



Study to Estimate Prevalence of Dental Caries and Determine its Association with Body Composition amongst School Going Children of Jodhpur (India)

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ABSTRACT

Introduction: Dental caries is the most prevalent NCD in the world. It is especially important in younger children due to erupting dentition and limited oral hygiene practices. It not only has short term morbidity but has long term outcomes and lifelong impact on dentition and quality of life. Several studies have been done across the globe to find prevalence of caries and its association with BMI, socioeconomic factors, oral hygiene practices etc. Very rarely any study is found determining any association with variables of body composition. The main objective of this study is to find prevalence of dental caries in school children of Jodhpur city and determine its association with body composition.

Methods: A cross sectional (descriptive and analytical) study was designed according to STROBE statement guidelines. The study draws a random sample from population of school going children of Jodhpur at an age 6 years. The oral examinations and measurements of body composition were done. Data collected was stored and analyzed using PSPP software.

Results: Out of a sample of 299 children the overall prevalence of dental caries was 74.24% (75.17% females and 73.38 % of male children were suffering with dental caries). The mean dmft score was 1.39 (95% confidence interval were 1.26 and 1.53) for the whole sample. The females had a mean dmft score of 1.31(95% confidence interval were 1.14 and 1.49) and males had a mean score of 1.47 (95% confidence interval were 1.28 and 1.67). A significant association between caries experience/dmft score and body composition variables was revealed using multivariate analysis ($p < 0.05$), especially with Bone mass, BMI and body fat.

Discussion: Dental caries seems to be very prevalent in Jodhpur city at young age, in both genders. Its association with body composition clearly displays its relation with nutritional status and overall health and somatic growth of child. This association will pave path for future researches in the field and help in policy making.

Limitations: Cross sectional studies lack temporality. Association of variables does not infer causality.

Keywords: COVID-19, Flight attendants, Knowledge, Observational study, Pandemic

Abbreviations: WHO (world health organization); NCD (Non Communicable disease); STROBE (Strengthening the Reporting of Observational Studies in Epidemiology); IRB (Institutional review board); BMI (Body mass index); BIA (Bioelectrical impedance analysis/ Bioimpedance analysis)

INTRODUCTION

Oral health is a key indicator of overall health. WHO defines oral health as “a state of being free from chronic mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual’s capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing?” Oral diseases are the most common non-communicable diseases (NCDs) and they affect half of populations throughout ages, causing morbidity in the form of pain & discomfort. Seven oral diseases and conditions account for most of the oral disease burden, like dental caries (tooth decay), periodontal (gum) diseases, oral cancers, oral manifestations of HIV, oral-dental trauma, cleft lip and palate, and noma. Almost all are preventable & can be treated in their early stages [1,2].

Dental caries in kids

Dental caries is one of the most known diseases and suffered by the masses. It is especially infamous by the associated pain, morbidity, and with intake of sweet food. The human race has been blessed with two sets of dentition (the deciduous and the permanent). It is particularly important to study dental caries occurrence in deciduous dentition due to several reasons:

1. The development of dental caries in deciduous teeth leads to altered eruption of permanent successors
2. Due to lack of dexterity the children are unable to maintain oral hygiene properly. Thus they tend to develop caries more often.
3. Frequent snacking, more intake of sweet and sticky food makes them more prone to dental caries.
4. Development of dental caries at an early age leads to pain and morbidity which hampers mastication, which subsequently causes reduced nutrition and thus overall somatic growth is retarded.
5. The small size, thin and less mineralized enamel and dentin of deciduous teeth makes them vulnerable to caries development and faster penetration of caries into the deeper tissues of teeth, thus causing pain and infection of associated tissues.
6. Once they develop caries and its complications, it is more difficult to treat children, because they are uncooperative, afraid and their parents are anxious too.
7. If children develop dental caries and its complications at an early age, they may require antibiotics for infection control, which when used multiple times is against the goals of antibiotic stewardship initiatives.

Etiology and associated factors

Dental caries results when microbial biofilm (plaque) formed on the tooth surface converts the free sugars contained in foods and drinks into acids that dissolve tooth enamel and dentine over time. With continued high intake of free sugars, inadequate exposure to fluoride and without regular microbial biofilm removable, tooth structures are destroyed, resulting in development of cavities and pain, impacts on oral-health-related quality of life, and, in the advanced stage, tooth loss and systemic infection [3].

Oral health inequalities are caused by a broad range of interacting biological, socio-behavioral, psychosocial, societal and political factors that create ‘the conditions in which people are born, grow, live, work, and age’ – the so-called social determinants [4].

