Universidad Europea

GRADUATION PROJECT

Degree in Dentistry

ORAL AND DENTAL MANIFESTATIONS IN PATIENTS WITH OBESITY: A DESCRIPTIVE CROSS-SECTIONAL STUDY BASED ON CLINICAL AND SELF-REPORTED DATA

Madrid, academic year 2025/2026

Identification number: 116

RESUMEN

Introducción: El sobrepeso y la obesidad se asocian con una inflamación sistémica crónica de bajo grado que puede afectar negativamente a los tejidos orales. Sin embargo, la mayoría de los estudios utilizan exámenes clínicos y no recogen síntomas autoinformados por el paciente. **Objetivo:** Describir las manifestaciones orales y dentales autoinformadas en pacientes con sobrepeso u obesidad y explorar su asociación con variables conductuales mediante un cuestionario autoadministrado breve. **Material y métodos:** Estudio transversal descriptivo realizado en 67 pacientes con índice de masa corporal (IMC) ≥25 kg/m² reclutados en centros de salud pública, unidades privadas de obesidad y teleconsulta. Se administró un cuestionario autoadministrado estructurado que recoge hábitos de higiene oral, síntomas parodontales y percepción de salud oral. **Resultados:** Se observó una alta prevalencia de síntomas autoinformados: sangrado gingival (66,7%), encías doloridas (58,2%) y xerostomía (74,6%). La mayoría de los participantes presentaban hábitos de higiene oral subóptimos. No se encontraron asociaciones estadísticamente significativas entre la categoría de IMC y los síntomas orales, aunque se observaron tendencias descriptivas notables para la recesión gingival (31,4% sobrepeso frente a 45,5% obesidad). El cuestionario resultó fácil de completar para el 59,7% de los participantes. **Conclusiones:** Los pacientes con sobrepeso u obesidad presentan una elevada carga sintomática oral autoinformada. El instrumento utilizado demostró ser viable en entornos clínicos no dentales, lo que refuerza su potencial como herramienta de cribado en unidades de obesidad y atención primaria.

PALABRAS CLAVE

Odontología, obesidad, salud oral, enfermedad periodontal, cuestionario autoadministrado.

ABSTRACT

Introduction: Overweight and obesity are associated with a chronic low-grade systemic inflammation that can adversely affect oral tissues. However, most studies rely on clinical examinations and do not capture patient-reported symptoms. **Objective:** To describe self-reported oral and dental manifestations in patients with overweight or obesity and to explore their association with behavioural variables using a brief self-administered questionnaire. **Material and methods:** Cross-sectional descriptive study conducted in 67 patients with body mass index (BMI) ≥25 kg/m² recruited across public health centres, private obesity units, and teleconsultation services. A structured self-administered questionnaire capturing oral hygiene habits, periodontal symptoms, and self-rated oral health was used as a practical screening tool. **Results:** A high prevalence of self-reported symptoms was observed: gingival bleeding (66.7%), painful gums (58.2%), and xerostomia (74.6%). Most participants reported suboptimal oral hygiene practices. No statistically significant associations were found between BMI category and oral symptoms, although notable descriptive trends were observed for gingival recession (31.4% overweight vs. 45.5% obesity). The questionnaire was rated as easy to complete by 59.7% of participants. **Conclusions:** Patients with overweight or obesity present a high self-reported oral symptom burden. The questionnaire proved feasible in non-dental clinical settings, supporting its potential as a screening tool in obesity units and primary care.

KEYWORDS

Dentistry, obesity, oral health, periodontal disease, self-administered questionnaire.

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1. INTRODUCTION

Obesity is no longer understood simply as a problem of energy imbalance. It is now widely described as a chronic systemic condition whose consequences extend well beyond metabolic regulation, a shift that the European Regional Obesity Report 2023 reflects in its framing of the disease [1]. Globally, more than one billion people are currently affected, making it one of the most pressing public health issues of our time [2].

