Relationship between anthropometric measures and dental caries among adolescent National Cadets Corps of Udupi district, south India

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Abstract

Objective: To evaluate the relationship between anthropometric measures and dental caries among National Cadets Corps of Udupi district, India. **Materials and Methods:** Demographic information like age, sex, and parental education were collected. Various anthropometric measures like weight, height, mid-upper arm circumference, waist circumference and hip circumference, and dental caries were recorded as per standard guidelines. **Results:** A total of 211 cadets with age range of 12-19 years constituted the final sample. Caries experience was significantly different with respect to age and gender (P = 0.049 and 0.05, respectively). Multivariate analysis was performed using Poisson regression with DMFT as dependent variable. Height, weight, BMI, and WC showed significant association with dental caries status (OR = 10.61, 1.03, 1.09, and 1.02, respectively). Stratified analysis showed no association with anthropometric measures (Height, weight, BMI, and WC) and dental caries in 12-14 years. Among 15-19 years age group, there was a significant association between anthropometric measures (Height, weight, and BMI) and dental caries. **Conclusion:** There was a significant association between anthropometric measures and caries status in 15-19 years age group while no association was found in 12-14 years age group.

Key words: Anthropometric measures, body mass index, dental caries, India

INTRODUCTION

Obesity and overweight are defined as being an excess of body fat related to lean mass, with multifactorial conditions involving psychological, biochemical, metabolic, anatomic, and social alterations.[1] Obesity has reached epidemic proportions globally, with more than 1 billion adults overweight-at least 300 million of them clinically obese.[2] Studies from developing countries like India report a high prevalence of obesity and overweight among school children.[3-7] Economic growth, urbanization, and globalization of food markets are some of the forces that can possibly influence this epidemic.[2]

Childhood obesity may also lead to serious diseases like decrease in life expectancy, greater risk for type 2 diabetes, cardiovascular disease, asthma, arthritis, and poor general health.[8] Obese adolescents are more likely to become obese adults, posing an increased risk of morbidity and early mortality in adulthood.[9]

Studies conducted so far showed inconsistent association between dental caries and body adiposity.[10,11] Previous studies[12-14] reported positive correlation while a systematic review showed an inconclusive relationship between obesity and dental caries.[11] Various parameters like weight,[15] height for age,[16] weight/height,[16] and body mass index[13] were used previously in establishing relationships between obesity/overweight and dental caries.

The voluntary civil defense units are an important part of any nation's security apparatus and are of help in times of war, natural disasters, and other such national crises. The National Cadet Corps (NCC) is one such organization, which is operated by the armed forces in India. The NCC recruits and train adolescents from schools through voluntary participation. Training involves participation in drills, exercises, sports, and recreational activities. Since the enrollment process is voluntary, it is not surprising to find adolescents with a more boisterous, aggressive nature with a greater interest in finding their career in armed forces, which demand good oral and general health. The association of body adiposity status and dental caries in this physically active group remains ambiguous.

Therefore, we conducted a survey aimed to evaluate the relationship between the various anthropometric measures and dental caries among NCC cadets of Udupi district, India.

MATERIALS AND METHODS

This study was carried out among a group of NCC adolescents participating in the annual training camp held in August 2011 in Udupi District, India. An informed consent was sought from the cadets 1 week before the survey along with a verbal consent from cadets at the time of participation. The study was also approved by the Institutional Ethics Committee, Manipal University, India. All cadets who were present on the day of the survey ($n = 220$) and who gave consent for the study were included constituting a total sample of 211. Children with systemic diseases, prolonged illness and those who had undergone orthodontic treatment ($n = 6$) were excluded from the study. Calibration and training exercises for measurement of clinical indices were done in Manipal College of Dental Sciences, Manipal University.

Demographic measures like age, sex, and parental education were recorded for each cadet before examination. Anthropometric measures recorded were weight, height, mid-upper arm circumference (MUAC), hip circumference (HC), and waist circumference (WC). Measures of weight (kilograms) and height (meters) were assessed using a standard physician's scale and a Stadiometer (WS 021, Anand Medical Exports, India), respectively. WC was measured at the minimum circumference between the iliac crest and the rib cage. MUAC measurements were taken in centimeters with non-elastic tape to the nearest 0.1 mm on the upper-left arm (halfway between the acromion process and the olecranon process). Hip circumference was recorded as the greatest measurement around the buttocks and below the iliac crest. Body mass index (BMI) was calculated by the formula weight/height.^{2} Anthropometric recordings were performed by two trained and calibrated examiners in a closed enclosure with sufficient lighting conditions.

Oral examination

Caries was assessed according to the guidelines given by WHO (1997) under natural day light using mouth mirrors and CPI probes.[17] Caries was recorded as present when a lesion has an unmistakable cavity, undermined enamel, or a detectably softened floor or wall. Decayed, missing and filled teeth (DMFT) due to caries were recorded and summarized as DMFT by a calibrated investigator who was not aware of the BMI. The intra-examiner reliability was assessed by re-examining 10% of the sample after 1 week of the first examination (Kappa coefficient = 0.97). Cadets were categorized as caries-free (DMFT = 0) and caries-experienced (DMFT ≥ 1).

Statistical analysis

Chi-square test was done for assessing differences between socio-demographic factors and caries experience. Poisson regression was used to evaluate the association of various anthropometric measures. All statistical analyzes were performed using SPSS software (17.0, SPSS Inc., Chicago Ill, USA). A P value of < 0.05 was considered statistically significant.

RESULTS

A total of 211 cadets with age range of 12-19 years constituted the final sample. Males constituted the major component of the sample (93.8%). Majority of the parents had primary level education (42.7%). Caries status was significantly different with respect to age and gender ($P = 0.049$ and 0.05, respectively) [Table 1].

