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State of Oral Health Dependent on Body Mass Index (BMI) in a Mexican Population: A Cross-Sectional Study

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Abstract

Background: Obesity in Mexico is an alarming problem that has been increasing in recent decades. Dietary factors make this pathology more incidents at younger ages and it is closely related to oral health. This study aims to know the association between the need and presence of prosthesis with the type of obesity in a Mexican population in the state of Yucatan.

Objectives: This study explores the relationship between obesity and oral health in the adult population of the Yucatan state in Mexico.

Methods: The research was carried out in July 2021 in Merida, Yucatán (Mexico). The sample was made up of 114 people, whose ages were between 15 and 81 years old. The data analysis focused on factors such as obesity type, gender distribution, and oral health status.

Results: A notable absence of dental prostheses is perceived in over 80% of participants, suggesting a potential impact on mastication and dietary choices. A direct correlation between obesity type and the need for dental prostheses is identified, with a higher prevalence in individuals with higher body mass indices. This underscores the potential interplay between oral health, obesity, and dietary habits.

Conclusions: This research contributes to a growing body of evidence emphasizing the importance of optimal oral health in facilitating efficient mastication and digestion. Further studies are needed on the need for preventive measures alongside treatment in promoting oral health awareness within the community.

Keywords: BMI oral epidemiology; Obesity; Oral health; Diet; Preventive dentistry; Prevention of periodontal disease; Tooth wear; Yucatan; Mexico

Abbreviations: Analysis of Variance (ANOVA); Body Mass Index (BMI); Standard Deviation (SD)

Introduction

Oral health is a continuous state determined not only by hygiene and dietary habits but also by the absence of oral and systemic pathologies [1,2]. Oral cavity diseases currently present a high prevalence and incidence rate, causing a direct impact on the quality of life perceived by the individual and affecting the daily performance of his life due to the interference of pain, inflammation and functional impotence among others [3-6].

Nowadays, more than 70% of the population has some type of oral pathology (understood as an abnormal oral health condition in contrast to an ideal oral state with complete dentition, absence of pathology, proper dental and intermaxillary relationships, and optimal morphofunctional parameters) that affects their systemic health to a greater or lesser extent. This percentage is more pronounced in underdeveloped or developing countries, even though the basic oral and dental needs are covered by the National Health System [6,7]. This is the case of Mexico, where, according to epidemiological documentation, the prevalence of oral pathology reaches a prevalence of over 90%. This is not only a local problem according to the pertinent health authorities, but also a community socio-health problem. In the present investigation, efforts will focus on the Yucatan region, taken as a reference and according to statistics with levels of oral and systemic pathology that can be extrapolated to the rest of the country [8-11].

Presently, the majority of oral disorders stem from unhealthy dietary habits, with the Mediterranean diet serving as a reference model [12-18]. These oral diseases pose a significant public health challenge, impacting individuals and society through pain, social consequences, and functional limitations. Remarkably, nine out of ten people worldwide are at risk of experiencing an oral disease [19-23].

Mexico is among the countries with a high prevalence of oral diseases. Caries, in particular, affect over 90% of the Mexican population. Notably, the Universal Catalogue of Health Services (CAUSES) in Mexico provides medical coverage that includes dental specialties [24,25].

Focusing on the Yucatan region, which lies in the southeastern part of Mexico, data from the General Direction of Epidemiology (Ministry of Health, Government of Mexico) reveals that in 2019, the region exhibited oral disease rates comparable to the rest of the country and significantly lower than those observed in other North American (United States of America) or European (United Kingdom or Sweden) nations [26].

Obesity in Mexico is an alarming problem that has been increasing in recent decades. The socio-cultural and dietary factors make this pathology more and more incident and at younger ages despite the government's efforts to raise awareness of the importance of a healthy lifestyle and how it affects the quality of life. This, in turn, is closely related to the presence of oral health, since an optimal state at the oral level implies maximum efficiency in the initial step of the digestive process such as chewing, bolus formation and swallowing [27-29].