One of the key mechanisms through which obesity affects multiple organ systems is the endocrine activity of adipose tissue. Adipocytes release a range of adipokines and cytokines — among them leptin, adiponectin, TNF-α, and IL-6, that sustain a low-grade pro-inflammatory state associated with type 2 diabetes, cardiovascular disease, and metabolic syndrome [3,4]. This chronic inflammatory background has also been linked to oral health. Data from the NHANES cohort in the United States, for instance, show a higher prevalence and greater severity of periodontitis in obese individuals compared to normal-weight controls, a pattern that appears to be driven, at least in part, by these immune and metabolic alterations [5,6].

At the biological level, the inflammatory cascade triggered by excess adiposity affects periodontal tissues in several ways. Adipokines and cytokines impair neutrophil and macrophage function, reduce phagocytic capacity, and amplify gingival inflammation [3,7]. Beyond these direct immune effects, the oral microbiome appears to be altered in individuals with obesity. The concept of the oral-gut axis, which describes a bidirectional link between systemic dysbiosis and the subgingival microbial environment, helps explain why obesity-related metabolic changes are associated with reduced microbial diversity and an overgrowth of pro-inflammatory species including Fusobacterium nucleatum, Treponema denticola, and Prevotella intermedia [8,9,10]. The fact that bariatric surgery partially normalises the oral microbiome [11] lends additional support to the idea that metabolic state directly shapes oral ecology.

Shared lifestyle factors add another layer to this relationship. Diets high in refined sugars, reduced physical activity, and insufficient oral hygiene are risk factors for both conditions [12,13]. Clinically, the picture is fairly consistent across studies: individuals with a higher BMI tend to have deeper periodontal pockets, greater attachment loss, and more frequent bleeding on probing [14,15].

Despite this body of evidence, most existing studies are based on clinical examinations and do not include what patients themselves report about their oral symptoms [16]. Tools such as the

Oral Health Impact Profile (OHIP-14) and the Geriatric Oral Health Assessment Index (GOHAI) were not designed with patients with overweight or obesity in mind, and their applicability to this specific population remains limited [16]. Brief, self-administered questionnaires, when structured appropriately and tested in real-world settings, offer a practical way to capture patient-reported oral health data across different care contexts, including telemedicine.

2. OBJECTIVES

2.1 General objective

To describe self-reported oral and dental manifestations in patients with overweight or obesity and explore their association with behavioural factors using a self-administered questionnaire. Given the evidence linking excess adiposity to low-grade systemic inflammation and periodontal disease, this study operates under the working hypothesis that patients with overweight or obesity report a greater oral symptom burden than the general population, and that this symptom burden is related to lifestyle behaviours such as poor oral hygiene and physical inactivity.

2.2 Specific objectives

1. To identify the frequency and types of self-reported oral and dental symptoms (e.g., gingival bleeding, halitosis, tooth mobility, dry mouth) among patients with overweight or obesity.

2. To analyse the association between these oral manifestations and behavioural variables such as oral-hygiene habits, physical activity, and smoking.

3. To assess the clarity, feasibility, and understanding of the self-administered questionnaire across private obesity units, public health centres, and teleconsultation services.

3. MATERIAL AND METHODS

3.1 Study design

This study follows a cross-sectional descriptive and analytical design based on a self-administered questionnaire. To structure the research question, the PICO framework was applied: the population of interest (P) consists of patients with overweight or obesity; the instrument under study (I) is a brief structured questionnaire; and the outcome (O) is the description of oral symptoms and their association with behavioural variables. No formal

comparison group was defined, as this is a descriptive study without an intervention. The descriptive component characterises oral health symptoms and behaviours in this population, while the analytical component explores potential associations between hygiene habits, smoking, physical activity, and reported oral manifestations. Data were collected across three settings: a private obesity unit, public health centres, and a teleconsultation platform. As with all cross-sectional designs, the study captures a single point in time and does not allow causal conclusions.

3.2 Population and sample

The target population comprised patients with overweight or obesity attending obesity-related healthcare services. Inclusion criteria were: age ≥18 years; BMI ≥25 kg/m² (self-reported); ability to complete the questionnaire autonomously; and voluntary participation. Exclusion criteria were: cognitive or psychiatric conditions limiting autonomous response; major language comprehension difficulties; and immediate postoperative period following bariatric surgery (<1 month).

