RESEARCH ARTICLE

Does body surface area of children affect the oral health?

Raya Rashid Aldafaai[1], Zainab Juma Jafar[2], Rasha Khalaf Zighair[3]

Abstract

Objective: To evaluate relationship between oral health and body surface area among children.

Method: The observational, cross-sectional study was conducted from January to February /2022 after approval from the ethics review committee of the College of Dentistry, University of Baghdad, Baghdad, Iraq, and comprised children of either gender aged 6-8 years who were randomly selected from primary schools in the city. Body surface area was calculated geometrically using different formulas, and the DuBois formula was used to make the intervals. The estimated body surface area values were broadly divided into four intervals: 0.8-0.9, >0.9-1.0, >1.0-1.1, >1.1. Dental caries was examined using the World Health Organisation criteria related to decayed, missed and filled teeth and surfaces for primary and permanent teeth. Dental plaque and gingival health status were measured using plaque and gingival indices. Data was analysed using SPSS 22.

Results: There were 240 subjects. There was no significant difference in terms of mean body surface area intervals of decayed, missed and filled teeth and surfaces for primary and permanent teeth ($p>0.05$). The mean values of gingival index showed significant differences across body surface area intervals ($p<0.05$). Mean plaque index values showed no significant differences ($p>0.05$).

Conclusion: No relationship between body surface area and caries experience of primary and permanent teeth was found. However, increasing the body surface area increased gingival inflammation.

Key Words: Periodontal Index, Oral Health, Dental Plaque, Health Status, World Health Organization, Inflammation

(JPMA 74: S22 (Supple-8); 2024) **DOI: https://doi.org/10.47391/JPMA-BAGH-16-06**

Introduction

Oral health is an important component of overall health and it helps a child grow into a healthy adult. Dental caries and plaque-induced gingivitis are the most frequent oral diseases affecting young children.[1] Oral problems may only affect a small part of the human body, but their implications and consequences affect the whole body. A healthy mouth tends to be associated with a healthy body[2]. On the other hand, poor oral health can have a negative impact on general health by causing significant pain and by changing the quality of life (QOL) and well-being.[3] For instance, dental caries may be associated with obesity.[4] A number of mechanisms have revealed a link between children's dental health and their development.[5] Accordingly, previous studies have revealed a relation between dental caries and gingival health with anthropometric measures using body mass index (BMI)[6,7], but there is no evidence to correlate oral health with body surface area (BSA), which is a measured or estimated surface area of a human body and is a better indication of metabolic mass than body weight for many medical applications as it is less influenced by adipose mass[8]. Several formulas for the calculation of the BSA have been developed over the past several decades, followed by a three-dimensional (3D) laser scanning technique[9].

The current study was planned to determine if there was a link of dental caries and plaque-induced gingivitis with BSA in young children using different formulas.

Materials and methods

The observational, cross-sectional study was conducted from January to February /2022 after approval from the ethics review committee of the College of Dentistry, University of Baghdad, Baghdad, Iraq, and comprised children of either gender aged 6-8 years with no history of medical diseases who were enrolled from primary schools in the city (Karkh 3 sector only) by using simple random sampling technique.

The sample size was calculated using G*power10 analysis with power of study 80%, alpha error of probability 0.05 and the effect size of F 0.216. The sample size was inflated by adding an error rate of 10%[10]. Any child with the history of systemic diseases was excluded from the study

After taking informed consent from parents or guardians,

[1]Department of Paediatric and Preventive Dentistry, Ibn Sina University of Medical and Pharmaceutical Sciences, [2]Department of Pedodontics and Preventive Dentistry, University of Baghdad, [3]Department of Anbar Health, Ministry of Health, Iraq.

Correspondence: Raya Rashid Aldafaai

Email: raya.aldafaai.g@ibnsina.edu.iq

the children were subjected to oral examination by a single consultant dentist to avoid bias. BSA was calculated based on a subject's height and weight by using different formulas, like Du Bois, Mosteller, Haycock, Gehan and George, Boyd, Fujimoto and Takahira[9].

Body weight was measured with the subjects wearing light clothing, and the children were asked to remove their shoes before assessment. The weight was measured by using a digital weighing scale (Yongkang Zhengya scales factory, China). Calibration of the scale was done by using a known weight of 10kg before and after weighting every 20 children. Weight was recorded in kg down to one decimal point. The height was assessed by using a stadiometer to the nearest 0.5cm.