Poisson regression was performed with DMFT as dependent variable and anthropometric measures as predictor variables. Height, weight, BMI, and WC showed significant association with dental caries status. Cadets who were taller, heavier, obese/overweight, and those had a higher waist circumference were more likely to have more caries scores (OR = 10.61, 1.03, 1.09, and 1.02, respectively) [Table 2].

Stratified analysis with Poisson regression was done twice using age-group and gender. Only predictors, which had significant association with dental caries, were used for this analysis. Among 12-14 years, only male cadets were present. No association was seen with anthropometric measures (height, weight, BMI, and WC) and dental caries in this group. Among 15-19 years age group, both males and

females had significant association between anthropometric measures (height, weight, and BMI) and dental caries.

DISCUSSION

The study of dental caries remains a daunting task to the oral health professional due to its multi-factorial nature. Due to recent increase in global prevalence of obesity, a plausible biological gradient between obesity and dental caries was proposed in the literature using diet as a common risk factor.

Our study reported that weight, height, BMI, and WC had significant association with dental caries in total sample of adolescents. In 15-19 year age group, significant association of dental caries with height, weight, and BMI in both males and females was found, which was in accordance with previous studies where elevated BMI and dental caries were associated.[12,14,18,19]

Exploration of the link between weight and oral health in children has been controversial. A recent study in school children with primary and mixed dentitions found a positive correlation,[20] while many studies have not found any association.[16,21,22] The lack of association with weight in 12-14 year children was in accordance with previous studies.[16,23] Many teeth would have recently erupted and for caries to progress, ample amount of time is needed. When prevalence of caries is low, such relationship could not be established.

Many studies have considered height as parameter for calculating the BMI, but have not related it to dental caries. Our study reported a significant association between dental caries and height only in 15-19 year olds. The association of BMI with dental caries is dependent on both height and weight. Hence, it is important to evaluate the association of height and dental caries to have an insight of the association of caries with obesity.

Waist circumference showed a significant association when overall sample was considered but failed to show a significant association in stratified analysis. This could be due to the gender variations in waist circumference in the overall sample. The fact that females tend to have higher waist circumference than males could possibly influence such association to be significant. The effect might have nullified when the stratification was done as per gender and age groups. The WHO expert consultation committee[24] recommended that in populations with a predisposition to central obesity, waist circumference should also be used to refine action levels on the basis of BMI.

Chen *et al.* (1998)[23] discussed a triangular relationship between dental caries, obesity, and frequency of sugar

Table 1: Comparison of demographic characteristics and caries status

Parameter	Caries free N (%)	Caries experienced N (%)	Total N (%)	P value
Age				
12-14	102 (59.6)	69 (40.4)	171 (81)	0.049
15-19	17 (42.5)	23 (57.5)	40 (19)	
Sex				
Male	115 (58.1)	83 (41.9)	198 (93.8)	0.05
Female	4 (30.8)	9 (69.2)	13 (6.2)	
Parent education				
Illiterate	13 (59.1)	9 (40.9)	22 (10.4)	0.277
Primary	53 (58.9)	37 (41.1)	90 (42.7)	
Secondary	45 (59.2)	31 (40.8)	76 (36)	
Intermediate	4 (30.8)	9 (69.2)	13 (6.2)	
Graduate	4 (40)	6 (60)	10 (4.7)	

p<0.05 this to p<0.05

Table 2: Poisson regression analysis with DMFT as dependent variable and anthropometric measures as independent variable

Parameter	Total sample			Stratified analysis				
	P-value	OR	95% CI	Age	Sex	P-value	OR	95% CI
Height	<0.001	10.61	2.81-40.07	12-14	Male	0.997	1	0.98-1.02
				15-19	Male	0.016	1.03	1.01-1.06
					Female	<0.001	1.15	1.07-1.23
Weight	<0.001	1.03	1.02-1.04	12-14	Male	0.220	0.99	0.97-1.01
				15-19	Male	0.010	1.03	1.01-1.06
					Female	0.001	1.05	1.02-1.08
BMI	<0.001	1.09	1.04-1.14	12-14	Male	0.063	0.93	0.85-1.00
				15-19	Male	0.032	1.17	1.01-1.35
					Female	0.036	1.10	1.01-1.2
MUAC	0.559	1.01	0.99-1.03	-	-	-	-	-
WC	0.04	1.02	1.00-1.03	12-14	Male	0.980	0.98	0.98-1.019
				15-19	Male	0.169	1.04	0.98-1.02
					Female	0.974	1.00	0.96-1.05
HC	0.40	1.00	1.00-1.01	-	-	-	-	-

CI: Confidence interval, OR: Odds ratio

ingestion. Time or duration should be taken into consideration to evaluate such relationship. If substantial numbers of teeth are newly erupted, then even in the obese children, such association will not be demonstrated. This could be one of the reasons that many studies reported a lack of association in 12-14 years. WHO also recommends 15 year age group to evaluate caries in adolescents. The caries index, which was used in our study, does not take into consideration the actual number of teeth at risk. Since it is most widely accepted index and recommended by WHO, we had considered the same for our study.

Limitations of this study include its cross-sectional nature and lack of any information on dietary habits. Caries prevalence[25] and obesity[3,5] in India have shown a strong association with socio-economic status. Our study evaluated only parental education as a proxy measure of socio-economic status, which showed no association with caries.

Future preventive programs should focus on common risk factor approaches like reducing frequency of intake of sugars to avoid overweight/obesity and caries. Established measures such as fluoride applications can also be easily incorporated in such programs.

CONCLUSION

There was a significant association between anthropometric measures and caries status in 15-19 years age group while no association was seen in 12-14 years age group. Obesity and dental caries have common risk determinants and require a comprehensive multidisciplinary approach by health care professionals.

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