A pragmatic convenience sample was used. The final sample comprised 67 participants, 61 recruited online and 6 on paper, which falls within the 60–120 range defined as methodologically acceptable for an exploratory analytical study of this nature.

3.3 Settings and recruitment procedure

Recruitment took place in three settings: private obesity clinics, public primary care centres, and teleconsultation services. Eligible participants received a brief explanation of the study objectives and recorded their consent at the start of the questionnaire. The primary collection mode was an online platform (Microsoft Forms) accessible via QR code. When participants could not complete the digital version, a paper form was provided and responses were subsequently transcribed manually by the researcher, applying a verification procedure to avoid transcription errors. Estimated completion time was 5–7 minutes. No personal identifiers were collected at any stage.

3.4 Instrument

Data were collected using the Short Questionnaire on Oral and Dental Problems in Patients with Overweight (v1.3), developed and approved in the first phase of the project and used as a structured screening tool to explore self-reported oral symptoms in this population. The instrument comprises seven sections: centre context, sociodemographics, physical activity, oral

hygiene habits, dental attendance patterns, self-reported symptoms, and general perception of oral health. Question formats include nominal, ordinal, dichotomous, and Likert-type items; the Likert-type items used a three-point response scale (never / sometimes / frequently). The questionnaire is anonymous and accessible both digitally and on paper.

3.5 Variables and operationalization

Variables were grouped as follows: (i) sociodemographic variables, age, sex, education level, and years living with overweight or obesity; (ii) behavioural variables, toothbrushing frequency, floss and mouthwash use, smoking status, and physical activity; (iii) self-reported symptoms, gingival bleeding, halitosis, tooth mobility, xerostomia, painful gums, gingival recession, and pus or unpleasant taste around a tooth; and (iv) perception variables, self-rated gum health and questionnaire clarity. All variables were treated as categorical or ordinal. BMI was calculated as weight in kilograms divided by height in metres squared (kg/m^2) from self-reported values, and categorised according to WHO criteria [2].

3.6 Data collection procedure

All participants received standardised study information prior to completing the questionnaire. Paper responses were stored in sealed envelopes and transcribed into the digital database. Digital responses were automatically stored in a secure file. All data were checked for completeness and reviewed manually before statistical processing. No identifiable information was collected at any time.

3.7 Data analysis

Data were analysed using descriptive statistics: absolute frequencies and percentages for categorical variables, and mean ± standard deviation (SD) or median [interquartile range, IQR] for continuous variables, depending on distribution. For BMI and all other variables with missing responses, available-case analysis was applied, percentages were calculated based on the number of participants who responded to each item, without excluding participants or imputing missing values. To explore potential associations between categorical variables, Pearson's chi-square test was used. It must be noted that, given the limited sample size and the descriptive nature of the study, these analyses are exploratory only. They are not designed to establish causal relationships, and the results should be read as hypothesis-generating rather than confirmatory. No power calculation was carried out prior to data collection. Statistical analysis was performed using Microsoft Excel.

3.8 Ethical considerations

The study was submitted to the Ethics Committee of Universidad Europea de Madrid for review and approval. Participation was voluntary, anonymous, and non-remunerated. Informed consent was obtained digitally or on paper prior to questionnaire completion. Data were handled in accordance with the Declaration of Helsinki and applicable data protection legislation. No personal identifiers were collected or stored at any stage of the study. Faculty/Department approval code: **OD.001/2526**. Ethics Committee reference: **2025-746**.

4. RESULTS

4.1 Participation and sample flow

A total of **67 participants** completed the questionnaire during the data-collection period. Sixty-one responses (91.0%) were received through the online platform (Microsoft Forms, QR code) and six (9.0%) were collected on paper and subsequently transcribed manually. All 67 participants accepted informed consent and met the inclusion criteria. Eight participants (11.9%) did not provide both height and weight values; their Body Mass Index (BMI) could therefore not be calculated. All other variables were analysed using available-case data, without imputation, as described in the methodology.

