ORIGINAL RESEARCH

The Oral Health Status and Anthropometric Measurements of Children at Early Childhood Development Centers in an Informal Settlement in Pretoria, South Africa

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Abstract

Objectives: Early childhood caries (ECC) continue to increase, especially among low socioeconomic communities. This study was conducted in an informal settlement comprising mostly foreigners who have settled in the area. Given the limited dental and medical services available to these communities, this study aimed to determine the dental and medical disease profile of these inhabitants. The objective was to determine the oral health status and the body mass index (BMI) of children attending crèches in an informal settlement.

Materials and methods: Oral health data, including dental caries (DC), soft tissue lesions, fluorosis, erosion, and trauma, were recorded using the World Health Organization (WHO) recommended methods. The examiners were calibrated, and all examinations took place at the crèches under natural sunlight. The BMI was calculated by a team of dieticians who were blinded to the oral health status. The height and weight were measured by calibrated examiners under standardized conditions.

Results: There were a total of 169 participants; the mean age was 4.02 years (±1.13; 1–7) and there was an equal distribution of males and females (49.7% females and 49.3% males). The prevalence of DC was 39.1%, with 19% having 4 or more carious teeth. The mean decayed, missing, and filled teeth (dmft) and plaque scores [Simplified Oral Hygiene Index (OHI-S)] were 1.58 (±2.70) and 0.65 (±0.43), respectively, and the mean dmft score increased with increasing age. The mean *d* component contributed 99% of the total mean dmft score (1.56). The mean BMI was 15.44, and this decreased significantly ($p = 0.009$) while the OHI increased significantly ($p < 0.001$) as the number of carious teeth increased.

Conclusion: The prevalence of caries was relatively high, and those with caries had multiple decayed teeth. The *d* component contributed almost 100% to the mean score, indicating a lack of access to dental care. The mean BMI score was inversely proportional to the number of carious teeth, which could imply that those with caries had difficulty eating.

Keywords: Body mass index, Dental caries.

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Introduction

Oral diseases, and dental caries (DC) in particular, have increased worldwide and continue to pose challenges to public health.[1,2] DC is one of the most common childhood diseases globally, affecting up to 70% of children from disadvantaged communities and developed countries.[3,4] DC is caused by multifactorial agents, including bacteria, poor diet (including sugar and refined carbohydrates), and poor oral hygiene.[5] Early childhood caries (ECC) is a term used for caries in children between the ages of 3 and 5 years and is a major public health concern, with 8% of children globally affected by untreated ECC.[6] Its consequences include both long- and short-term effects such as pain, loss of appetite, loss of school days, and if untreated, a generally poorer quality of life (QOL).[3,7] Studies have shown that children who develop DC as a child are more likely to develop DC as a teenager and adult and hence prevention of DC is essential for the wellbeing of children.[3,4]

Food security is also a major concern within this population, and anecdotal evidence from this site revealed poor nutritional habits and dietary intake. To date, no study has been done to determine the body mass index (BMI) of children in the area. As a result, there is no published evidence that can be used to initiate nutritional programs for the children of the area. Limited studies from around South Africa have reported that although the majority of young children are within the normal weight-to-height category, there are many who are either underweight or overweight.[8–10]

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Melusi is an informal settlement situated in Pretoria West and has limited access to oral health services. The University of Pretoria together with relevant stakeholders, is planning to introduce preventive and curative dental services to this community. Therefore, a situational analysis was conducted to determine the oral health status and anthropometric scores of this community. The results from this project will assist in identifying oral health needs and in planning appropriate and relevant oral health services. This study forms part of a larger community-based study

involving multiple departments from the University of Pretoria. The Melusi informal settlement has been identified as a pilot site where students from other departments, such as Physiotherapy, Occupational Therapy, Human Nutrition, and Medicine, provide health services. The School of Dentistry is collaborating with these departments to develop a database, obtain baseline data, and plan for the provision of necessary services to ensure this community receives the relevant services required.

The aim was to determine and correlate the oral health status and anthropometric measurements of children attending Early Childhood Development Centers (ECDCs) (3–6 years old) in the Melusi informal settlement, Pretoria, South Africa.

Materials and Methods

A quantitative cross-sectional analytical study design was used. All children aged between 3 and 6 years attending the ECDCs in the Melusi informal settlement, Pretoria, were included. There were 240 children registered at these ECDCs, and all children between 3 and 6 years old were invited to participate. The inclusion criteria encompassed all children registered at the ECDCs in 2021, aged between 3 and 6 years. Exclusion criteria included those who did not provide consent, were absent on the days of clinical examinations or were outside the specified age range. A minimum sample size of 148 was required to ensure a 95% confidence interval and a 5% margin of error.[11]

