Research Paper

Lifestyle Influences on Body Shape Index and Oral Health in Patients Visiting Public Healthcare Facilities in Chennai- A Cross-sectional study

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Abstract— **Background:** Asides from being an epidemic in and of itself, obesity is linked to a number of serious illnesses, such as diabetes, hypertension, cancer, and cardiovascular diseases, including dental problems.
Aim: The study aims to evaluate the impact of sedentary lifestyles in terms of A Body Shape Index (ABSI) on oral conditions among general patients attending Primary Health Centres (PHC) in Chennai, India.
Materials and Method: A cross-sectional descriptive study was carried out among 224 outpatients who visited PHCs from March to September 2024. Socio-demographic data was collected using self-administered questionnaires. A thorough clinical examination was carried out based on Oral Health Surveys Basic Methods (WHO, 2005) for the presence or absence of conditions like dental caries, gingivitis, and edentulism. Descriptive statistics and chi-square test to find the association between ABSI and oral hygiene. Kruskal Wallis test was performed to compare the risk groups of NCDs based on Body Shape Index with DMFT and OHI-S scores were carried out using SPSS 27.0 version.
Results: A total of 224 participants; most patients visiting PHC were females (66.1%). The mean scores of Decayed teeth (DT), Missing teeth (MT), Filled teeth (FT), and DMFT scores of the population were 2.02 ± 1.01, 0.23 ± 1.37, 0.19 ± 1.24 and 3.24 ± 1.67 respectively. There is an association between the consumption of unhealthy diets and poor oral hygiene ($p < 0.004$).
Conclusion: Results show a substantial association between poor dental health and unhealthy eating. It is high time that the government reforms its public policies related to unhealthy food consumption.

Keywords— Body Mass Index, Oral Health Status, Public Health Care, Sedentary Lifestyle, Obesity

1. Introduction

650 million people are fat and over 1.9 billion people are overweight globally.. In India, more than 135 million were affected by obesity. Chronic non-communicable diseases are more common than a few decades ago, which accounts for 71% of annual deaths [1]. Diabetes mellitus, heart disease, stroke, renal disease, vision issues, nerve damage, and other systemic disorders are all primarily caused by obesity. [2]. A sedentary lifestyle, unhealthy food habits, sedentary behaviors, psychological stress, and a lack of support are a few of the contributing factors. Prolonged periods of inactivity can raise triglyceride levels and cause insulin resistance, both of which are linked to metabolic diseases and obesity [3].

Sedentary lifestyles have been connected to a higher risk of mental health conditions like sadness and anxiety.. It has been established that physical activity enhances mood and cognitive function. Diabetes and cardiovascular disease, which are known to affect oral health by raising the risk of gum disease and other dental disorders, can be attributed to a sedentary lifestyle. People who have sedentary lifestyles may not be as conscientious or motivated to participate in health-promoting activities, such as maintaining good oral hygiene habits.

One of the worst consequences of eating an imbalanced diet is the potential for deficiencies in vital minerals, such as Vitamin D and calcium are necessary for strong teeth and gums.. Teeth damage can result from stress in several ways. It could lead to detrimental behaviors like clenching and teeth grinding (bruxism), which erode dental enamel and cause pain in the jaw and other oral health issues. Overstress can also lead to time limits or a lack of desire, which might neglect oral care and raise the risk of dental problems. Stress is linked to two conditions that might impair oral health, gum disease and xerostomia, or dry mouth caused due to reduced salivary flow. People are often greatly influenced by their support systems when it comes to encouraging and reminding them to maintain proper oral hygiene. Because a lack of resources, ignorance, or other obstacles may also indicate insufficient assistance, untreated dental problems, and poor oral health may result [4,5]. The unmet dental needs can be met by integrating artificial intelligence into risk factor identification, diagnosis, and treatment planning [6].