Dental caries was examined using the World Health Organisation (WHO) criteria[11] related to decayed, missed and filled teeth (DMFT) and decayed, missed and filled surfaces (DMFS) for primary and permanent teeth, respectively[11]. When a cavity is visible or softened tissue is present in a pit, fissure, or smooth surface, the tooth is considered carious. The tooth is categorised as sound if it has white lesions, rough enamel surfaces, or discoloured pits and fissures with no visible symptoms of cavities or softening the tissue. A missing tooth is one that has been lost as a result of the progression of a carious lesion; it is not to be confused with teeth that have been lost as a result of physiological exfoliation[12]. Dental plaque was recorded by plaque index (PII) as per the criteria reported by Silness and Loe[13]; 0 = no plaque, 1 = plaque seen only after application of disclosing solution or by using the probe, 2 = moderate plaque seen with the naked eye, and 3 = abundance of soft matter. For the assessment of gingival health condition, the gingival index (GI) was used as reported by Loe and Silness[14]; 0 = no inflammation, 1 = mild inflammation and no bleeding on probing, 2 = moderate inflammation, bleeding on probing, and 3 = severe inflammation and spontaneous bleeding.

Data was analysed using SPSS 22. Data was expressed as means and standards deviations of dental caries, plaque and gingival indices. BSA intervals were calculated using the Du Bois formula[9], and the values were broadly divided into four intervals: 0.8-0.9, >0.9-1.0, >1.0-1.1, >1.1. One-way analysis of variance (ANOVA) and least significant difference (LSD) post hoc tests were used to compare the mean values among the intervals. $P<0.05$ was considered significant.

Results

There were 240 subjects. Among the 7 BSA formulas chosen, there was no significant difference in the mean values ($F=1.769$, $p=0.102$), and, therefore, only one formula (Du Bois) was finalised for making the intervals.

The caries experience of primary teeth in relation to BSA intervals was not significantly different ($p>0.05$) (Table 1). There was no significant difference in the caries experience of permanent teeth across BSA intervals

Table-1: Caries experience of primary teeth according to body surface area intervals.

Caries experience	Intervals	N	Mean	SD	SE	F	Sig.
DS	0.8-0.9	49	13.449	11.904	1.700	2.110	0.100
	0.9-1.0	65	15.738	10.455	1.296		
	1.0-1.1	56	11.785	9.249	1.236		
	>1.1	70	12.000	8.625	1.030		
MS	0.8-0.9	49	1.326	2.656	0.379	0.424	0.736
	0.9-1.0	65	1.846	3.255	0.403		
	1.0-1.1	56	1.964	4.229	0.565		
	>1.1	70	1.500	3.224	0.385		
FS	0.8-0.9	49	0.122	0.484	0.069	2.664	0.052
	0.9-1.0	65	0.076	0.620	0.076		
	1.0-1.1	56	0.553	2.271	0.303		
	>1.1	70	0.857	2.577	0.308		
DMFS	0.8-0.9	49	14.959	12.345	1.763	.227	0.227
	0.9-1.0	65	17.661	11.358	1.456		
	1.0-1.1	56	14.285	9.825	1.312		
	>1.1	70	14.414	8.523	1.018		
DMFT	0.8-0.9	49	6.183	3.795	0.542	1.166	0.323
	0.9-1.0	65	6.738	3.058	0.379		
	1.0-1.1	56	6.017	3.210	0.429		
	>1.1	70	5.728	2.868	0.342		

D: Decayed, M: Missing, F: Filled, T: Teeth, S: Surfaces, SD: Standard deviation, SE: Standard error.

Table-2: Caries experience of permanent teeth according to body surface area intervals.