The data collection consisted of oral and anthropometric examinations. The clinical oral examinations were conducted in the ECDCs under fluorescent lighting, with the participant sitting on a school chair, following the World Health Organization (WHO) criteria.[12] The decayed, missing, and filled teeth (dmft) index was used to record the caries status of the primary dentition only. The permanent dentition was excluded. Only teeth with cavitated caries were diagnosed as decayed. The pufa index, which records the presence of severely decayed teeth with visible pulpal involvement (p), ulceration caused by dislocated tooth fragments (u), fistula (f), and abscess (a) was used to measure the severity of dental caries.[13] Decayed teeth were classified as "p" if there was a visible pulp present, "u" if there was ulceration of the oral mucosa due to root fragments, "f" for a fistula, and "a" for an abscess. Soft tissue lesions from the surrounding tissues that were not related to a tooth or caries were recorded under the soft tissue lesions criteria discussed below. Only one score was assigned per decayed tooth.

The prevalence and severity of dental erosion were measured using the basic erosive wear examination index (BEWE).[14] Dental fluorosis was recorded using the Dean's index. This index, used by the WHO, remains the gold standard for diagnosing fluorosis in epidemiological studies.[15] Oral lesions not associated with dental caries were identified and recorded according to the WHO classification.[16] The plaque was recorded using the Simplified Oral Hygiene Index (OHI-S).[17] In order to achieve an acceptable level of reliability, two examiners were calibrated by the Department of Community Dentistry to record the caries status, fluorosis, and erosion. Calibration included the use of slides, photographs, and mounted extracted teeth. κ scores were calculated, with scores ranging between 0.80 and 0.85 for intra- and interexaminer reliability, respectively. Additionally, every 10th learner was reexamined to ensure intra- and interexaminer reliability.

The anthropometric status was measured during the same period as the dental data collection. Trained community health workers and human nutrition dietetic students employed at the University of Pretoria completed the anthropometric measurements according to standard guidelines.[18,19] The data were collected according to standard measurement guidelines, using calibrated scales and stadiometers. The BMI was calculated and classified into underweight, normal weight, overweight, and obese using the WHO guidelines.[18]

The data was captured using Microsoft Excel and imported into Statistical Package for the Social Sciences version 28 for analysis. Descriptive statistics including percentages, means, and standard deviations were calculated. Inferential tests, such as the Chi-squared test, were used to test for significance between categorical data. Associations between continuous data were analyzed using the Kruskal–Wallis test or the one-way analysis of variance (ANOVA) test. Anthropometric data were analyzed using the WHO programs Anthro and Epi info.

The protocol was submitted to the Research Committee at the School of Dentistry (RESCOM) and subsequently to the Research Ethics Committee of the Faculty of Health Sciences for approval. Teachers were instructed to send consent forms with the children to their parents for written consent. Permission to conduct the study was also obtained from the ECDC owners. Participants requiring dental treatment were referred for appropriate care.

All children received a toothbrush, toothpaste, and oral hygiene instructions once the screening was completed.

Results

There were a total of 169 participants who provided consent and were available on the day of the examinations out of the planned 240 sample size (70%). The mean age was 4.02 years (±1.13; 1–7) and there was an equal distribution of males and females (49.7% females and 49.3% males). The overall prevalence of DC was 39% (males 41% and females 37%) with 19% (32) of all children examined having four or more carious teeth. The mean dmft was 1.58 (±2.70) and the mean dmft score increased significantly with increasing age ($p = 0.01$). There was no significant association between the plaque scores and gender ($p = 0.30$) and age ($p = 0.46$). The mean *d* component contributed 99% of the total mean dmft score (Table 1).

Table 1: Caries and plaque status according to gender and age

	d	*m*	*f*	*dmft*	*p-value**	*plaque*	*p-value**
Males (*n* = 83)	1.36	0.02	0	1.39 ± 2.29	0.39	0.69	0.30
Females (*n* = 84)	1.73	0.02	0	1.75 ± 3.06		0.61	
3 (*n* = 59)	0.76	0.0	0	0.76 ± 2.03	0.01	0.68 ± 0.40	0.46
4 (*n* = 53)	1.58	0.02	0	1.60 ± 2.76		0.56 ± 0.34	
5 (*n* = 44)	2.41	0.02	0	2.43 ± 3.14		0.72 ± 0.56	
6 (*n* = 13)	2.15	0.15	0	2.31 ± 2.75		0.64 ± 0.26	
Total	1.56	0.02	0	1.58 ± 2.70		0.65 ± 0.43	

*ANOVA test

Table 2: Body mass index categories according to plaque and caries status

BMI categories	*N (%)*	*Plaque*	*p-value*	*dmft*	*p-value*
Underweight	23 (19)	0.54	0.53	1.78	0.17
Normal weight	78 (66)	0.69		1.85	
Overweight	11 (9)	0.62		0.0	
Obese	7 (6)	0.54		1.00	
	119	0.64		1.61	

The mean OHI score was 0.65 which indicated that of those who were examined, an average of 65% of their teeth had plaque covering one or more surfaces. There was no significant relationship between the plaque score and the age ($p = 0.46$)

There was a significant positive correlation ($r = 0.312$, $p < 0.01$) between the mean plaque scores and the mean dmft scores. This meant that the participants with more plaque tended to have more DC.