4.2 Sample characteristics

The sociodemographic and anthropometric characteristics of the sample are presented in **Table 1**, with age and BMI distributions illustrated in **Figure 1** and **Figure 2**. Participants were distributed across all adult age groups, with the largest proportion in the 45–59 year range (31.3%), followed by 30–44 years (28.4%). Sex distribution was virtually equal (50.7% female; 49.3% male). Secondary education was most frequent (41.8%), followed by university education (38.8%). Recruitment was distributed across public health centres (43.3%), private obesity units (34.3%), teleconsultation services (13.4%), and other settings (9.0%).

Among the 59 participants with available anthropometric data, mean BMI was **30.2 ± 4.7 kg/m²** (median 28.8 kg/m², IQR 27.5–31.0). According to WHO classification [2], 59.3% were classified as overweight (BMI 25.0–29.9 kg/m²) and 37.3% as obese (BMI ≥30.0 kg/m²). Most participants (47.8%) had been living with excess weight for more than five years. A total of 19.4% reported a confirmed diagnosis of diabetes and 13.4% pre-diabetes.

Table 1. Sociodemographic and anthropometric characteristics of the sample (N = 67).

Variable	Category	n	%
Age group (N = 67)			
18–29 years	13	13	19.4%
30–44 years	19	19	28.4%
45–59 years	21	21	31.3%
≥60 years	14	14	20.9%
Sex (N = 67)			
Female	34	34	50.7%
Male	33	33	49.3%
Education level (N = 67)			
Primary or no schooling	10	10	14.9%
Secondary education	28	28	41.8%
University education	26	26	38.8%
Other	3	3	4.5%
Recruitment setting (N = 67)			
Public health centre	29	29	43.3%
Private obesity unit	23	23	34.3%
Teleconsultation	9	9	13.4%
Other	6	6	9.0%
Data collection mode (N = 67)			
Online (Microsoft Forms / QR)	61	61	91.0%
Paper (manual transcription)	6	6	9.0%
BMI — kg/m² (n = 59)*			
Mean ± SD	30.2 ± 4.7 kg/m²		—
Median [IQR]	28.8 [27.5–31.0] kg/m²		—
BMI category — WHO (n = 59)			
Normal weight (18.5–24.9)	2	2	3.4%
Overweight (25.0–29.9)	35	35	59.3%
Obesity (≥30.0)	22	22	37.3%
Duration of overweight (N = 67)			
< 1 year	9	9	13.4%
1–5 years	22	22	32.8%

Variable	Category	n	%
> 5 years	32	32	47.8%
Not sure	4	4	6.0%
Smoking status (N = 67)			
Non-smoker	39	39	58.2%
Daily smoker	13	13	19.4%
Occasional smoker	9	9	13.4%
Ex-smoker	6	6	9.0%
Glycaemic status / diabetes (N = 67)			
No known alteration	37	37	55.2%
Diabetes	13	13	19.4%
Pre-diabetes	9	9	13.4%
Unknown	8	8	11.9%

Note. BMI = Body Mass Index; IQR = Interquartile Range; SD = Standard Deviation. *BMI calculated from self-reported weight and height; missing for 8 participants (11.9%). BMI-category percentages based on available cases (n = 59).