Sedentary living is often associated with bad dietary behaviors, such as consuming more processed and sugary meals. This may lead to higher risks of dental caries and periodontal disease. Regular exercise is a good way to mitigate the detrimental effects of a sedentary lifestyle. Increasing public awareness of maintaining good dental hygiene and its connection to overall health is one method to minimize the detrimental effects of sedentary behavior. A Body Shape Index (ABSI) examines the distribution of fat, particularly the percentage of abdominal fat, using the waist circumference.. ABSI may be more sensitive to changes in body composition and weight distribution over time, providing a more dynamic measure of health status compared to BMI alone [7]. With ABSI, premature mortality risk from Non-Communicable Diseases (NCDs) is predicted in a more convenient form than BMI's capability of predicting it [8]. Addressing sedentary lifestyles with a comprehensive approach that includes dietary counseling, physical activity promotion, and oral health education can improve general health outcomes more successfully. The purpose of this study was to look into how lifestyle choices affect dental health and how they relate to body shape index.

2. Related works

Many studies have been conducted by the authors on a similar topic of interest, showing the influence of gender variations, socioeconomic status, lifestyle factors, and diet quality index on oral health [9-11].

3. Materials and Method

A study that was cross-sectional was carried out in government-run Primary Health Centres in Chennai, Tamil Nadu. The study was conducted over 6 months, from March to September 2024. A pilot study was conducted, and the prevalence of obesity and poor oral hygiene was found to be 14.9%.

3.1 Sample Size

Therefore, a sample size of 203 was calculated for the main study based on the formula z^2pq/d^2 where, z = Confidence Interval at 95%, which is the constant value of 1.96 (z^2 rounding off to 4); p = 14.9%; q = 1-p = 85.1; d = 5%, allowable error. The sample size was adjusted for a non-response rate of 10%, and the final sample size was determined to be 224.

3.2 Eligibility Criteria

The Patients aged 15 or above and those The study includes those who provided informed consent. Any communicable disease, pregnancy, steroids used for athletic purposes, orthodontic treatment, and pregnancy were excluded. The ethical committee approval was obtained from the Institutional Review Board (IRB) of SRM Dental College and Hospital Ramapuram, Chennai.

3.3 Assessment tools

Self-administered questionnaires were used to gather information regarding medical history, current health status, medication use, and lifestyle conditions, including tobacco and alcohol consumption, physical activity, diet, sleep pattern, stress level, and oral hygiene practices. A number of anthropometric measurements, such as height, weight, and waist circumference, were taken to determine ABSI. The questionnaire was pre-tested among the pilot study group, and modifications were made accordingly.

A Body Shape Index is calculated as, A Body Shape Index=Waist circumference/Body Mass Index$^{2/3}$×height$^{1/2}$.ABSI is divided into five groups based on the z-values, which indicate the degree of health risk: very low, low, average, high, and very high [12].
$$ABSI\ z = ABSI - ABSI_{mean}(age,sex) / ABSI_{std}(age,sex)$$

3.4 Methodology

A thorough clinical oral examination was determined based on the criteria of Oral Health Surveys Basic Methods (WHO, 2013). Type III examination was conducted on a dental chair with headrests, and adequate light illumination using dental mirrors, and shepherd's hook (No. 17 and 23) was used in the examination [13]. Decayed, Missing and Filled data recorded based on Modified Henry T. Klein, Carrole E. Palmer, Knuston JW DMFT index (1997). Oral Hygiene Status measures using John C. Greene and Jack R. Vermillion OHI-Simplified Index (OHI-S), 1964. Inter-examiner reliability was assessed between two calibrated dentists. Cohen's kappa coefficient was found to be 0.87 (Near perfect agreement).

3.5 Statistical Analysis

Statistical analyses were carried out using SPSS 27.0 software. A survey will be conducted and the data collected will be analyzed and organized. A descriptive statistical

analysis was performed on the data. The Kolmogorov-Smirnov test was used to evaluate whether the data had a normal distribution. Chi-square test was conducted to find the association between sedentary lifestyle practices and ABSI. Kruskal Wallis test was performed to compare the risk groups of NCDs based on Body Shape Index with DMFT and OHI-S scores. $P < 0.05$ was considered to be statistically significant.