None of the participants had any abscesses or fistulas or ulcers, two had erosion, three showed signs of trauma on the anterior teeth; two had oral ulcers not associated with dental caries, and one had dental fluorosis. The pufa score was 0 as none of the participants had any lesions related to caries.

The majority (66%) of participants were classified in the normal weight category and 19% in the underweight category. There was no statistical significance when comparing the BMI to the plaque ($p = 0.53$) and caries ($p = 0.17$) scores. The normal weight cohort had the highest mean plaque (0.69) and dmft (1.85) scores (Table 2).

The mean BMI was 15.34 (±1.54) and there was a significant negative correlation ($r = -0.187$, $p = 0.042$) between the mean BMI scores and the mean dmft scores. This meant that those with higher mean BMI scores tended to have less DC compared to those with a lower BMI score. There was no significant correlation between the BMI and plaque scores ($r = 0.01$, $p = 0.92$).

Discussion

Not all children participated in the study; some did not provide consent, while others were absent on the day of the examination. A minimum of 148 respondents were required to ensure a generalizable sample, and this requirement was met. There were equal numbers of males and females in the study. The DC prevalence was 39% and this was considerably lower than other similar studies done in South Africa. The South African National Oral Health Survey done in 2002 reported the national prevalence of DC to be 60% among 6 year olds while two other cross sectional studies reported a prevalence of 49% respectively.[20–22] The reduction in caries prevalence over time could be attributed to improved oral health education, increased access to services, and enhanced school-based programs.

The mean dmft in the current study was 1.58, which was lower than the 2.49 and 2.24 reported in other similar local studies.[21,22] This meant that, on average, every child had almost two primary teeth that were either decayed, filled, or missing as a result of DC. The *d* component contributed >95% to the overall mean dmft score, indicating that the majority of decayed teeth were untreated. This could be attributed to factors such as a lack of dental services, insufficient knowledge, or fear of dental care. Although many participants had DC, the caries were not severe enough to have resulted in any abscesses, fistulas, or pulpal exposures.

Anthropometry is the most commonly used approach for assessing nutritional needs among children.[18] Although two-thirds of the children fell into the normal BMI category, 19% were underweight. These results were similar to other studies that reported 64% of the sample in the normal BMI category and 17% in the underweight category.[8]

The number of overweight and obese children was 9% and 6%, respectively. This prevalence was much lower than in other studies, which reported overweight and obese rates of 22% and 24%, respectively, and 16% overweight, respectively.[8,9] The lower prevalence of overweight and obese children could be attributed to several factors, including the fact that these children were from an informal settlement with a very low socioeconomic status. This could lead to reduced access to a variety and volume of foods consumed, thereby reducing the prevalence of overweight and obesity.

A study in Limpopo reported that 29% of children under 3 years were underweight, which was much higher than the 17% reported in the current study.[10] This difference could be due to the setting, as the study in Limpopo was conducted at a hospital rather than a crèche or school. A sample drawn from a healthcare institution would naturally have a higher prevalence of underweight children, as these facilities primarily serve ill patients. However, it remains a concern that 19% of the participants in the current study are underweight.

There was a significant negative correlation between the mean BMI scores and the mean dmft scores, indicating that those with higher mean BMI scores tended to have fewer DC compared to those with lower BMI scores. This finding was similar to another study and could be attributed to the possibility that undernourished individuals did not receive sufficient nutrients like calcium and fluoride, potentially contributing to an increase in caries.[23] However, some studies have shown that children with a high BMI tended to have more caries. This could be attributed to factors such as diet, socioeconomic status, and dental hygiene practices, all of which play a role in dental caries. As a result, different studies have yielded contradictory results on this relationship.[24] Many of the studies were carried out on different ages and this has led to a difference in results among researchers as reported in a systematic review.[25]

There was no significant correlation between the BMI and plaque scores ($r = 0.01$, $p = 0.92$).

There was a significant positive correlation ($r = 0.312$, $p < 0.01$) between the mean plaque scores and the mean dmft scores. This meant that the participants with more plaque tended to have more DC.

Recommendations

The high prevalence of DC which was untreated is a concern. It is recommended that additional dental services be provided by establishing portable or permanent oral healthcare facilities in the area.

It is also suggested that the government introduce feeding schemes in this area to address the malnutrition of these children.

Conclusion

The prevalence of DC was relatively high and those with caries had multiple decayed teeth. The decayed component was very high which could indicate a lack of access to dental care, poor oral hygiene, and dental knowledge. Although the majority of children were in the normal weight category, there were a number

of children who were under and overweight. There was a positive correlation between caries and plaque and an inverse correlation between BMI and caries.

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