian Soc Pedod Prev Dent 2014 Jul-Sep;32(3):197-201.
30. Dhar V, Jain A, Van Dyke TE, Kohli A. Prevalence of dental caries and treatment needs in school-going children of rural areas in Udaipur district. J Indian Soc Pedod Prev Dent 2007 Jul-Sep;25(3):119-121.
31. Sudha P, Bhasin S, Anegundi RT. Prevalence of dental caries among 5-13 year old children of Mangalore city. J Indian Soc Pedod Prev Dent 2005 Jun;23(2):74-79.
32. Singh V, Deshpande AR, Wavare R. An assessment of teeth cleaning practices in 12 and 15 year old school going children in rural areas of Sanwer block of district Indore, Madhya Pradesh. Natl J Community Med 2014 Oct-Dec;5(4): 359-363.
33. Mtaya M, Brudvik P, Astrøm AN. Prevalence of malocclusion and its relationship with socio-demographic factors, dental caries, and oral hygiene in 12–14 year old Tanzanian school children. Eur J Orthod 2009 Oct;31(5):467-476.
34. Khanal S, Acharya J. Dental caries status and oral health practice among 12-15 year old children in Jorpati, Kathmandu. Nepal Med Coll J 2014 Sep;16(1):84-87.
35. Punitha VC, Amudhan A, Sivaprakasam P, Rathnaprabhu V. Pocket money: influence on body mass index and dental caries among urban adolescents. J Clin Diagn Res 2014 Dec;8(12):JC10-JC12.
36. Patnaik S, Patnaik L, Patnaik S, Hussain M. Prevalence of overweight and obesity in a private school of Orissa, India. Internet J Epidemiol 2010 Dec;10(1):1-5.
37. Panwar NK, Mohan A, Arora R, Gupta A, Marya CM, Dhingra S. Study on relationship between the nutritional status and dental caries in 8-12 year old children of Udaipur City, India. Kathmandu Univ Med J 2014 Jan-Mar;12(45):26-31.
38. Narang R, Saha S, Jagannath GV, Sahana S, Kumari M, Mohd S. Nutritional status and caries experience among 12 to 15 years old school going children of Lucknow. J Int Dent Med Res 2012 Apr;5(1):30.
39. Lazzeri G, Rossi S, Pammolli A, Pilato V, Pozzi T, Giacchi MV. Underweight and overweight among children and adolescents in Tuscany (Italy). Prevalence and short-term trends. J Prev Med Hyg 2008 Mar;49(1):13-21.
40. Paracha PI, Bakht S, Paracha SI, Vriesekoop F, Alam I, Din Z, Ullah N. Nutritional status, dietary practices and physical activities of adolescents in public and private schools, Karachi, Pakistan. Obes Res Open J 2016 Aug;3(2):30-39.
41. Chopra A, Rao NC, Gupta N, Vashisth S, Lakhanpal M. Influence of behavioral determinants on deviation of body mass index among 12-15 years old school children of Panchkula. Epidemiol Health 2014 Sep;36:e2014021.
42. Mahfouj M, Esaid AA. Dental caries prevalence among 12-15 year old Palestinian children. Int Sch Res Notices 2014 Oct;2014:4.
43. Parkar SM, Chokshi M. Exploring the association between dental caries and body mass index in public school children of Ahmedabad city, Gujarat. SRM J Res Dent Sci 2013 Jul-Sep;4(3): 101-105.
44. Ingle NA, Dubey HV, Kaur N, Gupta R. Prevalence of dental caries among school children of Bharatpur city, India. J Int Soc Prev Community Dent 2014 Jan-Apr;4(1):52-55.
45. Goel R, Vedi A, Veeresha KL, Sogi GM, Gambhir RS. Oral hygiene practices and dental caries prevalence among 12-15 years school children in Ambala, Haryana – a cross-sectional study. J Clin Exp Dent 2015 Jul;7(3):e374-e379.