Original Research Article

Assessment of Association between Anthropometry and Dental Caries among Nigerian Young Adults: A Case Control Study

ABSTRACT

Aims: The aim of the study was to evaluate the relationship between anthropometric parameters and dental caries among young adults in Ile-Ife, Osun state, Nigeria.
Study design: This was a cross-sectional case-control study.
Place and Duration of Study: The study was carried out at Department of Physiological Sciences and University Health Centre, Obafemi Awolowo University, Ile-Ife between December 2015 to December 2016.
Methodology: Ninety-two university students aged 18-35 years were recruited for the study. The participants were classified into two groups (cases and control) which were age-and sex-matched. The cases were 46 students with dental caries while the control were 46 students without dental caries. The weight and height of the participants were measured using standard health scale and were utilized for the estimation of the Body Surface Area (BSA) and Body Mass Index (BMI). Dental caries status was assessed using Decay Missing and Filled Teeth (DMFT) index. A dietary chart was utilized to assess the dietary patterns of the participants. Data obtained were analyzed using descriptive and inferential statistics.
Results: The mean values of BSA(m^2) in cases and controls were 1.67±0.17 and 1.66 ± 0.16 (t = .37; *P*= .71) while the mean values of BMI(kg/m^2) for cases and controls were 22.56 ± 3.84 and 22.35 ± 3.34 kg/m^2 (t = 0.29; *P*= .78). There was a significant association between BMI classes and caries status (x^2 = 10.00; *P* = .01). More participants with caries were overweight. Caries was significantly linked with high caries diet (x^2 = 53.49; *P* = .001)
Conclusion: In conclusion, this study established that there was a significant association between body mass index classes and caries status. Overweight and high caries diet contributed significantly to caries formation.

Keywords : Anthropometry, Association, Dental Caries, Young Adult

1. INTRODUCTION

Oral health has a considerable impact on general health and vice versa. Dental caries is a multifactorial oral infection (1). It is the most common chronic childhood disease in oral health (2). Factors predisposing to dental caries include consumption of refined sugar, poor oral hygiene, inadequate fluoride supplementation, low socio-economic status, low salivary immunoglobulins and high oral bacterial load.

As one of the most common prevalent disease in the world, dental caries is hypothesized to be a potential risk factor for general health (2). Anthropometry is the scientific assessment of body size. It provides the single most portable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body(3). The common anthropometric indices include weight, height, body mass index(BMI) and body surface area(BSA).BMI is also called Quetelex index. It is an internationally accepted index for defining and classification of obesity(4-6).

Abnormal BMI is part of global health burden. A high BMI may be an indicator of excess body fat deposition. BMI can also be used as a screening tool but is not diagnostic of the body fatness (6). According to World Health Organization (WHO), BMI (kg/m^2) of an adult is classified as underweight (<18.5), normal (18.5 - 24.9), overweight (25.0 to 29.9) or obesity (≥ 30) (7). Underweight, overweight and obesity were associated with increased risk of morbidity and mortality (8). Individuals with abnormal BMI were at increased risk of numerous multisystemic health challenges involving the endocrine, metabolic, cardiovascular, respiratory, musculoskeletal and neurological systems (9). Obese adolescents are more likely to become obese adults, posing an increased risk of morbidity and mortality in adulthood (10). While genes are important in determining a person's susceptibility to weight gain, energy balance is determined by calorie intake and physical activity. Dental caries is a multifactorial medical condition with overwhelming task to healthcare professionals in dentistry. Changes in behavior, culture, environment, genetic factors and worldwide nutrition transition have been implicated in driving the obesity epidemic (11) and some of these factors are also responsible for dental caries.

Obesity and dental caries have common risk determinants and require a comprehensive multidisciplinary approach (10). While obesity may be caused by eating too much calories and refined sugar and burning too little, dental caries is caused by eating too much of refined sugar (11). Dietary interventions by dental practitioners to eliminate the development of dental caries may at the same time reduce the body mass index. This can be achieved by administration of dietary chat which will point out the major diet(s) causing the carious lesion and or obesity. BSA measures the total surface area of the body and is used to calculate drug dosages and medical indicators or assessments. The present study was conducted to evaluate the relationship between BMI, BSA and dental caries among young adult in Ile-Ife, Nigeria