4. Results

A total of 224 participants, males were 76 (33.9%) and females were 148 (66.1%). The mean age of the participants was 33.4±2. The majority of the participants attending PHCs were homemakers (38.8%), followed by unemployed (14.8%) and skilled workers (12.1%), as represented in Table 1. Most of the participants were illiterate, with 25%. As far as their body shape index and BMI are concerned, most participants fall into the moderate stable category (52.2%) and the healthy category (66.6%), respectively. Almost 63.4% of the participants lack adequate sleep, and 62.5% of participants are stressed for more than three days a week. Consumption of unhealthy diet is more common among 26-39 age groups, with 9.9% having it almost every day or multiple times a day. Nearly 16.1% of participants never visit a dentist, even when in a problem, as shown in Figure 1.

Table 1: Socio-demographic profiles of all the included participants

Groups		Frequency N	Percentage %
Gender	Male	76	33.9
	Female	148	66.1
Age	<25 years	48	21.4
	26-39 years	78	34.8
	40-59 years	58	25.9
	>60 years	40	17.9
Occupation	Unemployment	33	14.8
	Homemaker	87	38.8
	Semi-skilled worker	20	8.9
	Skilled worker	27	12.1
	Semi Profession	24	10.7
	Professional	22	9.8
	Retired	11	4.9
Educational Qualification	Professional	33	14.7
	Graduate	41	18.3
	Diploma/Intermediate	10	4.5
	High School	24	10.7
	Middle School	44	19.6
	Primary School	16	7.1
	Illiterate	56	25.0
BMI	Healthy	149	66.5
	Underweight	22	9.8
	Overweight	38	17.0
	Obese	9	4.0
	Severely Obese	6	2.7

Body Shape Index	Very low risk	67	29.9
	Low risk	20	8
	Average	117	52.2
	High risk	12	5.4
	Very high risk	8	3.6
Physical activity	None	18	8.0
	Light activity	123	54.9
	Moderate activity	65	29.0
	Sedentary	18	8.0
Sleep duration	7-8 hours	74	33.0
	5-7 hours	123	54.9
	>8 hours	8	3.6
	3-5 hours	19	8.5
Stress level	≤ 2 days	84	37.5
	3-4 days	68	30.4
	≥ 5 days	72	32.1
Smoking	Never	200	89.3
	Former smoker	7	3.1
	Current smoker	17	7.6
Smokeless	Never	205	91.5
	Former user	7	3.1
	Current user <10 years	12	5.4
Alcohol	Never	190	84.8
	Former regular drinker	4	1.8
	Current drinker	30	13.4
Consumption of an unhealthy diet	≤ 1 day/ week	68	30.4
	2-3 days/week	96	42.9
	4-5 days/ week	38	17.0
	6-7 days/week	12	5.4
	Multiple times a day	10	4.5
Oral hygiene practices	Twice	101	45.1
	Once	121	54.0
	Infrequent	2	0.9
Oral hygiene Aids	Multiple Aids	4	1.8
	Fluoridated toothpaste	16	7.1
	Interdental brushing	8	3.6
	Dental floss	4	1.8
	None	192	85.7
Symptoms	None	96	42.9
	Sensitivity	38	17.0
	Bleeding gums	26	11.6
	Halitosis	14	6.3
	Pain or discomfort	14	6.3
	Loss of taste	2	0.9
	More than 1 symptoms	34	15.2
Dental visits	Every 6 months	52	23.2
	Once a year	46	20.5
	Only when there is a problem	90	40.2
	Never	36	16.1
Oral Hygiene Index	Good	107	47.8
	Fair	82	36.6
	Poor	35	15.6

As shown in Table 2, sedentary lifestyle parameters such as physical activity, sleep duration, stress, diet, and deleterious

habits are associated with a higher risk of Non-communicable diseases based on the Body Shape Index (ABSI).