Association of Dental caries with factors of somatic growth of body (i.e. body mass for age, height for age and BMI):

The results of various studies demonstrated that children growth indicated by weight-for-age and height-for-age was inversely associated with dental caries. Earlier studies in developing countries reported similar negative correlations between anthropometric measures and the number of untreated carious surfaces and caries experience of the children. Meta-analysis suggests that overweight and obese preschool children are at greater risk of having early childhood caries. Also it is demonstrated that a significant association exists between caries frequency with high body mass index. For these reasons, the evaluation of nutritional status in students should be implemented in control programs for dental caries both on the community, schools, and individual levels [5,6].

Dental caries and Socio-economic factors

Studies have identified socio-economic and behavioral determinants for dental caries in primary and permanent dentition on Indian schoolchildren. One of the studies intended to find the prevalence of nursing caries in Davangere preschool children and its relationship with feeding practices and socioeconomic status of the family. This revealed that duration of breastfeeding increases the number of children with nursing caries and the mean DFS. Nursing caries were more in children who were taking a feeding bottle to bed at night and were increasingly seen in large families and lower socioeconomic groups. A significant association was found between the history of bottle-feeding and ECC. Prevalence of ECC was more among those who were bottle-fed than those who were not bottle-fed [7,8].

The presence and severity of dental caries in children is affected by several factors (and their complex interactions) few of which are summarized below:

1. **Factors of somatic growth of the body (like BMI, height and weight for age, MUAC etc):** The studies although with varying results somewhere indicate that better the growth of the body, less are the chances and severity of dental caries in early childhood. These factors are also the indicators of their nutritional status.
2. **Socio-economic status:** The children with lower socio-economic status are vulnerable to caries.
3. **Feeding habits / bottle feeding/ breast feeding/ sugar intake:** Unrestricted feeding, nocturnal feeding, more sugar intake etc have delirious effects on dental health.
4. **Oral hygiene habits:** Better oral hygiene practices is associated with better dental health
5. **Parental educational level/awareness:** More awareness of parents is associated with better dental health.

Gap in the literature

1. Several studies have been done with potential confounders like age, which when not controlled leads to spurious associations
2. Very few studies found in western part of Rajasthan (India) and Jodhpur city.
3. Rarely any study found which tries to find any association between severity/presence of dental caries and factors body composition variables.

Salient features of the current study and its rationale

1. The study is being done in Jodhpur city, where few such have been done in past. Jodhpur is the second largest city of Rajasthan (which is largest state of India in terms of surface area).
2. The study will be describing the burden of disease (descriptive part) and also analyzing the association of dental caries with variables of body composition. The variables of body composition indicate the somatic growth and nutritional status of the body.
3. The potential confounders like age, gender and past illness were controlled.

Objectives of study

The study aims to achieve following objectives:

Primary Objectives: Estimate the prevalence and severity of dental caries, amongst school going children, of 6 years age of Jodhpur city

Secondary objectives: Determine the possible association of presence/severity of dental caries with variables of body composition.

METHODOLOGY

Study Design: The following details summarize the various aspects of this study:

1. **Type of study:** The research study design conducted was a cross-sectional study design (Quantitative) with both descriptive as well as analytical aspects. Thus the exposure and outcome variables were measured at the same time.
2. **Guidelines followed:** STROBE statement
3. **Research population:** School going children of 6 years age, of Jodhpur city
4. **Inclusion criteria:**
 - School going children of age 72 months to 83 months (i.e. 6 old) of Jodhpur city.
5. **Exclusion criteria:**
 - Those kids whose parents don't give consent for examination.
 - Those who have any past history of significant illness/treatment/trauma of OroFacial region
 - Uncooperative children
 - Those children who do not brush at all.
6. **Duration of the study:** January 2020 to march 2020

Sample size determination

Minimum Sample size determination for descriptive statistics: The sample size was calculated using Formula

Sample size n =

$$n = \frac{[DEFF \times Np(1-p)]}{\left[d^2 / Z^2_{1-\alpha/2} \times (N-1) + p \times (1-p) \right]}$$

Software Used: OpenEpi, Version 3, open source calculator—SSPropor

Here d is margin of error (6%), confidence interval 95%, hypothesized caries prevalence as 69.1% (published in a systematic review research) Thus minimum sample size as estimated to be 229 [9].