The objective of this study is to relate the need and presence of prostheses in obese people with the type of obesity in a Mexican population in the state of Yucatan.

Methods

Type of study and characteristics

An observational, descriptive, cross-sectional study was carried out, covering the rural population of Merida (Mexico) and surrounding areas in July 2021. The study was conducted in accordance with the Declaration of Helsinki and was approved by an Ethics Committee. Likewise, informed consent was obtained from participants and all parents and/or legal guardians involved in the study. STROBE guidelines were followed.

The initial sample size was 170 patients who came to a routine check in their public health center without any particular claim or prior knowledge of the data collection in order to avoid bias. Subjects were aged between 2 and 81 years. The inclusion criterion was the presence of the entire definitive dentition according to chronology, while the exclusion criterion was to be of deciduous or mixed dentition age. After the application of these criteria, the final sample size was 114 patients. Of these, 70% of the initial sample was women, and this percentage was 67.5% in the final sample. All the patients came of their own free will in view of the need for dental medical care. All were informed of the process orally, and the explanation was extensive and personalized. They all signed an informed consent form. After this, they filled out a research dossier with questions about their oral and dental health, anamnesis and clinical history, well-balanced health habits according to an ideal model of the Mediterranean diet, body measurements and socioeconomic level in addition but it has no further value in this investigation due to the main purpose.

All patients had the same clinical examiner, with the same methodology used on all of them to avoid bias. It was decided to carry out the scanning for data collection through the work of a single examiner (a dentist with lots of experience in prosthesis assessment). With the aim of measuring the consistency of the observations, the examiner was subjected to a so-called intra-observer calibration, obtaining the ratio of agreement with a Kappa test (0.85).

Variables

The study variables were gender, degree of obesity, use of prosthesis, and need for prosthesis. The central variable of the study was the degree of obesity, which was in turn divided into three degrees according to body mass index (BMI), these being: Type 1: BMI from 30 to 34.99, Type 2: BMI from 35 to 39.99, and Type 3: BMI greater than 40.00.

The use of prosthesis is understood as the presence of fixed or removable, denture-supported, implant-supported, dentomucosal-supported or mucosal-supported prosthesis present in the mouth at the time of the examination.

The need for prosthesis is understood as the clinical demand or the requirement according to the criteria of evidence-based dentistry, for fixed or removable prosthesis, denture-supported, implant-supported, dentomucosal-supported or mucosal-supported, whether demanded or not and whether in combination with other types of prosthesis at the time of the examination. The need for prosthesis does not include the demand for purely esthetic criteria that do not result in an improvement in masticatory function or an improvement in oral and oral-facial quality of life, including at the articular level.

These study variables were obtained by routine and voluntary examination of the patients who came to receive dental care at the "International Resident Dentist" campaign site. The documentary completion of the data was carried out by the same explorer, as well as its transcription into a validated research dossier.

Statistical analysis

The Kolmorogov-Smirnov test was performed to evaluate the normality of the distribution of the variables. For data that did not follow a normal distribution, the Kruskal Wallis test and the ANOVA test were used for data with normal distribution in descriptive statistics.

Fisher's exact test was used for the comparison of tables between two groups and the chi-square test for contingency tables of all groups. The multivariate analysis to determine the relationship between the dependent and independent variables was the multiple regression analysis.

The analysis was performed using the automatic statistical calculator IBM SPSS Statistics for Windows, Version 25.0. Statistical significance was accepted for $p < 0.05$.

Limitations of the study

The study presented is part of a Social Dentistry solidarity project, and given the large number of patients included in the sample presented, it does not allow us to make an initial estimate for carrying out larger studies in the future.

Results

Age

The mean age was 39.38 years, with a standard deviation (SD) ± 15.70. A median of 37.50 years was obtained and the range of ages seen was from 15 years old to 81.

Table 1 and figure 1 show the age in the obesity groups. There were no significant differences ($p = 0.177$).

Sex

Table 2 shows showing sex distribution per type of obesity in the general population studied.

