Description of the Simplified Oral Hygiene Index (Ohi-S) in Stunting Children

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Abstract

Oral hygiene is vital for dental and oral health because it is linked to local and systemic diseases. Dental plaque and calculus are the most contributing factors among the various causes of dental and oral problems. The OHI-S (simplified oral hygiene index) measures children's dental and oral health status. Stunting is a chronic malnutrition problem, indicated by Z-Score is under -2 SD for height for age measurement according to the World Health Organization (WHO) child growth standard. One of the oral manifestations of stunting is impaired development of the salivary glands, even atrophy, so the buffering and self-cleansing abilities are reduced.

This descriptive observational study aims to describe the OHI-S in stunted children. This study was conducted on 76 subjects.

The study showed that 71% of subjects had poor OHI-S scores, 28% had moderate scores and only 1% of subjects with good scores. Male children dominated the poor OHI-S group. This study concludes that stunting can affect the OHI-S index.

Introduction

Stunting is a macronutrient and micronutrient malnutrition disease which leads to children's growth and developmental disorder [1,2]. Stunting is measured by height for age ratio with Z-score<-2 SD according to WHO standards[3]. Stunting is indicated by a lower growth rate and disruption of physical growth due to malnutrition[4]. Malnutrition in the first 1000 days of life initiates chronic nutritional problems; thus, stunting occurs. Stunting can impair oral health through salivary gland atrophy due to vitamin A deficiency and Protein-Energy Malnutrition (PEM). Salivary gland hypofunction, i.e., decrease in salivary flow rate, salivary constituents buffering, and self-cleansing capacity, reduces the resistance to acid from plaque and leads to poor oral health conditions. Saliva is a buffer that keeps the oral cavity clean from food debris so bacteria cannot grow and multiply[5]. The buffer balances the oral pH after a meal and minimizes demineralization. This condition can also affect saliva amount and composition so that the protective properties of saliva are reduced and affects oral hygiene [6,7]. Dental plaque is a complex microbial ecosystem that grows as biofilms on the teeth' enamel surface[8]. The oral cavity condition, i.e. wet, dark, and moist, supports plaque formation. Bacterial colonization will grow continuously and widely on the entire tooth surface if oral hygiene practice is neglected. Oral Hygiene Index-Simplified (OHI-S) is one of many methods to assess personal oral hygiene. Someone with good oral hygiene shows clean tooth, free from debris and calculus, and healthy gums (painless and non-bleeding gingiva). [9]

Oral hygiene is a significant risk factor for dental and oral diseases, especially caries[8]. Greene and Vermillion created the Simplified Oral Hygiene Index (OHI-S) to assess oral hygiene. It consists of two indexes, i.e. the Simplified Calculus Index (CI-S) and the Simplified Debris Index (DI-S), which measures the amount of calculus and debris found on the tooth surface[10,11]. Efforts to remove plaque are related to the child's ability to brush their teeth. Brushing teeth depends on the development of children's motor skills[12]. In stunted children, there

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are disturbances of psychomotor development, child hand ability, and coordination of visual and motor skills[12,13]. The lower mechanical ability of the tricep surae thereby slows down the maturation process of this muscle; thus, children with better motor development will be more able to brush their teeth efficiently[14,15].

Materials and methods

The research was a descriptive observational study to describe the OHI-S in stunted children. This research was carried out from January to August 2022 in Lubuk Kilangan Health Center, Padang City, West Sumatra. The population is 308 stunted children aged 10-12 years in Lubuk Kilangan districts, according to the Lubuk Kilangan Stunted Children Health Center database.

The samples were selected from the population with a simple random technique and met the inclusion and exclusion criteria. Seventy-six subjects were chosen as study samples calculated using by Slovin formula.

Height measurement was conducted by anthropometric measurements based on height per age (TB/U) indicators according to the WHO Child Growth standard, with a Z-score TB/U <-2SD. Height was measured using a microtoise with a precision of 0.1 cm. Height measurements are converted into Z-scores following WHO guidelines. The disclosing solution was placed under the subject's tongue, and subjects were instructed to apply it to the entire tooth surface. The red-purplish stain on the tooth surface was defined as tooth debris. Half moon probe was used to examine the dental surface, and the rough surface was defined as calculus. Then debris score and calculus score were summed to calculate the OHI-S score. The OHI-S score is categorized as good (score 0-1.2), moderate (1.3-3.0) and poor (3.1-6.0). The data were analyzed by univariate statistic analysis.