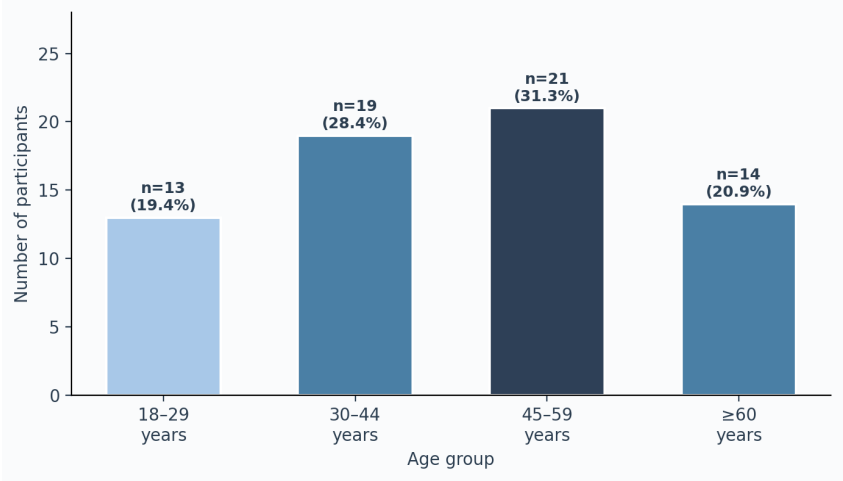


Figure 1. Distribution of participants by age group (N = 67). Own elaboration.

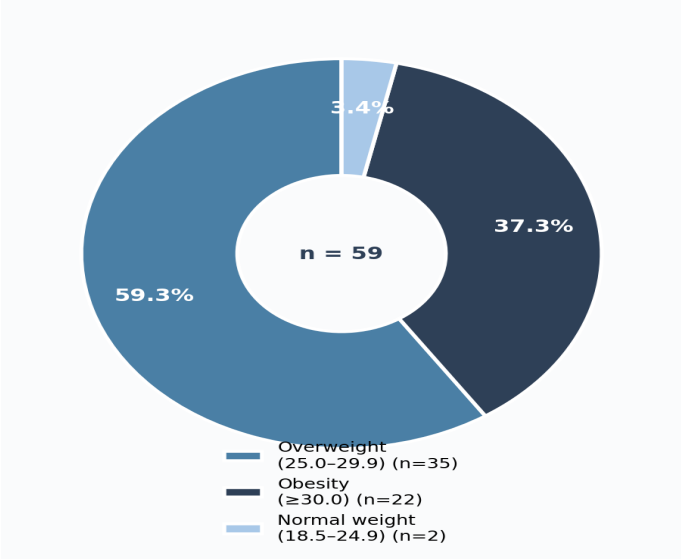


Figure 2. Distribution of participants by BMI category according to WHO classification [2] (n = 59). Own elaboration.

4.3 Oral hygiene habits and dental attendance

Oral hygiene behaviours and dental attendance are shown in **Table 2** and **Figure 3**. Nearly half of participants brushed twice or more daily (47.0%), while 43.9% brushed once daily and 9.1% less than once per day. Interdental cleaning was largely inadequate: 47.8% used dental floss or interdental brushes rarely or never, and only 23.9% daily. Mouthwash was similarly underused (52.2% rarely or never). Regarding dental attendance, 41.8% had last visited a dentist 6–12 months previously, 29.9% more than 12 months ago, and only 17.9% within the preceding six months. Concerning physical activity, 50.7% exercised 1–2 days per week and 29.9% were almost physically inactive.

Table 2. Oral hygiene habits, dental attendance, and physical activity (N = 67).

Variable	Response	n	%
Toothbrushing frequency (n = 66)			
	≥ 2 times/day	31	47.0%
	Once a day	29	43.9%
	< Once a day	6	9.1%
Interdental cleaning (n = 67)			
	Rarely or never	32	47.8%
	2–3 times/week	19	28.4%
	Daily	16	23.9%

Variable	Response	n	%
Mouthwash use (n = 67)			
Rarely or never		35	52.2%
Daily		20	29.9%
2–3 times/week		12	17.9%
Last dental visit (n = 67)			
< 6 months ago		12	17.9%
6–12 months ago		28	41.8%
> 12 months ago		20	29.9%
Not sure		7	10.4%
Physical activity — days/week (n = 67)			
Never or almost never		20	29.9%
1–2 days/week		34	50.7%
3–5 days/week		12	17.9%
Almost daily		1	1.5%

Note. Percentages calculated on available cases. One participant did not respond to the toothbrushing item (n = 66 for that variable).