There was no significant difference between the sex of the population and the degrees of obesity.

Table 1: Age in the obesity groups (Oral Health in Yucatan. Mexico. 2020-2023).

Group	Mean	SD	Median	Range
Type I	34.88	18.46	33.00	15-64
Type II	45.40	18.50	47.00	17-75
Type III	38.27	14.34	36.00	15-81

Table 2: Sex distribution by groups in the overall sample (Oral Health in Yucatan, Mexico, 2020-2023).

Cross table between sex and study groups						
			Groups			Total
			Obese type I	Obese type II	Obese type III	
Sex	Female	Count	5	15	57	77
		% With in de Sex	6.5%	19.5%	74.0%	100.0%
		% Within de Groups	55.6%	68.2%	68.7%	67.5%
		% Total	4.4%	13.2%	50.0%	67.5%
		Corrected residual	-0.8	0.1	0.4	
	Male	Count	4	7	26	37
		% Within de Sex	10.8%	18.9%	70.3%	100.0%
		% Within de Groups	44.4%	31.8%	31.3%	32.5%
		% Total	3.5%	6.1%	22.8%	32.5%
		Corrected residual	0.8	-0.1	-0.4	

Chi-square: 0.643, p-value: 0.725

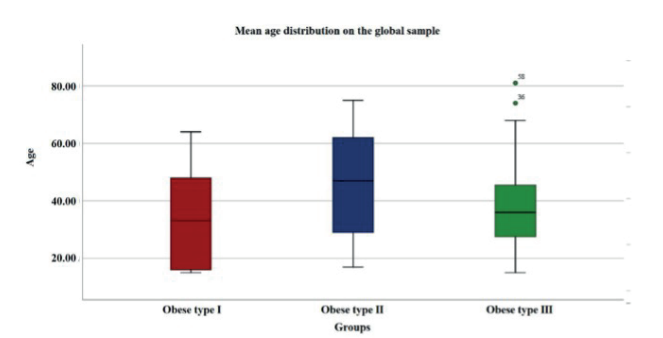

Figure 1: Mean age in the obesity groups (Oral Health in Yucatan, Mexico, 2020-2023).

The group with the highest percentage of women was in the type III obesity group at 68.7%, and the highest percentage of men was in the type I obesity group at 44.4% with a p-value of 0.725 (non-statistical significance). There is a higher percentage of women 67.5 % than men 32.5 % within the general sample.

Figure 2 shows the sex distribution in the overall sample with no statistical significance.

IMC

General group: Table 3 shows the unadjusted and adjusted R-squared values from the multiple regression between BMI and the independent variables in the general group.

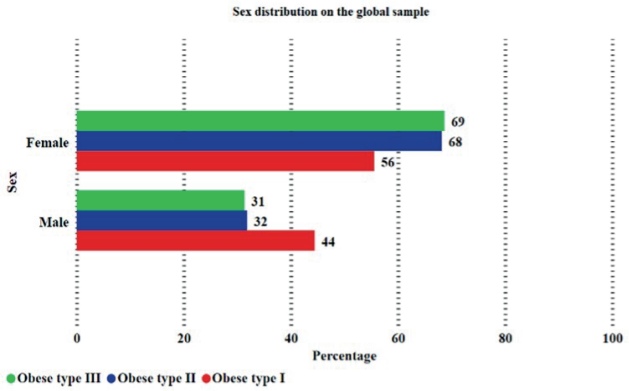

Figure 2: Sex distribution in the overall sample (Oral Health in Yucatan, Mexico, 2020-2023).

Table 3: The unadjusted and adjusted R-squared values from the multiple regression between BMI and the independent variables in the general group.

R	Adjusted R Square	p-value	95,0% Confidence Interval	
			Lower Bound	Upper Bound
0.903	0.899	0.003	5.124	25.543

The correlation between BMI and age, with a negative regression coefficient (-0.109), shows a negative or inverse trend, where younger ages are associated with higher BMI (p= 0.001).