2. METHODOLOGY

The research was a case-control study that compared the anthropometric parameters in young adults with and without dental caries. The sample size of 92 was determined using a formula for comparison of proportion defined by STATA statistically software (version 10). The participants were grouped into two; cases (46 students with dental caries) and controls (46 students without dental caries). The cases and controls were sex- and age- matched and selection was by purposive sampling technique. Participants were undergraduates of Obafemi Awolowo University, (OAU) Ile-Ife, Osun State who were within the age range of 18-35 years. A written informed consent was sought from each participant. Ethical clearance was obtained from Institute of Public Health, College of Health Sciences, Obafemi Awolowo University, Ile-Ife. Volunteers for the study had dental examination done by a calibrated dentist. Caries status was assessed using World Health Organization(WHO) index called Decayed, Missing, and Filled Teeth (DMFT) index. Using the DMFT, individuals were classified into cases (DMFT>1) and controls(DMFT<1). Individuals who were less than 18 years or older than 35 years, underlining systemic conditions, history of cigarette smoking, regular alcohol intake and long-term coffee consumption were excluded from the study. The participants were examined seated on a plastic chair in a room with good lighting source using sterile mouth mirrors and a probe for each participant. Caries was determined visually with the optimal illumination of oral cavity and no x-rays was used. Participants were asked to complete the dietary chart by writing the meals and in-between meals eaten over a period of three days including a weekend day. These meals and in-between meals were categorized into high caries/cariogenic diet (high in refined sugar) or low caries/non-cariogenic diet (low in refined sugar). Weight and height of each selected participant were assessed using a standard physician scale (200CHUB) and a wall-mounted stadiometer respectively. The body mass index (BMI) was calculated using a Quetelex formula; BMI=weight/height^2(4). Weight was measured in kilogram while height was measured in meters. Body surface area was calculated using the Mosteller formula; BSA = (height (cm) x weight (kg)/3600)$^{1/2}$. Data were analyzed using SPSS Windows Version 23 (SPSS Inc, IBM, UK). A P value less than .05 was considered statistically significant.

3. RESULTS AND DISCUSSION

3.1. Result

A total of ninety-two participants were selected into the study, out of which forty-six (50.0%) were caries free and forty-six (50.0%) were caries active. Among the caries active participants, 50.0% were

males with 30.0% of them within the age of 25-29 years and another 30.0% of them within the age of 30-34 years; the remaining 40.0% were less than 24 years. The mean age of caries active participants was 24.0 ± 5.0 years. Among the caries free participants, 50.0% male out of which 48.0% falls between 20-24 years and 50.0% were females out of which 78.0% were between 20-24 years. The mean age of caries-free participants was 23.0 ± 5.0 years. Presence of decayed, missing or filled teeth/tooth were observed in the oral cavities of the caries active participants and the number of such teeth ranges from 1 to 5. There was no significant difference in the mean values body mass index of cases compared with control (Table 1). The mean BMI of caries active participants was found to be 22.56 ± 3.84 while that of caries free participants was 22.35 ± 3.34 (t = 0.29, *P* = .78). The BSA showed no significant relationship with caries status (Table 1). The proportion of individuals with overweight was significantly higher in cases than the control (Table 2). There was a significant relationship between BMI classes and caries status (X^2 = 10.00, *P* = 0.02).

Table 1: Relationship between anthropometric measurements and dental caries status

Anthropometry	Caries active	Caries free	t	*P*-value
Height	1.65±0.67	1.64±0.72	0.28	.78
Weight	61.30±11.56	60.41±10.38	0.39	.70
Body mass index	22.56± 3.84	22.35±3.34	0.29	.78
Body Surface Area	1.67± 0.17	1.66 ± 0.16	0.37	.71

**P*<.05

Table 2: Distribution between BMI class and dental caries

BMI Class	Caries Status		Total	X^2	*P*-value
	Caries active	Caries free			
Underweight	6(13.04%)	2(4.35%)	8(8.69%)	10.000	0.02*
Normal weight	26(56.52%)	39(84.78%)	65(70.65%)		
Overweight	12(26.09%)	3(6.52%)	15(16.30%)		
Obese	2(4.35%)	2(4.35%)	4(4.35%)		
Total	46(100%)	46(100%)	92(100%)		

**P* <0.05

Table 3: Effects of diet on caries status

Parameter	Caries Active	Caries Free	X^2	P value
Low Caries Diet	04	39	53.49	0.001*
High caries Diet	42	07		
Total	46	46		