Although there is no statistically significant difference among the risk groups based on body shape index with respect to DMFT and OHI scores as mentioned in table 3, high DMFT score (9-12) and the poor oral hygiene are associated with high and very high risk of mortality from NCDs.
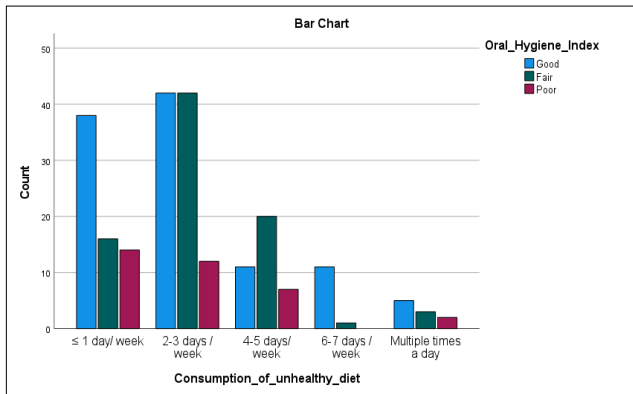

Figure 1: Clustered Bar Chart representing the association of Oral Hygiene Index across Consumption of unhealthy diet ($P < 0.004$)
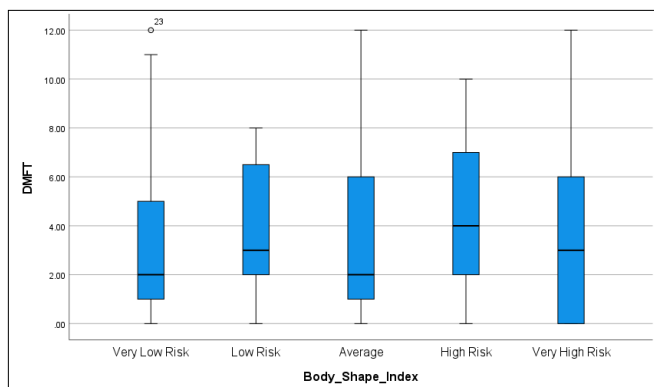

Figure 2: Box and Whisker plot representing the distribution of DMFT scores among five risk groups of Body Shape Index
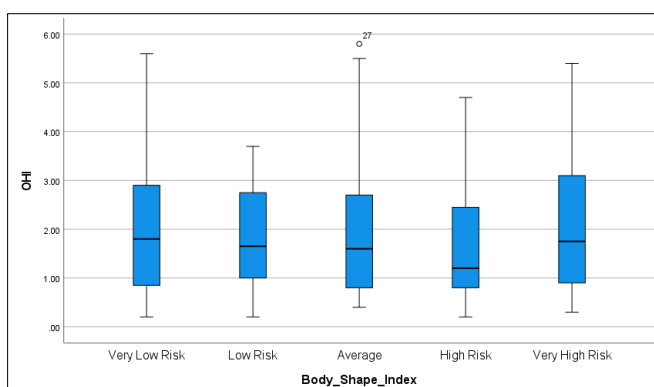

Figure 3: Box and Whisker plot representing the distribution of OHI-S scores among five risk groups of Body Shape Index

5. Discussion

As far as we are aware, this is the first investigation of its kind addressing obesity in relation to the Body Shape Index among people attending Primary Health Centres regarding their dental health problems. The study attempted to better understand how public health centers meet the needs of unmet populations. This method aids in creating a complete picture of the behavior of people seeking health care across age groups, genders, socioeconomic classes, and health conditions.