The correlation between BMI and the waist-to-hip ratio, with a positive regression coefficient (44.355), shows a positive or direct trend, where a higher waist-to-hip ratio is associated with higher BMI (p= 0.0001).

The correlation between BMI and abdominal circumference, with a positive regression coefficient (0.776), shows a positive or direct trend, where a larger abdominal circumference is associated with higher BMI (p= 0.0001).

The correlation between BMI and the second periodontal probing under the category "other," with a positive regression coefficient (7.989), shows a positive or direct trend, where the presence of other findings is associated with higher BMI (p= 0.035) (Figure 3).

Type I Obesity Group: No significant relationships were observed with the variables in the multivariate analysis.

Type II Obesity Group: Table 4 shows the unadjusted and adjusted R-squared values from the multiple regression between BMI and the independent variables in the Type II Obesity group.

Table 5 shows the variables studied.

In table 6, the correlation between BMI and independent variables in the GO group is shown.

The correlation between BMI and the waist-to-hip ratio, with a positive regression coefficient (12.234), shows a positive or direct trend, where a higher waist-to-hip ratio is associated with a higher BMI (p= 0.032).

The correlation between BMI and oral health 2 in the "sensitive teeth" category, with a negative regression coefficient (-1.181), shows

Table 4: Correlation between BMI and the independent variables in the general sample.

Variables	Unstandardized Coefficients Beta	Standardized Coefficients Beta	p-value	95.0% Confidence Interval Lower Bound	95.30% Confidence Interval Upper Bound
Age	-0.109	-0.165	0.001	-0.171	-0.048
Waist hip	44.355	0.235	0.0001	59.764	28.946
Circumference	0.776	1.039	0.0001	0.716	0.836
Second periodontal probe (Other)	7.989	0.08	0.035	0.569	15.410

Table 5: The variables studied.

R	Adjusted R Square	p-value	95.0% Confidence Interval	
			Lower Bound	Upper Bound
0.530	0.420	0.0002	37.873	52.247

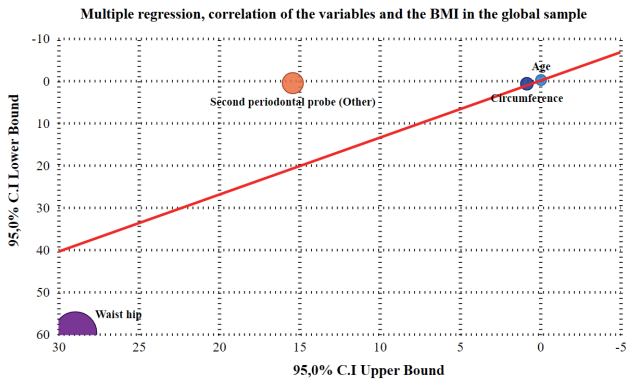

Figure 3: Multiple regression, correlation of the variables and BMI in the global sample.

a negative or inverse trend, where fewer sensitive teeth are associated with a higher BMI (p= 0.044).

The correlation between BMI and oral health 2 in the "bleeding gums" category, with a negative regression coefficient (-2.056), shows a negative or inverse trend, where fewer bleeding gums are associated with a higher BMI (p= 0.015).

The correlation between BMI and oral health 2 in the "other" category, with a negative regression coefficient (-1.906), shows a negative or inverse trend, where fewer other findings are associated with a higher BMI (p= 0.032) (Figure 4).

Type III Obesity Group: Table 7 shows the unadjusted and adjusted R-squared values from the multiple regression between the BMI of the GO group and the independent variables in the GO group.

Table 8 shows the correlation between BMI and the independent variables in the GO group.

The correlation between BMI and age, with a negative regression coefficient (-0.073), shows a negative or inverse trend, where younger ages are associated with higher BMI (p= 0.045).