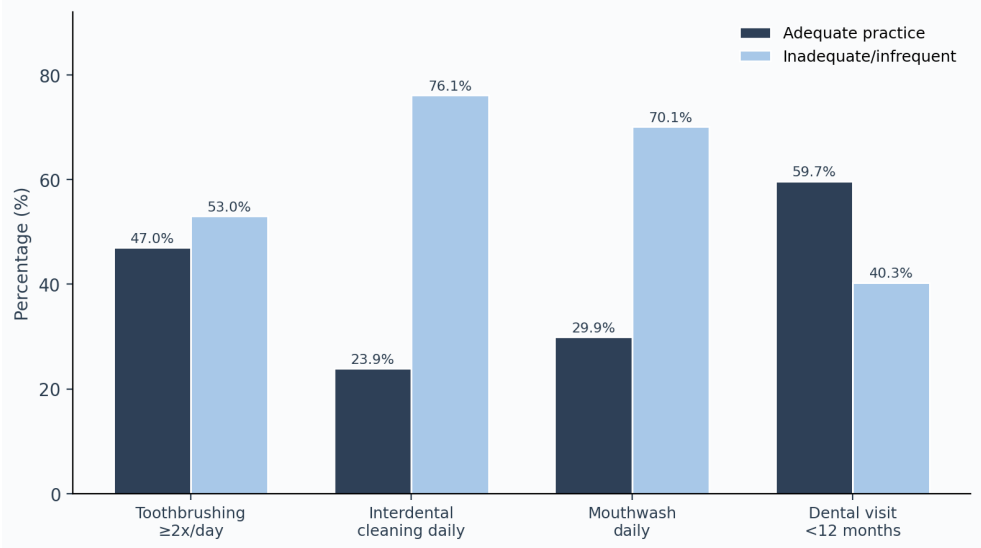


Figure 3. Comparison of adequate versus inadequate oral hygiene practices and dental attendance (N = 67). 'Adequate' is defined as brushing ≥2×/day, daily interdental cleaning, daily mouthwash, and dental visit within 12 months. Own elaboration.

4.4 Self-reported oral and periodontal symptoms

The frequency of self-reported oral symptoms is detailed in **Table 3** and summarised in **Figure 4** Gingival bleeding was highly prevalent, with 57.6% reporting it sometimes and 9.1% frequently; only 33.3% reported no bleeding. Painful or inflamed gums in the past year were reported by 58.2% of participants. Dry mouth (xerostomia) was the most widely reported symptom overall, affecting 74.6% of participants to some degree. Gingival recession was noted by 36.4%, pus or an unpleasant taste by 24.2%, and tooth mobility by 16.7%.

Despite this symptom burden, 68.6% of participants rated their gum health as good or excellent and only 6.0% as poor, suggesting a possible underestimation of periodontal risk. When asked whether they would accept a periodontal referral if recommended, 64.2% answered yes. Regarding questionnaire feasibility, 59.7% found it easy to complete and only 9.0% reported difficulty.

Table 3. Self-reported oral and periodontal symptoms, self-rated gum health, and questionnaire feasibility (N = 67).

Symptom	Response	n	%
Gingival bleeding on brushing/flossing (n = 66)			
	Never	22	33.3%
	Sometimes	38	57.6%
	Frequently	6	9.1%
Painful or inflamed gums — past year (n = 67)			
	No	28	41.8%
	Yes, mildly	35	52.2%
	Yes, severely	4	6.0%
Persistent halitosis despite brushing (n = 67)			
	No	34	50.7%
	Sometimes	28	41.8%
	Frequently	5	7.5%
Tooth mobility (n = 66)			
	No	55	83.3%
	Yes	11	16.7%
Gingival recession (n = 66)			

Symptom	Response	n	%
No		42	63.6%
Yes		24	36.4%
Pus or unpleasant taste around a tooth (n = 66)			
No		50	75.8%
Yes		16	24.2%
Dry mouth / xerostomia (n = 67)			
Never		17	25.4%
Sometimes		38	56.7%
Frequently		12	17.9%
Self-rated gum health (n = 67)			
Excellent		8	11.9%
Good		38	56.7%
Fair		17	25.4%
Poor		4	6.0%
Would accept periodontal referral (n = 67)			
Yes		43	64.2%
Not sure		11	16.4%
No		13	19.4%
Questionnaire clarity (n = 67)			
Easy		40	59.7%
Neither easy nor difficult		21	31.3%
Difficult		6	9.0%

Note. Percentages calculated on available cases. One participant did not respond to gingival bleeding, tooth mobility, gingival recession, and pus items (n = 66 for those variables).

