ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 4, Issue – 4, August - 2021, Page No. : 333 - 339

Association between nutritional status and malocclusion among government school going children Tamil Nadu-A Cross sectional study

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Citation of this Article: Dr. Lavanya P, "Association between nutritional status and malocclusion among government school going children Tamil Nadu-A Cross sectional study", IJDSIR- August - 2021, Vol. – 4, Issue - 4, P. No. 333 – 339.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: The understanding of the etiological factors causing malocclusion can help decrease its prevalence and the burden of treatment. This study was conducted to evaluate the association between some features of malocclusion and the nutritional status among 9-11 years old children.

Aim: The aim of this study was to evaluate the association between some features of malocclusion and the nutritional status among 9-11 years old children.

Materials and methods: It is a Cross-sectional analytical study. The examined variables were continuous variable (facial height, weight and height) and categorical variables (one segment and two segments cross bite, crowding and spacing open bite). Body Mass index (BMI) was used to estimate the nutritional status of the children.

Statistical analysis used: Results presented as proportion with p-value. Chi-square test was done to assess the association of the BMI and malocclusion.

Results: Among the 280 participants there was a significant association between BMI, crowding and cross bite. However facial height, open bite, spacing was not significantly associated to the BMI.

Conclusion: It is reasonable to say that the nutritional status may have a negative impact on oral health and contribute to malocclusion. The severity of malocclusion was higher among obese females. Treating malocclusion early will uplift self-esteem and overcome the disadvantages related to the condition.

Keywords: Body mass index, Children, Malocclusion, Nutritional status.

Introduction

There is an increased concern about dental appearance during childhood and adolescence to early adulthood. The society equates good dental appearance with success in many pursuits. [1]Malocclusion is not a disease but a morphological variation, if the etiology of malocclusion is better understood then the prevention of malocclusion would be possible without the need for treatment.[2]

Factors such as genetics, environment or combination of both along with various local factors such as adverse or deleterious oral habits can cause malocclusion. [3]

Environmental factors associated with malocclusion are diet, oral habits and premature loss of primary teeth. [4]

The nutritional status may also be associated with malocclusion. Nutritional status is the body condition that is influenced by the diet; the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity.[5]

Despite the recent economic progress in India, the fruit of development has failed to secure a better nutritional status among the children of the country. Growing evidence suggest that there exists a socio-economic gradient of childhood malnutrition in India. [6] Globally, there are many significant forms of malnutrition including protein-energy malnutrition (PEM). [7]

It is believed that malnutrition may also be associated with malocclusion particularly dental crowding. Altered bone growth in the craniofacial complex can be caused by poor nutrition and it could be reflected in reduced space for dental eruption. [8]

We can observe a lot of changes in the food trends in India. Processed food has become much more accessible as a results of India's continued integration in global food market. The studies done relating obesity and malocclusion stated that mandibular length and width were larger with reduced upper facial height. They suggest that the short upper facial height might be related to decrease in human growth hormone which is down regulated by obese state. [9]

The nutritional status can be assessed using BMI (Body Mass Index) proposed by keys et al in 1972. BMI is used to estimate a healthy body weight based on height.[10]

Although the prevalence of malocclusion has been widely reported, there are very few studies that have been done to address the factors associated to malocclusion. This study will assess the association between nutrition status and malocclusion of age 9-11years.

Materials and methods

Study design: We used a population based cross-sectional analytical.

Sample size: Assuming an alpha error of 5%, confidence interval (CI) of 95%, absolute precision of 5%, and the expected proportion of malocclusion as 77% the required sample size was calculated to be 273 using an online software OpenEpi version 3.01 (AG Dean, KM Sullivian & MM Soe).

Study setting: The study was conducted in 4 schools of various zones (North, south, east and west) in Chennai. Four primary schools were chosen using simple random sampling technique. The principal approval was taken first then 9 to11 year old children belonging to the selected schools were invited to participate, for children who showed willing to participate. Examination was done on the students with an average of 60 students examined per school at 9-11 years old. The children with systemic diseases, craniofacial anomalies (clefts and syndromes), who were undergoing or previously received orthodontic treatment, had premature birth or low birth weight were excluded. The total number of the sample was 280.