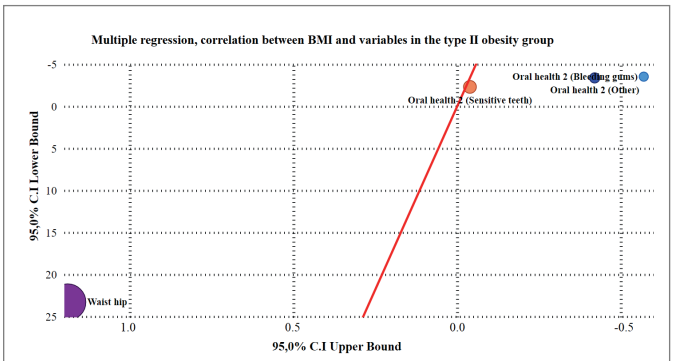

Figure 4: Multiple regression, correlation between BMI and the variables in the Type II Obesity group.

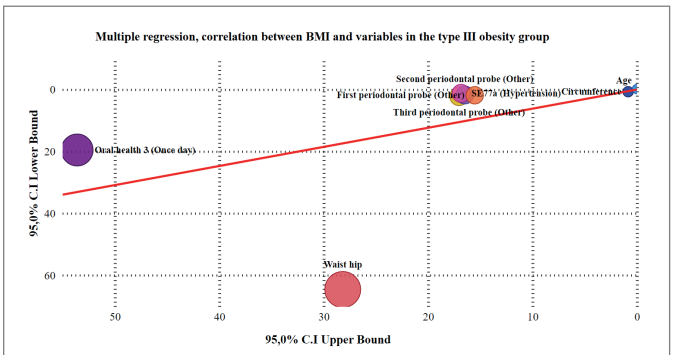

Figure 5: Multiple regression, correlation of the variables and BMI in the GO group.

The correlation between BMI and the waist-to-hip ratio, with a positive regression coefficient (46.416), shows a positive or direct trend, where a higher waist-to-hip ratio is associated with higher BMI (p= 0.0001).

The correlation between BMI and abdominal circumference, with a positive regression coefficient (0.773), shows a positive or direct trend, where a larger abdominal circumference is associated with higher BMI (p= 0.0001).

The correlation between BMI and the first periodontal probing under the category "other," with a positive regression coefficient (8.696), shows a positive or direct trend, where the presence of other findings is associated with higher BMI (p= 0.013).

Table 6: The correlation between BMI and independent variables in the GO group.

Variables	Unstandardized Coefficients Beta	Standardized Coefficients Beta	p-value	95.0% Confidence Interval Lower Bound	95.0% Confidence Interval Upper Bound
Oral health 2 (Sensitive teeth)	-1.181	-0.411	0.044	-2.322	-0.039
Oral health 2 (Bleeding gums)	-2.056	-0.533	0.010	-3.541	-0.570
Oral health 2 (Other)	-1.906	-0.494	0.015	-3.391	-0.420
Waist hip	12.234	0.614	0.032	23.279	1.190

Table 7: The unadjusted and adjusted R-squared values from the multiple regression between the BMI of the GO group and the independent variables in the GO group.

R	Adjusted R Square	p-value	95.0% Confidence Interval	
			Lower Bound	Upper Bound
0.898	0.887	0.147	-3.903	25.456

Table 8: The correlation between BMI and the independent variables in the GO group.

Variables	Unstandardized Coefficients Beta	Standardized Coefficients Beta	p-value	95.0% Confidence Interval Lower Bound	95.0% Confidence Interval Upper Bound
Age	-0.073	-0.114	0.045	-0.147	0.000
Waist hip	46.416	0.259	0.000	64.654	28.178
Circumference	0.773	1.049	0.000	0.697	0.848
First periodontal probe (Other)	8.696	0.296	0.013	1.851	15.541
Second periodontal probe (Other)	9.124	0.277	0.016	1.758	16.490
Third periodontal probe (Other)	9.626	0.311	0.012	2.208	17.043
Oral health 3 (Once day)	36.578	0.436	0.000	19.542	53.613
SE77a (Hypertension)	9.035	0.256	0.024	1.225	16.845

The correlation between BMI and the second periodontal probing under the category "other," with a positive regression coefficient (9.124), shows a positive or direct trend, where the presence of other findings is associated with higher BMI (p= 0.016).