The study revealed an increasing trend of women utilizing health centers in India, emphasizing the affordability and accessibility of these amenities. According to Maria Teresa Carretero et al. (2014), the increased use of PHCs by women may be attributed to a greater morbidity burden than men in India [14]. In India, where economic and social barriers often limit access to private health care, the need for adequate dental manpower and infrastructure in every PHC was stressed in Kiran Iyer et al.'s study [15]. Due to their shared etiological factors—such as binge eating unhealthy foods, physical inactivity, and sedentary lifestyles—the relationship between obesity and poor dental health has been receiving more attention [16]. Along with lifestyle choices like drinking and smoking, diet and physical activity significantly impact the Body Shape Index, which in turn influences both dental and general health. In contrast to the present study, where the dental caries burden was highest among the very high-risk group (25%), Gudipaneni RK et al.'s (2021) study reported an association between dental caries and underweight BMI as well as non-obese Waist Circumference (WC).

Although the results are conflicting, both studies highlighted an association between the frequency of sugar consumption and dental caries [17]. Despite the fact that the causes of dental caries and obesity differ, both conditions are often exacerbated by a diet high in sugar [18, 19].

Table 2: Association between lifestyle factors and A Body Shape Index (ABSI)

Variables	Categories	Very low risk N (%)	Low risk N (%)	Average N (%)	High risk N (%)	Very high risk N (%)	P-value
Physical Activity	None	8 (44.4)	2(11.1)	8 (44.4)	0	0	0.030*
	Light activity	43 (35)	14 (11.4)	52 (42.3)	10 (8.1)	4 (3.3)	
	Moderate activity	12 (18.5)	2 (3.1)	45 (69.2)	2 (3.1)	4 (6.2)	
	Sedentary	4 (22.2)	2 (11.1)	12 (66.7)	0	0	
Sleep duration	>8 hours	2 (25)	2 (25)	0	2 (25)	2 (25)	<0.001***
	7-8 hours	20 (27)	6 (8.1)	40 (54.1)	4 (5.4)	4 (5.4)	
	5-7 hours	34 (27.6)	10 (8.1)	71 (57.7)	6 (4.9)	2 (1.6)	
	3-5 hours	11 (57.9)	2 (10.5)	6 (31.6)	0	0	
Stress level	≤ 2 days	25 (29.8)	6 (7.1)	45 (53.6)	4 (4.8)	4 (4.8)	0.012
	3-4 days	10 (14.7)	6 (8.8)	44 (64.7)	4 (5.9)	4 (5.9)	
	≥ 5 days	32 (44.4)	8 (11.1)	28 (38.9)	4 (5.6)	0	
Smoking	Never	57 (28.5)	17 (8.5)	107 (53.5)	11(5.5)	8 (4)	0.640
	Former smoker	3 (45)	0	4 (55)	0	0	
	Current smoker	6 (36.15)	3 (16.65)	5 (38.9)	1 (8.3)	0	
Smokeless	Never	60 (29.3)	17 (8.3)	110 (53.7)	11(5.4)	7(3.4)	0.719
	Former user	4 (54.17)	1 (16.66)	2 (29.17)	0	0	
	Current user	3 (27.15)	2 (17.1)	5 (41.45)	1 (7.15)	1 (7.15)	
Alcohol	Never	53 (27.9)	17 (8.9)	102 (53.7)	11(5.8)	7 (3.7)	0.694
	Former drinker	2 (50)	0	2 (50)	0	0	
	Current drinker	12 (41.3)	3 (7.7)	13 (44.7)	1 (2.6)	1 (3.7)	
Consumption of an unhealthy diet	≤ 1 day/ wk	22 (32.4)	8 (11.8)	32 (47.1)	4 (5.9)	2 (2.9)	<0.001***
	2-3 days/wk	22 (22.9)	6 (6.3)	64 (66.7)	0	4 (4.2)	
	4-5 days/ wk	13 (34.2)	4 (10.5)	11 (28.9)	8(21.1)	2 (5.3)	
	6-7 days/wk	6 (50)	0	6 (50)	0	0	
	Multiple times a day	4 (40)	2 (20)	4 (40)	0	0	

Chi-square test; *$P < 0.05$ considered as statistically significant; ***$P < 0.001$ considered as highly statistically significant.