*: Significance at *P* < .05

3.2. Discussion

The present study compared caries active and caries free individual with the aim of finding the differences in the anthropometry. Poor oral health had a profound effect negative effect on general health (12). Poor oral health is typified by the onset of dental caries, presently adjudged most common chronic disease (13). Current study showed that there was a significant association between BMI class and dental caries (p=0.02). Critically, a number of studies have linked consumption of sweetened beverages with increased energy intake, obesity (14-16) and dental decay (13, 17-18),

there are reports of associations between obesity and dental caries, (19-21) these data are diverse and provide conflicting evidence. Obesity and dental caries share common, modifiable, influences such as diet and lifestyle. Recent national data from Sweden (22) suggest a positive correlation between dental caries and Body Mass Index (BMI), and showed that behaviours such as snacking on refined carbohydrate in early childhood predicted caries development in adolescence. BMI is widely used as a surrogate measure for obesity because it corrects for an individual's height in relation to weight, and it is a commonly used indicator of nutritional status (23). The observed relationship that dental caries rates and BMI are a measure of diet-related health outcome makes the association not to be a surprise. Changes in diet and lifestyle since the mid1990s, such as increased affluence and access to high caloric carbohydrate-rich foods and drinks, may help to account for the rising prevalence of dental caries and obesity (24,25) . Chen *et al*., (26) discussed a triangular relationship between dental caries, obesity and frequency of ingestion of refined carbohydrates. The current study also showed more carious lesion occur among overweight individuals. Overweight adults are more predisposed to eat or snack on refined carbohydrate. Time or duration should be taken into cognizance to assess such correlations. World Health Organization (WHO) recommends 15 years of age to evaluate caries in young adults. The caries index that was used in this study took into consideration the actual number of teeth at risk and the severity of the lesion. Previous studies reported by Pentapati *et al*.,(27) claimed that there were limited or lack of information on dietary habits. This study, however, included dietary chart, which was administered to the participants. The finding of this study was in tandem with previous studies that showed significant relationship between consumption of refined sugar and dental caries (25). More of caries active participants were found to consume more of cariogenic diets than the caries free participants. This present study revealed that overweight was closely linked with dental caries. This was in consonance with previous studies where there was a correlation between high BMI and dental caries (24, 28-31).

4. CONCLUSION

In conclusion, this study established that there was a significant association between body mass index classes and caries status. Overweight and high caries diet contributed significantly to caries formation.

CONSENT

All authors declare that 'written informed consent' was obtained from the participants for the research.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the Institute of Public Health Ethics and Research committee, Obafemi Awolowo University, Ile-Ife and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki."

REFERENCES

1. Selwitz RH, Ismail AI, Pitts NB. Dental caries. The Lancet. 2007; 369(9555):51-59.
2. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C.The global burden of oral diseases and risks to oral health. Bulletin of the World Health Organization. 2005;83(9):661-669.
3. Status WP. The use and interpretation of anthropometry. Geneva CH. WHO 1995, technical report 854; 1995.
4. Eknoyan G. Adolphe Quetelet (1796–1874)—the average man and indices of obesity.Oxford University Press; 2007.
5. Jéquier E. Energy, obesity, and body weight standards.American journal of clinical nutrition (USA). 1987; 5: 1035-1036.
6. Shah NR, Braverman ER. Measuring Adiposity in Patients: The Utility of Body Mass Index (BMI), Percent Body Fat, and Leptin. PLoS ONE. 2012;7(4). e33308-e33308.
7. World Health Organization. Obesity and Overweight. Fact Sheet No. 311. September 2006.Online document at: www who int/ media centre /fact sheets /fs311/en/index html.Accessed September. 2010;13.

8. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. Jama. 2005;293(15):1861-1867.
9. Ogunlade O, Asafa M. Pattern and prevalence of underweight, overweight and obesity among young adult Nigerians. Am J Biomed Life Sci. 2015;3:12-15.
10. Freedman DS, Khan LK, Dietz WH, Srinivasan SR, Berenson GS. Relationship of childhood obesity to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. Pediatrics. 2001;108(3):712-718.
11. Thippeswamy H, Kumar N, Acharya S, Pentapati K. Relationship between body mass index and dental caries among adolescent children in South India. West Indian Medical Journal. 2011;60(5):581-586.
12. World Health Organization. World Health Organization Oral Health Surveys–Basic Methods.Geneva: World Health Organization; 1997.
13. Hayden C, Bowler JO, Chambers S, Freeman R, Humphris G, Richards D, et al. Obesity and dental caries in children: a systematic review and meta- analysis. Community dentistry and oral epidemiology. 2013;41(4):289-308.
14. Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis.The Lancet. 2001;357(9255):505-508.
15. Linardakis M, Sarri K, Pateraki M-S, Sbokos M, Kafatos A. Sugar-added beverages consumption among kindergarten children of Crete: effects on nutritional status and risk of obesity. BMC Public Health. 2008;8(1):279-285.
16. Schulze MB, Manson JE, Ludwig DS, Colditz GA, Stampfer MJ, Willett WC, et al. Sugar-sweetened beverages, weight gain, and incidence of type 2 diabetes in young and middle-aged women. Jama. 2004;292(8):927-934.
17. Al-Dlaigan Y, Shaw L, Smith A. Tooth surface loss: Dental erosion in a group of British 14-year-old school children Part II: Influence of dietary intake. British Dental Journal. 2001;190(5):258-261.
18. Marshall TA, Levy SM, Broffitt B, Warren JJ, Eichenberger-Gilmore JM, Burns TL *et al*.Dental caries and beverage consumption in young children. Pediatrics. 2003 ; 112 (3):e184-e191.
19. Bailleul-Forestier I, Lopes K, Souames M, Azoguy-Levy S, Frelut ML, Boy-Lefevre ML. Caries experience in a severely obese adolescent population.Int J Paediatr Dent. 2007;17(5): 358-363.
20. Gerdin EW, Angbratt M, Aronsson K, Eriksson E, Johansson I.Dental caries and body mass index by socio-economic status in Swedish children. Community Dent Oral Epidemiol. 2008;36(5):459-465.
21. Sharma A, Hegde AM. Relationship between body mass index, caries experience and dietary preferences in children. J Clin Pediatr Dent. 2009; 34(1): 49-52.
22. Alm A, Isaksson H, Fahraeus C, Koch G, Andersson-Gare B, Nilsson M, *et al*.BMI status in Swedish children and young adults in relation to caries prevalence. Swed Dent J. 2011;35(1): 1-8.
23. Hooley M, Skouteris H, Boganin C, Satur J, Kilpatrick N.Body mass index and dental caries in children and adolescents: a systematic review of literature published 2004 to 2011.Systematic Reviews.2012;1(1):1-57.
24. Armfield JM, Robents-Thomson KF, Spencer AJ. The child Dental Health Survey Australia 1999: Trends across the 1990s, (No AIHW Cat. No. DEN 95). Adelaide: The University of Adelaide (AIHW Dental Statistics and Research Series No.27), 2003.
25. Sakeenabi B, Swamy HS, Mohammed RN. Association between obesity, dental caries and socioeconomic status in 6- and 13-year-old school children. Oral Health Prev Dent. 2012;10(3):231-241.
26. Chen W, Chen P, Chen SC, Shih WT, Hu HC. Lack of association between obesity and dental caries in three-year-old children. Acta Paed Sin. 1998;39(2):109-111.
27. Pentapati KC, Acharya S, Bhat M, Rao K, Vidya S, Singh S.Oral health impact, dental caries, and oral health behaviors among the National Cadets Corps in South India. Journal of investigative and clinical dentistry. 2013;4(1):39-43.
28. Booth M, Dobbins T, Okely A, Denney-Wilson E, Hardy L.Trends in the prevalence of overweight and obesity among young Australians,1985–1997, and 2004. Obesity. 2007;15(5):1089-1095.
29. Larsson B, Johansson I, Hallmans G, Ericson T. Relationship between dental caries and risk factors for atherosclerosis in Swedish adolescents'. Community dentistry and oral epidemiology. 1995;23(4):205-210.

30. Honne T, Pentapati K, Kumar N, Acharya S.Relationship between obesity/ overweight status, sugar consumption and dental caries among adolescents in South India. International journal of dental hygiene. 2012;10(4):240-244.
31. Willershausen B, Haas G, Krummenauer F, Hohenfellner K. Relationship betweem high weight and caries frequency in German elementary school children. Eur J Med Res. 2004;9(8):400-404.