The correlation between BMI and the third periodontal probing under the category "other," with a positive regression coefficient (9.626), shows a positive or direct trend, where the presence of other findings is associated with higher BMI (p= 0.012).

The correlation between BMI and oral health under the category "once a day," with a positive regression coefficient (36.578), shows a positive or direct trend, where the presence of the category "once a day" is associated with higher BMI (p= 0.0001).

The correlation between BMI and high blood pressure, with a positive regression coefficient (9.035), shows a positive or direct trend, where the presence of hypertension is associated with higher BMI (p= 0.024) (Figure 5).

Discussion and Conclusion

Obesity is defined as an excessive or anomalous deposit of adipose tissue in the body, which has harmful consequences for health, according to Vara M, et al. [30]. This is caused by an excess of calories ingested by the diet with respect to the basal calories consumed by the organism [23-27].

The oral cavity of a healthy adult without agenesia presents 32 teeth in normal conditions, showing in this way and case of an optimal disposition of the same, maximum efficiency in the development of the masticatory process and formation of the alimentary bolus, indispensable as an initial part of the digestion [30].

The Mexican population has a high rate of obesity, which is a serious socioeconomic problem for the country that has been addressed from different perspectives. This problem has been attributed to cultural and lifestyle factors. However, it has not been possible to delve into the origin of the situation and the reasons for this lifestyle [9-11]. According to the results obtained after collecting information from 170 people between the ages of 15 and 81 years, some alarming numbers are reflected: while the distribution by gender is slightly tending towards the female gender with 60%, non-use of dental prostheses in the sample as a whole is 86% on average. Meanwhile, 31.6% of the total sample needs dental prostheses. Which means that some people need prostheses despite the fact they don't have them?

Women in the three groups of obesity are the ones who present a higher proportion, in addition (55.6%, 68.2% and 68.7% in each group from type I to type III with a p-value of 0.725), as their size within the total sample is greater, we can make a hypothesis according to the higher proportion in the sample that they are the ones who have less use of prosthesis and a greater need.

This may be due to several reasons: on the one hand, in Mexico, the birth culture is oriented towards large families and several styles confirm the presence of altered oral health conditions during pregnancy, many of them involving tooth loss (pregnancy caries). Secondly, Mexican society is an eminently traditional society (especially in the lower and middle social classes), so the jobs with the greatest physical performance are performed by men. These jobs involve a higher caloric expenditure that can compensate to some extent for the excessive caloric intake.

In spite of all the above, this research can provide a basis on which to carry out studies on the importance of optimal oral health with the presence of all the dental pieces in the first phases of digestion and formation of the alimentary bolus. This oral health allows optimal performance in the ingestion of medium/high consistency foods, many of which are associated with the gold dietary standard that is the Mediterranean diet, which are vegetables, fruits, nuts, meat, bread, etc. It is advisable to continue carrying out studies that provide more evidence in this regard and that create a basis for social awareness of the importance not only of treatment but also of prevention in terms of oral health.

Also, this study may have the bias of studying a sample of Yucatan, which cannot be related to the whole population of Mexico, due to the huge differences among states of the country. Focusing on our sample, investigators can reduce bias by increasing the amount of people to represent the Yucatan population at least but COVID-19 restricts the mobility to people who wanted to come up to the health centers at that time. It must be considered to restudy this hypothesis with the aim of supporting scientific associations among degrees of obesity, use of dental prostheses, need of dental prostheses and gender mainly.

The main conclusion of the study is the relationship between a high body mass index and tooth loss, which is increased, which implies a worse diet, due to the difficulty of generating a correct bolus.

More studies are needed in order to focus on this presumptive relationship and other risk factors should be studied to confirm this association with more evidence or to increase the knowledge of the interaction between degrees of obesity and the presence or not of a complete dentition, focusing on variables like gender, age, diet or type of oral prosthesis.

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