Although there is no statistically significant difference among the risk groups based on body shape index with respect to DMFT and OHI scores as mentioned in table 3, high DMFT score (9-12) and the poor oral hygiene are associated with high and very high risk of mortality from NCDs.

Table 3: Comparison of Risks of Non-Communicable Diseases in relation to DMFT and OHI score

Groups	Categories	Very low risk N (%)	Low risk N (%)	Average N (%)	High risk N (%)	Very high risk N (%)	P-value
DMFT	0	14 (30.4)	3 (6.5)	24 (52.3)	2 (4.3)	3 (6.5)	0.539
	1-4	35 (30.7)	9 (7.9)	63 (55.3)	5 (4.4)	2 (1.7)	
	5-8	13 (23.7)	8 (14.5)	28 (50.90)	4 (7.30)	2 (3.6)	
	9-12	5 (55.6)	0	2 (22.2)	1 (11.1)	1 (11.1)	
OHI	Good	28 (26.17)	10 (9.35)	60 (56.07)	6 (5.61)	3 (2.80)	0.930
	Fair	25 (30.48)	8 (9.76)	42 (51.22)	4 (4.88)	3 (3.66)	
	Poor	14 (40)	2 (5.71)	15 (42.87)	2 (5.71)	2 (5.71)	

Kruskal-Wallis test; *$P < 0.05$ is considered as statistically significant

The present study divulged that oral hygiene improves with age, as older individuals adopt better living practices compared to younger people. The findings were similar to those of the Bakaradoss JK et al. study conducted in 2019 [20]. Like the present study, Eftchia Kotronia et al.'s study (2021) also stated that an unhealthy diet combined with inadequate essential nutrient intake establishes a bidirectional association between poor oral hygiene and poor nutrition [21]. Improved lifestyle choices and daily decisions about diet, exercise, and other lifestyle factors can prevent diseases like obesity and Type 2 diabetes [22]. One effective strategy to combat non-communicable diseases in India is to tax unhealthy food products while subsidizing healthier alternatives [23]. The cohort study conducted by Sumit Agarwal et al. (2023) demonstrated how the fast-food purchase ratio declined following the implementation of a fat tax in Kerala [24].

According to W.J. Millar et al., smokers are more prone to developing periodontal disease, and smoking negatively

impacts oral health [25]. Due to their work schedules, irregular eating patterns, and night shifts, which contribute to physical and mental stress, smoking was more common among the study participants. As a coping strategy for this stress, they adopted these harmful habits. Choudhury AR et al. (2022) stated that stress and strain at work are the primary causes of tobacco use and smoking among many individuals [26]. Conflicting results were obtained from Sasikala et al. (2021), who concluded that mid-arm circumference was associated with paternal deprivation measures but not individual deprivation measures [27]. Another important lifestyle factor influencing poor dental health in the present study was sleep deprivation [28]. Han Sungjun et al. (2015) further revealed that poor oral health was linked to both short and long sleep durations [29].

One of the main limitations of this study is that sample recruitment was restricted to two PHCs, both of which were equipped with comprehensive dental infrastructure. Furthermore, the reliance on a self-reported questionnaire in a cross-sectional study presents a limitation, as it impedes the establishment of causal effects and introduces potential response bias.

6. Conclusion

Consequently, the study's outcomes indicate that eating unhealthily is significantly associated with poor oral hygiene. The link between obesity and poor oral health has been gaining attention, as both share common etiological factors like binge eating unhealthy foods, physical inactivity, and sedentary lifestyles. The government should take steps to improve oral health literacy across the country. Dentists should be responsible for enhancing the general public's dental health knowledge, and the government should build adequate dental infrastructure in all Primary Health Centers.

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