Caries experience	Intervals	N	Mean	SD	SE	F	Sig.
DS	0.8-0.9	41	1.243	2.244	0.350	2.564	0.056
	0.9-1.0	63	2.650	3.173	0.399		
	1.0-1.1	54	1.981	2.235	0.304		
	>1.1	68	1.882	2.391	0.289		
	>1.1	70	12.000	8.625	1.030		
MS	0.8-0.9	41	0.000	0.000	0.000	1.942	0.124
	0.9-1.0	63	0.000	0.000	0.000		
	1.0-1.1	54	0.277	1.509	0.205		
	>1.1	68	0.000	0.000	0.000		
FS	0.8-0.9	41	0.000	0.000	0.000	1.479	0.221
	0.9-1.0	63	0.063	0.353	0.044		
	1.0-1.1	54	0.148	0.626	0.085		
	>1.1	68	0.176	0.571	0.069		
DMFS	0.8-0.9	41	0.878	1.381	0.215	2.714	0.051
	0.9-1.0	63	1.698	1.602	0.201		
	1.0-1.1	54	1.629	1.685	0.229		
	>1.1	68	1.367	1.465	0.177		
DMFT	0.8-0.9	41	1.24	2.245	0.351	2.550	0.057
	0.9-1.0	63	2.71	3.210	0.404		
	1.0-1.1	54	2.31	2.598	0.354		
	>1.1	68	2.06	2.503	0.304		

D: Decayed, M: Missing, F: Filled, T: Teeth, S: Surfaces, SD: Standard deviation, SE: Standard error.

(p>0.05) (Table 2).

Mean GI values showed significant differences across BSA intervals (p<0.05), and mean PII values showed no significant differences (p>0.05) (Table 3).

Table-3: Gingival and plaque index according to body surface area intervals.

Gingival and plaque index	Intervals	N	Mean	SD	SE	F	Sig.
GI	0.8-0.9	49	0.849	0.341	0.048	0.003	0.003*
	0.9-1.0	65	1.152	0.524	4.750		
	1.0-1.1	56	1.127	0.474	0.063		
	>1.1	70	1.143	0.539	0.064		
PII	0.8-0.9	49	1.475	0.550	0.078	1.281	0.281
	0.9-1.0	65	1.446	0.546	0.067		
	1.0-1.1	56	1.355	0.648	0.086		
	>1.1	70	1.288	0.616	0.073		

*Significant: P <0.05, GI: Gingival index, PII: Plaque index.

Discussion

The current study used 7 formulas to calculate BSA and after finding no significant difference in the mean values settled for the Du Bois formula to make the intervals which is the most commonly used in medical cases[15].

Oral disease causes problems with chewing, swallowing and speaking, and it disrupts sleep and productivity[16].

The present study showed no significant relations between the mean decayed, missing and filled primary and permanent teeth scores and the BSA of children aged 6-8 years. There is no comparable data in literature, but this could be due to the fact that both BSA and dental caries have multifactorial aetiology, with many genetic and environmental variables influencing their development[7].

Gingivitis is a widespread oral health problem that is a mild form of periodontal disease[17]. Gingivitis, which is related to bacterial plaque, seems to be the most widespread type of gingivitis due to the aetiological element of dental plaque[18]. A highly significant relationship was found between GI and BSA in the current

study, with gingivitis increasing with increased BSA. No study in literature has reported the relationship between GI and BSA. Some studies, however, established a link between obesity and the prevalence of gingivitis in children.[19, 20]

Overweight has the ability to increase inflammatory lineage cells (macrophages, monocytes and T lymphocytes), as well as their immunological response to microbial pathogens. Additionally, obese people are more likely to produce adipokines, proinflammatory cytokines, and reactive oxygen species, and all of them can promote gingival inflammation[21]. Although the relation between BSA and GI was significant, the present study identified a non-significant association between BSA and PII. It is clear that the epidemiology of oral disease is complex[22], and the current findings provide only minimal information about oral health which needs further and more detailed examination.

Limitation: The current study was conducted in only one sector of Baghdad city and comprised children of a specific age group, which has limited the generalisability of the findings.

Conclusion

No relationship between BSA of children and caries experience of primary and permanent teeth was found, but Gingivitis increased with increased BSA.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