Data variables, sources of data, and collection methods

There was high agreement in the inter- and intra-examiner calibration (Percentage of agreement was 98%).The examination was performed in a specially Accommodated classroom of each participating school. The students examined were seated in a chair with high back rest with their head supported in an upright position under day light and sometime with the aid of artificial light. For oral inspection, the following were used: sterilized mouth mirrors, explorers, probes, tweezers, Graded metal scale, inch tape, audiometer, digital weighing machine, disinfected solution, disposable gloves, masks, and artificial light.

The continuous variables (variation in the lower facial height) were measured to the nearest millimetre to confirm its existent. The discrete variables, one segment crowding, two segment crowding, one segment spacing, two segment spacing, one segment cross bite, two segments cross bite, open bite was recorded as present or absent.

Dental crowding is defined as a discrepancy between tooth size and jaw size that results in a misalignment of the tooth row. [11] It was recorded by visual examination of the dental arches.

Facial height (FH) was represented by the distance between the soft tissue nation and menton. The lower face height (LFH) was the distance between the subnasale and menton. After marking the anatomical points, the facial heights were measured with a venire. The ratio of the LFH to the total FH was measured. Increased or decreased LFH was recorded as present when it's more or less than 55% of FH respectively during centric occlusion.

Cross bite is defined as deviations from ideal occlusion in the transverse plane of space in the posterior and/or in the sagittal plane of space in the anterior.[12] The measurements of the anterior and transverse lateral arcade relation were made by direct inspection and recorded as present or absent.

Nutritional status was evaluated by means of body mass index. The child weight was recorded by using electronic digital scale (Plena, model MS-1) with capacity of up to 150 kg and 100 g division placed on a flat surface for recording weight. The height was measured by using ordinary measuring tape fixed at the wall, the child was straight in upright position and the Frankfort plane was horizontal. A head-pressing piece was gently lowered until it touched the top of child’s head, and the exact read could be easily obtained, the measurement should be recorded to the nearest 0. 1cm.Child age was calculated by subtraction his/her birth date from the date of the visit or measurement, the age was determined to the nearest ¼ year. The BMI is computed by dividing the weight (in kilograms) by the height (in meter) squared (kg/m2).

The Centre for Disease Control and prevention CDC recommended utilizing BMI for age in screening the weight status of children and teens aged 2 years old through 20years.[13] The BMI number is plotted on gender specific growth chart. The CDC BMI-for-age growth charts are a national reference that used to assess physical growth and allow translation of BMI number into a percentile specific for a child's or teen's gender and age. The percentile determines whether a person's nutritional status is a healthy weight when the percentile range (PR) between 5thto less than 85th, and whether that person is underweight when PR less than 5th or at risk of overweight PR 85th to less than 95th, the child considered over weight when the PR equal or greater than 95th percentile.

Statistical analysis

The data so collected was entered into SPSS Statistics for Windows, Version 20.0. (IBM Corp, Armonk, NY) and analysed using the Chi-squared test. $P < 0.05$ was considered statistically significant.

Ethical Approval

Ethical permission was granted from the Chief educational officer. The information concerning the total number of Government primary and middle schools in Chennai district of Tamil Nadu was obtained from the Education Directorate of Chennai.

Results

A total of 280 participants were enrolled and three fourth of the participants were in the normal weight range, 9.6% participants were underweight, 10.7% participants were overweight and 4.3% participants were obese. Most of

the underweight and overweight study subjects belong to the 9year old age group (Table1).

Among the 153 male participants 5.7% participants were underweight, 43.2% participants were of normal weight, 4.6% participants were overweight, and 1.1% participants were obese. It was observed that most of the underweight participants were males and most of the obese participants were females. (Table 2). Among the 10 male and 6 female participants with crossbite there is a statistically significant association with their nutritional status. (Table 3)

Around 15.4% overweight males had spacing and among female participants 12.2% had normal BMI and 29.4% of participants with overweight BMI had spacing in one segment. Two segment spacing was seen in 2.2% females of normal range and 11.1%participants in obese subjects. More than one fourth of spacing participants were seen in (33.3%) females with obese BMI (Table 4). We found a statistically significant association between spacing and the nutritional status. (Table 5)

Among the male participants 23.1% participants who were overweight and 33.3% participants who were obese participants had open bite. In females 11.8% participants in overweight category and 11.1% in obese category had open bite. (Table 6)