Minimum Sample size determination for analytical statistics:

Software Used: G*Power version 3.1.9.4

Thus sample size was calculated using 95% confidence interval, 0.05 significance level, and 0.95 power, number of predictors 5 and 0.15 effect size for running multiple linear regressions. This resulted into a minimum sample size of 138 (with actual power as 0.9507643) [10].

F tests- Linear multiple regression: Fixed model, R² deviation from zero

Analysis: A priori: Compute required sample size

Input:	Effect size f ²	=	0.15
	α err prob	=	0.05
	Power (1-β err prob)	=	0.95
	Number of predictors	=	5
Output:	Noncentrality parameter λ	=	20.7000000
	Critical F	=	2.2828562
	Numerator df	=	5
	Denominator df	=	132
	Total sample size	=	138
	Actual power	=	0.9507643

Thus taking the above two methods in consideration, the sample of 299 participants was studied, which is greater than both the above calculated values. Out of which 154 participants were males and 145 females.

Sampling technique

Random sampling technique was used to obtain a sample for study. The ward for study was selected by table of random numbers. Then a list of schools present in the said ward was prepared using internet sources and manual inspection. Then the schools for study were again selected using table of random numbers. Software used was OpenEpi.com for generating table of random numbers [11,12].

Study participants

The study participants were school going children of age 6 years age (i.e. between 72 to 83 months age). The schools as per table of random number were approached and their principals were asked for relevant consent. Also principals were asked to inform parents of the children, for permission, regarding study. The study participants were included as per the inclusion and exclusion criteria. The parents were asked for consent for child's examination (Oral examination, anthropometric measurements and body composition recording). Also parents were asked regarding oral hygiene practices of kid, past illness, hospitalization etc relevant history, to help us in including/excluding study participants as per our criteria. The school records were used to check kids' date of birth, for age determination.

Data collection

The relevant data for study was collected according to following methods:

Oral Examination: Oral examination was done using sterile mouth mirror, probe, disposable tongue retractors and other personal protective equipment's. The method used for oral examination was as prescribed by W.H.O.; all examinations were conducted by a single observer, who was a licensed and qualified dentist. Oral examination was done in natural light and using high intensity torch light, on an ordinary chair. The dmft index was used for recording status of dental caries, as prescribed by W.H.O [13].

The eruption status of FPM was recorded as erupted if any of its parts emerged through the gingiva. In case of doubt, the area was dried with cotton to confirm eruption.

Variables recorded:

- dmft= which is measurement variable

Anthropometric measurements: The height and weight of children were examined according to the WHO/UNICEF criteria. It was done in an upright position, with school uniform, but without shoes and socks. Instruments used for examination were height measuring machine, weight measuring machines.

Variables recorded:

- Height in Centimeters = measurement continuous variable
- Weight in Kilograms = measurement continuous variable

Body Composition analysis:

Body composition analysis was done using "Health Sense Scan-Pro Body Fat Monitor (Bf-425)", personal scale body composition analyzer.¹⁷ This method uses Bio-Electrical Impedance analysis for recording body composition variables.

Variables recorded: all measurement variables

- BMI
- Bone Mass
- Muscle mass
- Visceral Fat

- Body fat

Data quality control

The quality of data collected was assured by checking the reliability and validity of data recorded, as per following methods.

Reliability

The reliability of data recorded is checked and assured as below:

Inter-observer error: All observations were done by a single observer.

Intra-observer error: Ten observations per school were selected randomly, and repeated same participants, by the same observer to calculate intra-observer error. Then kappa statistics were used to calculate reliability of the tests. This resulted in a Cohen's Kappa value of 0.8, which is quite satisfactory.

Validity

The validity of measurement instruments was checked by comparing the readings with similar measuring instruments at other health care/research organizations. The readings were consistent when tested.

Ethical considerations

The following ethical considerations were followed in the study:

1. **Ethical committee clearance:** The ethical clearances were obtained from IRB of Maulana Azad University, Jodhpur.
2. **Vulnerable population:** the study participants of this study were children who are of minor age, thus parents consent was obtained before any observations.
3. **Confidentiality:** No personal identities were revealed in this study. Number codes were used rather than names.
4. **Informed consent:** Autonomy was maintained and parents and children were given full rights to choose, between participating or not in this study.
5. **Infection control:** All protocols of infection control were followed, using personal protective equipments like masks, caps, tongue retractors etc were used and sterile autoclaved instruments like mouth mirror and probe were used.
6. **Professional care:** All observations were done by a qualified licensed dentist, in the presence of atleast one female staff member of school, using non-invasive methods.