Results

This study was conducted at the Lubuk Kilangan Community Health Center on 76 stunted children. The investigation involved characteristics of the sample based on gender and age, the distribution of subjects based on height and Z-score, and OHIS scores in stunted children.
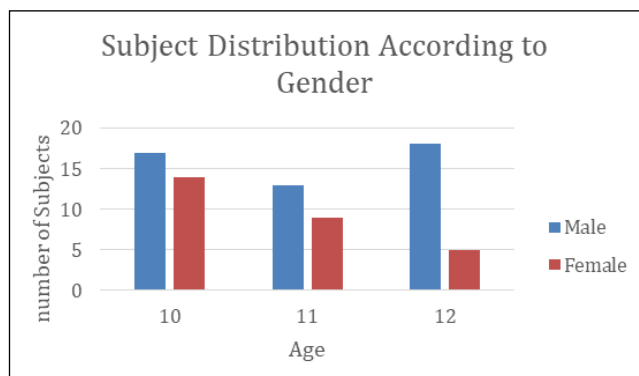

Figure 1. Subject Distribution According to Gender.

The picture above demonstrates the characteristics of the subject based on gender. The number of male subjects is more than female. In terms of age, 31 children are ten years, 22 children are 11 years, and 23 children are 12 years. The average age of study subjects is 10.89 years $\pm$ 0.84.
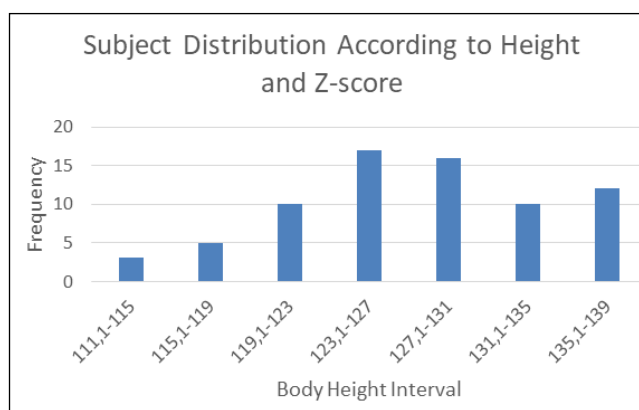

Figure 2. Subject Distribution According to Height and Z-score.

Based on figure 2, regarding the distribution of subjects based on height, The average height of the male group is 127.31 cm $\pm$ 6.76 cm, and the female group is 128.54 $\pm$ 6.26. The maximum and minimum height in the male group is 137.5 cm and 111.1 respectively. The highest height in the female group is 140.5 cm, and the shortest is 117 cm.

Figure 3 shows the subject's characteristics based on the z-score; in the female group, 24 children obtained SD<-2 and 4 children with SD<-3. Meanwhile, in the male group, 37 children showed z-score < -2 and 11 children < -3.
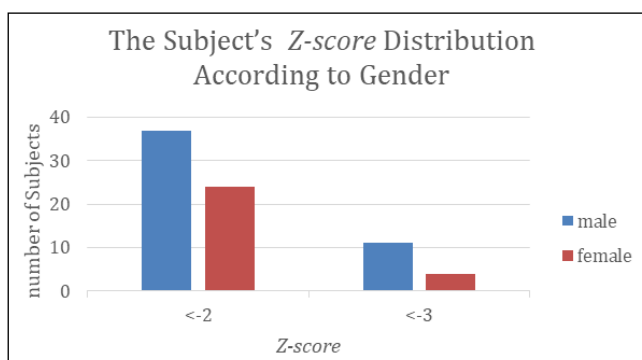
Figure 3. The Subject's *Z-score* Distribution According to Gender.