The upper facial height was decreased among more than half of (56.2%) underweight male participants. Among females around 45.5% underweight, 58.8% overweight participants, 77.8% obese participants had decreased upper facial height The lower facial height was decreased in males with 12.5% participants in underweight, 15.4%participants in overweight and 33.3% in obese subjects and in females with 18.2% in underweight and17.6% in overweight. (Table 7)

Discussion

This cross-sectional analytical study was conducted among 9-11years old children to find the association between malocclusion their Nutritional status. Examination of results obtained in the present study drew attention to the fact that 10.7% of the examined children were over-weight. The majority of overweight and underweight subjects belong to the 9-year-old age group. Most of the under-weight study participants were males and overweight study participants were females. This might be due to the different growth spurts among males and females.

Obesity among children has increased to an epidemic proportion in developed countries and developing countries are not far behind.

Childhood obesity, in developed countries has reached epidemic proportion and developing countries are not far behind. It has been estimated that worldwide over 22 million children under the age of 5 are obese, and one in 10 children is overweight.[14] A study conducted among 24,842 school children in south India showed that the proportion of overweight children increased from 4.94% of the total students in 2003 to 6.57% in 2005 demonstrating the time trend of this rapidly growing epidemic. [15]

A study conducted in United States about prevalence of malocclusion and orthodontic treatment need from NHANES III survey revealed that 35% of individuals had incisor irregularity. [16] Another cross sectional study conducted in schools of northeast Brazil among 2060 students suggested that malnutrition is related to crowding. [7]A similar study done by BR Chandra Shekar et al in Nalgonda, Andhra Pradesh, India shows 17.9% prevalence of malocclusion and females have higher prevalence 23.4%.[17]

This study revealed a statistically significant association between the crossbite and nutritional status of the children in both genders. The obese subject might have hormonal alteration changing the pubertal development. A study conducted in United States about the obesity and its implications in orthodontic treatment implies that bone metabolism could be altered in those who are obese, leading to growth and development changes or tooth movement. [18]

The results showed a statistically significant association between BMI and dental crowding with prevalence of crowding 31.2% and 45.5% in underweight males and females respectively. Some authors have found a significant adverse effect of malnutrition on the growth and development of facial bones of children and on the development of skeletal muscles and the reduced space for dental eruption in the dental arches leading to bad positioning of the teeth. Therefore, malnutrition might also be associated with dental occlusion disorders.[19]

The facial height was related to the BMI, the observation of facial height prevalence would reveal that there was decreased facial height seen majorly in obese females, this would be in agreement with increasing lower facial heights in obese reported by Ferrario *et al* and Ohrn *et al* found larger mandibular length and width and reduced upper face height, but overall increases in vertical dimensions in obese subjects. They suggested that the short upper face height might be related to decreased levels of human growth hormone, which is down-regulated by the obese state.[4]

The strengths of the study were that the oral examination to identify the malocclusion was done by qualified dentists thus it eliminated misclassification bias. The sample size was calculated using OpenEpi software and analyzed used SPSS version 20.

The limitations of the study include the parameters used to measure the nutritional status and malocclusion. BMI was only used and occlusal relationship was only examined for assessing malocclusion. The sample was taken only from four schools which may not be representative of the whole population.

India, a developing country face many challenges in rendering oral health needs as majority of the population lack awareness about dental problems has resulted in gross neglect of oral health. Among the dental diseases malocclusion is second most common in children and young adults next to dental caries. Psychosocial effects of malocclusion should never be underestimated no matter how small. It may have a greater impact on their psychological health. The nutritional status of children not only reflects the well-being of the children but also the efficiency of health care systems.[20]

The study results states that there is a statistically significant relationship between nutritional status, crowding and crossbite.

Policy actions aimed at monitoring the nutritional status of the children and early identification of malocclusion are recommended. However further studies are required to improve the consistency of these findings and better understanding of the subject.

Conclusion

It is reasonable to say that the nutritional status may have a negative impact on oral health and contribute to malocclusion. The severity of malocclusion was higher among obese females. Treating malocclusion early will uplift self-esteem and overcome the disadvantages related to the condition. Moreover, due to the limitations of the study further studies are needed to emphasis the consistency and improve the understanding.

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