Bias involved and methods used to control them

1. **Selection bias:** The selection bias was controlled by using random selection of schools for study.
2. **Information bias:** The data regarding age of children was verified from school records.
3. **Confounders:** Various confounders like age, gender, history of past illness/trauma/hospitalizations etc were controlled by matching and restrictions techniques.
4. Co-variables were controlled by multivariate analysis.

RESULTS

The data obtained were stored and analysed using PSPP software²¹, as mentioned below:

Descriptive statistics

Prevalence of dental caries: Out of a sample of 299 children the number of females was 145 and males were 154. The overall prevalence of dental caries in children of 6 years of age was 74.24%. The gender wise prevalence of caries shows that 75.17% females and 73.38 % of male children were suffering with dental caries.

The dmft score of the sample: The dmft score (i.e. the decayed missing filled teeth index score) of the sample represents the severity of disease. The mean dmft score recorded was 1.39 (upper and lower limits at 95% confidence interval are 1.26 & 1.53) for the whole sample. The females had a mean dmft score of 1.31 (upper and lower limits at 95% confidence interval are 1.14 & 1.49) and males had a mean score of 1.47 (upper and lower limits at 95% confidence interval are 1.28 & 1.67).

Analytical statistics

The results of multiple linear regression revealed that the dmft score (which represents the severity of caries) increases with increase in values of BMI (p value=0.006<0.05) and Body Fat (p value=0.003<0.05); While the association of dmft scores with varying values of visceral fat (p value=0.243>0.05), muscle mass (0.044>0.05) and bone mass (p value=0.087>0.05) was statistically NOT significant, in females.

The results of multiple logistic regression revealed that the probability of caries experience is associated with varying values of bone mass (p value=0.044<0.05); While its association with varying values of visceral fat (p value=0.07>0.05), muscle mass (0.242>0.05), BMI (p value=0.182>0.05) and body fat (p value=0.881>0.05) was statistically NOT significant, in females.

The results of correlation analysis revealed that the values of dmft is significantly correlated with varying values of visceral fat (p value=0.006<0.05), muscle mass (p value=0.005<0.05), BMI (p value=0.000<0.05) and body fat (p value=0.001<0.05); While its association was statistically insignificant with varying values of Bone mass (p value=0.271>0.05), in females.

The results of multiple linear regression revealed that the dmft score (which represents the severity of caries) increases with increase in values of visceral fat (p value=0.039<0.05) BMI ((p value=0.002<0.05)) and Body Fat (p value=0.014<0.05); While the association of variation in dmft scores with varying values of muscle mass (0.155>0.05) and bone mass (p value=0.244>0.05) was statistically NOT significant, in males.

The results of multiple logistic regression revealed that the probability of caries experience is associated with varying values of bone mass (p value=0.019<0.05) and BMI (p value=0.005<0.05); While its association with varying values of visceral fat (p value=0.634>0.05), muscle mass (0.075>0.05), and body fat (p value=0.284>0.05) was statistically NOT significant, in males.

The results of correlation analysis revealed that the values of dmft is significantly correlated with varying values of visceral fat (p value=0.001<0.05), BMI (p value=0.000<0.05), muscle mass (p value=0.000<0.05), and body fat (p value=0.000<0.05); While its association was statistically insignificant with varying values of Bone mass (p value=0.082>0.05), in males [14,15].

DISCUSSION

The descriptive part of research reveals the fact that the caries prevalence is very high amongst the school going children of Jodhpur city. Both genders are significantly affected by the caries disease. The high prevalence of caries experience at a tender age of 6 years could result into future morbidities like malocclusion, facial growth, pain, infections, fear of dental treatments, compromised self-confidence, anxiety, speech abnormalities etc.

The results of various tests reveal the fact that the caries experience and its severity is associated with some or the other various factors of body composition/somatic growth of the body. Thus the growth of child (and his/her nutrition) is an important determinant of oral health. The significant association of body composition factors with the disease should be studied in future in order to reveal the unknown facts which could help prevent the disease by making nutritional interventions. They will help in making policies to promote oral health and also eventually reduce the burden of the disease on the society.

DECLARATIONS

Limitations of the study

Due to limited resources, funds, and time the study is limited by following limitations:

1. This is Cross sectional study which does not ensure temporality.
2. The association of two variables does not guarantee causality. This can only be assured in long term longitudinal studies.
3. Due to lack of resources the machines used in the study solve basic purpose and gives an approximate idea. More accurate measurement needs costly machines like MRI etc.

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Conflicts of Interest

There are no conflicts of interest

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