Index Score	Min	Max	Mean	SD
Debris	0,667	3,00	2,20	0,535
Calculus	0,333	2,667	1,30	0,38
OHI-S	1,00	5,667	3,50	0,823

Table 1. The Score of The Debris Index, The Calculus Index and The Simplified Oral Hygiene Index (OHI-S) in Stunted Children**.**

Based on the table above, it can be seen that the average debris index score in stunted children is 2.20 ± 0.535, with the highest and lowest debris index score being 3.00 and 0.667, respectively. Meanwhile, the average calculus index in stunted children is 1.30 ± 0.38. The highest calculus index score is 2.667, while the lowest is 0.333. The debris index and calculus index scores were summed to obtain the OHI-S score. Stunted children's average OHI-S score is 3.50 ± 0.823, with the highest and lowest score being 5.667 and 1.00, respectively. The OHI-S percentage is illustrated in the diagram below.
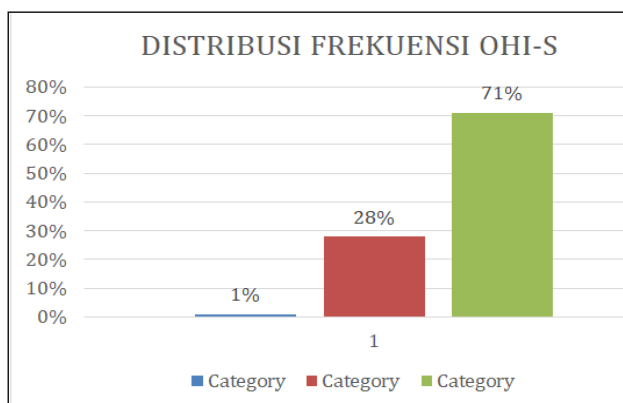

Figure 4. The OHI-S in Stunted Children.

Overall, it can be seen that the OHI-S score of 71% of subjects is poor, and 28% is moderate; meanwhile, only 1% of stunted children obtain a good score.
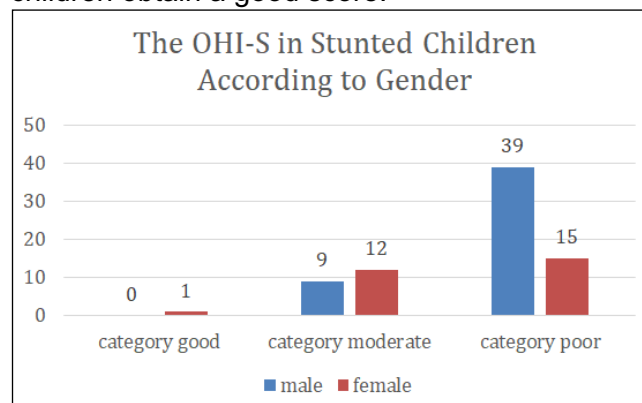

Figure 5. The OHI-S in Stunted Children According to Gender.

Based on Figure 4, most subjects with good OHI-S score are female, while male dominates the poor OHI-S.

Discussion

The results showed that most of the research subjects were male children representing 48 persons, followed by female children, accounting for 28 persons. This study's results align with research conducted by Mishu et al. in 2016, which showed that the average prevalence of stunting was higher in males compared to females in 15 out of 18 studies. In pooled analyses, stunting in male children was still more significant than in female children by the 95% confidence interval[17]. Research by Setyawati in 2018 also showed that the problem of stunting was more common in boys. The study was conducted on 444 subjects, 65 males and 50 females were stunted, and the rest were average and tall children. The cause is that males' gross motor development is faster and more varied, so they need more energy[18].

This study found that out of 76 stunted children (71%) had poor OHI-S, 25 children (28%) had moderate OHI-S, and one child (1%) had good OHI-S. The results of this study stated that the most stunted children were males, namely 48 children (63%. This present study is in line with research by Lestari et al. in 2014, which stated that stunting was most common in boys at 50.9% [19]. Another similar topic study by Damayanti et al. (2017) found that stunting

mainly occurs in boys (25%) compared to girls (22.6%)[18]. Gender determines a person's nutritional needs, so there is a relationship between nutritional status and gender. Nutritional needs are influenced by differences in male and female body composition[19]. The female body has more fat tissue than muscle, while the male body obtains the opposite. Metabolically, muscle is more active than fat, so muscle requires more energy than fat. It can be concluded that men and women of the same height and age have different body compositions, so their energy and nutritional needs will also be different[20].