1. Godson J, Csikar J, White S. Oral health of children in England: a call to action! Arch Dis Child 2018;103:5-10. doi: 10.1136/archdischild-2017-312725.
2. Janakiram C, Sanjeevan V, Br R, Joseph J, Stauf N, Benzian H. Political priority of oral health in India: analysis of the reasons for neglect. J Public Health Dent 2018;78:144-53. doi: 10.1111/jphd.12254
3. Sheiham A. Oral health, general health and quality of life. Bull World Health Organ 2005;83:644.
4. Anzar W, Qureshi A, Afaq A, Kattan HF, Almutairi B, Alzahrani KM, et al. Association of Dental Caries and Anthropometric Measures among Primary School Children. Children (Basel) 2021;8:223. doi: 10.3390/children8030223
5. Paisi M, Kay E, Bennett C, Kaimi I, Witton R, Nelder R, et al. Body mass index and dental caries in young people: a systematic review. BMC Pediatr 2019;19:122. doi: 10.1186/s12887-019-1511-x
6. Ramírez K, Gómez-Fernández A, Rojas M, Rojas-Guzmán R, Solano-Sanabria M, Villalobos-Méndez C, et al. Gingival health Related to Intake of Different Types of Foods and Body Mass Index in 12-year-old Schoolchildren. Int J Dental Sc 2020;22:165-77. DOI: 10.15517/IJDS.2020.41001
7. Reddy VP, Reddy VC, Krishna Kumar RVS, Sudhir KM, Srinivasulu G, Deepthi A. Dental caries experience in relation to body mass index and anthropometric measurements of rural children of Nellore district: A cross-sectional study. J Indian Soc Pedod Prev Dent 2019;37:12-7. doi: 10.4103/JISPPD.JISPPD_52_18
8. Villa C, Primeau C, Hesse U, Hougen HP, Lynnerup N, Hesse B. Body surface area determined by whole-body CT scanning: need for new formulae? Clin Physiol Funct Imaging 2017;37:183-9. doi: 10.1111/cpf.12284
9. Redlarski G, Palkowski A, Krawczuk M. Body surface area formulae: an alarming ambiguity. Sci Rep 2016;6:27966. doi: 10.1038/srep27966
10. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods 2009;41:1149-60. doi: 10.3758/BRM.41.4.1149
11. World Health Organization (WHO). Oral Health Surveys: Basic methods, 3rd ed. Geneva, Switzerland: WHO Press; 1987.
12. de Luca da Cunha CMB, Cançado N, Chibinski ACR, Pinto MHB, Wambier DS. Caries Prevalence in Preschool Children in a City of Southern Brazil According to Two Diagnostic Criteria: dmf-t and ICDAS II. Pesqui Bras Odontopediatria Clin Integr 2019;19:e4666. DOI: 10.4034/PBOCI.2019.191.70
13. Silness J, Löe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. Acta Odontol Scand 1964;22:121-35. Doi: 10.3109/00016356408993968.
14. Löe H, Sillness J. Periodontal disease in pregnancy. I. Prevalence and severity. Acta Odontol Scand 1963;21:533-51. doi: 10.3109/00016356309011240.
15. Shuter B, Aslani A. Body surface area: Du Bois and Du Bois revisited. Eur J Appl Physiol 2000;82:250-4. doi: 10.1007/s004210050679
16. Baiju RM, Peter E, Varghese NO, Sivaram R. Oral Health and Quality of Life: Current Concepts. J Clin Diagn Res 2017;11:ZE21-6. doi: 10.7860/JCDR/2017/25866.10110
17. Janakiram C, Mehta A, Venkitachalam R. Prevalence of periodontal disease among adults in India: A systematic review and meta-analysis. J Oral Biol Craniofac Res 2020;10:800-6. doi: 10.1016/j.jobcr.2020.10.016
18. Murakami S, Mealey BL, Mariotti A, Chapple ILC. Dental plaque-induced gingival conditions. J Clin Periodontol 2018;45(Suppl 20):s17-2. doi: 10.1111/jcpe.12937
19. Keller A, Rohde JF, Raymond K, Heitmann BL. Association between periodontal disease and overweight and obesity: a systematic review. J Periodontol 2015;86:766-7. doi: 10.1902/jop.2015.140589
20. Martinez-Herrera M, Silvestre-Rangil J, Silvestre FJ. Association between obesity and periodontal disease. A systematic review of epidemiological studies and controlled clinical trials. Med Oral Patol Oral Cir Bucal 2017;22:e708-15. doi: 10.4317/medoral.21786.
21. Ganesan SM, Vazana S, Stuhr S. Waistline to the gumline: Relationship between obesity and periodontal disease-biological and management considerations. Periodontol 2000 2021;87:299-314. doi: 10.1111/prd.12390
22. Dhaifullah E, Al-Maweri SA, Koppolu P, Elkhtat E, Mostafa D, Mahgoub M. Body mass index and periodontal health status among young Saudi adults: a cross-sectional study. Ann Saudi Med 2019;39:433-40. doi: 10.5144/0256-4947.2019.433