The OHI-S assessment was obtained from the accumulation of debris and calculus scores found on the surface of the child's teeth. Castaneda Alvarado et al. stated that acute or chronic malnutrition is associated with poor oral health conditions, measured through various indicators such as poor oral hygiene and dental bacterial plaque. In line with the study of Vargas et al., found a high percentage of bacterial plaque in children with poor oral hygiene[21]. The destructive effect of microbes on the plaque in the tooth structure and the undeniable role of brushing in mechanical plaque removal means that brushing should be started from an early age [12,22].

Tooth brushing is one of the behaviours to maintain oral hygiene, which should be started from childhood[12,22]. According to research by Mahmoodi et al., 2014, it was stated that the tooth brushing ability in children is related to children's motor skills[12]. This study was also supported by research by Pantaleon et al. in 2016 found that stunted children have lower motor development by 22% compared to normal children by 2%[23]. Hanani and Syauqy's research in 2016 showed differences in development in stunted and normal children, which included gross and fine motor development with a p<0.05. Low motor skills in stunted children are caused by delayed formation and maturation of muscles so that the mechanical abilities of the muscles are reduced[13]. It can be concluded that children with better motor development skills can brush their teeth efficiently[12].

Another study found that stunted children with malnutrition were accompanied by poor hygiene oral[21]. Undernutrition is related to salivary gland hypofunction; thus, it leads to poor oral hygiene[10]. Salivary gland hypofunction can cause a decrease in the flow rate of saliva, interfering with the function of saliva as a buffer and oral cleanser[24]. In stunted children, the salivary glands experience atrophy which will interfere with the function of saliva in the oral cavity[7]. Saliva is essential in maintaining the oral cavity's health and functions[25]. Saliva is an oral cleanser fluid that protects the tissues in the oral cavity by cleaning it mechanically to reduce plaque accumulation and as a buffer. The protective function of saliva can play a role in cleaning the tooth surface, one of which is from bacteria that accumulate in plaque and debris[7].

A decrease in salivary flow rate is associated with a deficiency of protein and vitamin A. Findings in a study said that malnourished children had lower average values of protein and vitamins (A, C, and E)[7]. Another consequence of protein and vitamin A deficiency can reduce the saliva buffering capacity of plaque-derived acids[27]. The buffer capacity of saliva is the ability to neutralize the acidic pH in the oral cavity, thereby inhibiting the growth of microorganisms[28].

Conclusions

Based on the results of this study, it can be concluded that stunting can affect the OHI-S index. In stunted children, the salivary glands experience atrophy which will interfere with the function of saliva in the oral cavity. This condition can reduce the function of saliva as an oral cleansing fluid to protect the tissues in the oral cavity by cleaning it mechanically to reduce plaque accumulation and as a buffer.

Acknowledgements

Declaration of Interest

The authors report no conflict of interest.

References

1. de Onis M, Branca, F. Childhood stunting: A global perspective. Maternal and Child Nutrition. 2016; 12: 12–26.

2. Prendergast AJ, Humphrey JH. The Stunting Syndrome in Developing Countries. Paediatrics and International Child Health 2014; 34(4): 250–265.
3. Hutasoit M. Status of Exclusive Breastfeeding in Stunting Toddlers. Journal Center of Research Publication in Midwifery and Nursing 2019 ;3(2): 16–22.
4. Apriluana, Gladys, Fikawati, S. Analysis of Risk Factors for Stunting in Toddlers (0-59 Months) in Developing Countries and Southeast Asia. Health Research And Development Media 2018; 28(4): 247–256.
5. Rahman T, Adhani R., Triawanti. Correlation between Short Nutritional Status (Stunting) with Levels of Dental Caries. Journal of Dentistry 2016; I(1): 88–93.
6. Aviva NN, Pangemanan DH, Anindita PS. Description of Primary Tooth Caries in Stunted Children in Indonesia. E-GiGi 2020; 8(2): 73–78
7. Radhi NJ. Salivary Vitamins and Total Proteins, in Relation to Caries Experience and Gingival Health, According to Nutritional Status of A Group of Five-Year Old Children. Journal of Baghdad College of Dentistry 2012; 24(3): 129–136.
8. Sheetal A, Hiremath VK, Patil AG, Sajjansetty S, Sheetal KR. (2013). Malnutrition and Its Oral Outcome - A review. Journal of Clinical and Diagnostic Research 2013; 7(1): 178–180
9. Kridaningrat BB, Soegyanto AI, Wimardhani YS. Correlation of Oral Health Literacy with Demographic Factors and Oral Hygiene Among the Elderly. Journal of International Dental and Medical Research 2017; 10 (Special Issue): 460-464
10. Delgado-Angulo EK, Hobdell MH, Bernabé E. Childhood Stunting and Caries Increment in Permanent Teeth: A Three and A Half Year Longitudinal Study in Peru. International Journal of Paediatric Dentistry 2013: 23(2); 101–109.
11. Sasea A, Lampus BS, Supit A. Description of Oral Hygiene Status and Gingival Status in College Students with Crowded Teeth. E-DENTAL 2013; 1(1): 52–58.
12. Mahmoodi P, Salimi P, Ashtiyani RD, Valaii N, et al. Assessment of Fine Motor Skills and Tooth Brushing Skills in 5-6 Year Olds in Tehran. Restorative Dental Science 2014, 11(3), 176–181.
13. Solihin RDM, Anwar F, Sukandar D.. The Relationship between Nutritional Status, Cognitive Development, and Motor Development in Preschool Children. Nutrition and Food Research 2013; 36(1): 62-72.
14. Das G, Paiva M., Souza TOL, et al. Stunting Delays Maturation of Triceps Surae Mechanical Properties and Motor Performance in Prepubertal Children. European Journal of Applied Physiology 2012; 112(12): 4053–4061.
15. Mishu AA, Uddin MA, Sarkar DC, et al. a Meta-Analysis of Gender and Socio Economic Factors Associated With Stunting in Pre-School Children. Journal of Science and Technology2016; 6 (December): 125–136.
16. Setyawati VAV. Study of Stunting Based on Age and Gender in Semarang City. The 7th University Research Colloquium 2018; 834–838.
17. Lestari W, Margawati A, Rahfiludin, Z. Risk Factors for Stunting in Children Aged 6-24 Months in Penanggalan District, Subulussalam City, Aceh Province. Indonesian Journal of Nutrition 2014; 3(1): 37-45.
18. Damayanti RA, Muniroh L, Farapti, F. Differences in Levels of Adequacy of Nutrients and History of Exclusive Breastfeeding in Stunting and Non-Stunting Toddlers. Indonesian Nutrition Media 2017; 11(1): 61.
19. Angelina FC, Humairoh, Aji Perdana A. Factors in the incidence of stunting in toddlers aged 6-23 months in Lampung province. Journal of Public Health 2018, 7(3), 212–214.
20. Almatsier, S. Basic Principles of Nutrition Science. 9th ed. Jakarta. Main Library Gramedia; 2019: 98-101.
21. Vargas PKE, Chipana HCR, Arriola GLE. Oral Health and Oral Hygiene Conditions and Nutritional Status in Children Attending a Health Facility in The Huanuco Region, Peru. Rev Peru Med Exp Salud Publica 2020; 36(4): 653–657.
22. McTigue DJ, Nowak AJ, Fields HW, et al. Pediatric Dentistry: Infancy Through Adolescence. Elsevier. 2013; 214 (11): 648.
23. Pantaleon MG, Hadi H, Gamayanti IL. Stunting Related to Children's Motoric Development in Sedayu District, Bantul, Yogyakarta. Indonesian Journal of Nutrition and Dietetics (Indonesian Journal of Nutrition and Dietetics) 2016; 3(1): 10.
24. Achmad H, Marhama FS, Shinta A, Sri R, Hendrastuti H, Sumintarti. Analysis of Ascorbic Acid in Gingival Handling of children's Mouth cavity. Indian Journal of Public Health Research & Development 2019; 10(5):610-615.
25. Sruthi KS, Yashoda R, Manjunath P. Association Between Oral Health Status and Salivary Flow Rate among Individuals With and Without Burning Mouth : A Case-Control Study. Journal Od Indian Association of Public Health Dentistry 2020; 18(1): 47–53.
26. Palancoi, NA. The Relationship between Knowledge and the Environment with the Incidence of Acute Diarrhea in Children in the Pabbundukang Village, Pangkajene District, Pangkep Regency. Journal of Health 2014; 7(2): 346-352.
27. Samnieng P, Ueno M, Shinada K, et al. Association of Hyposalivation with Oral Function, Nutrition and Oral Health in Community-Dwelling Elderly Thai. Community Dental Health 2012; 29(1): 117—123.