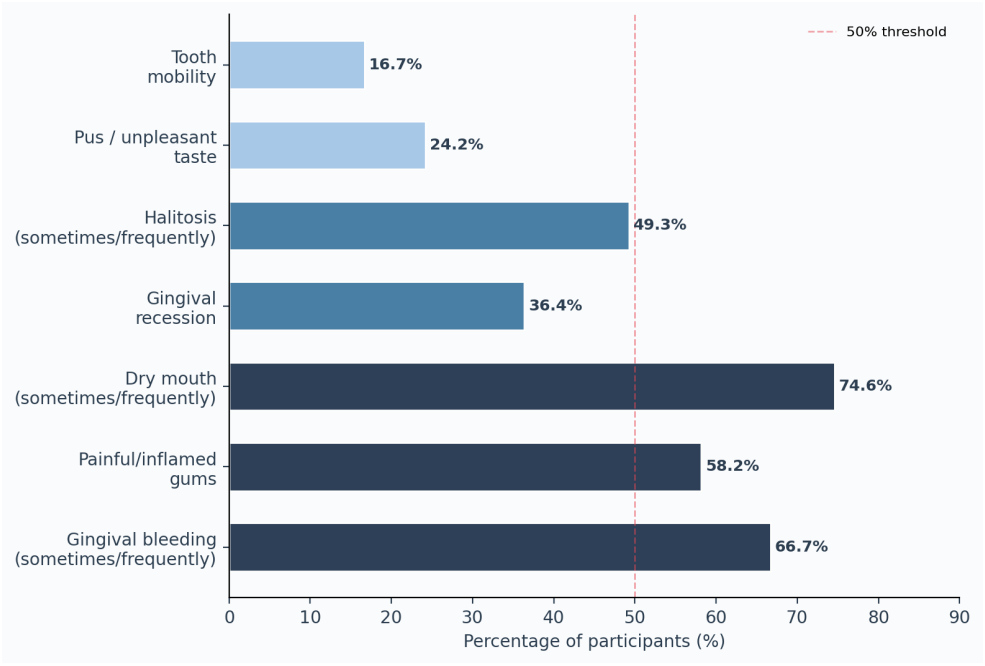


Figure 4. Prevalence of self-reported oral symptoms among patients with overweight or obesity (N = 67). Bars represent the percentage of participants reporting each symptom at least sometimes or as present. Own elaboration.

4.5 Exploratory association analysis

Four pre-specified exploratory associations were examined using chi-square tests (**Table 4**), following the study protocol. All findings represent statistical associations only and cannot be interpreted as causal relationships given the observational cross-sectional design.

None of the four associations reached statistical significance ($\alpha = 0.05$). The association between BMI category and self-rated gum health showed the highest chi-square value ($\chi^2 = 8.06$, $p = 0.234$). The association between smoking and halitosis was the closest to significance ($\chi^2 = 11.89$, $p = 0.065$), suggesting a possible trend. **Figure 5** illustrates gingival bleeding distribution by BMI category, and **Figure 6** provides a descriptive comparison of all symptoms between overweight and obese participants. A descriptive trend was observed for gingival recession (31.4% overweight vs. 45.5% obesity, +14.1 percentage points) and tooth mobility (11.8% vs. 18.2%), consistent with a possible dose-response pattern that warrants investigation in larger samples [14,6].

Table 4. Exploratory chi-square association analysis between selected variables and self-reported oral symptoms (n = 57–67).

Association tested	n	χ^2	df	p-value	Significant
BMI category × Gingival bleeding	58	5.01	4	0.286	No

Association tested	n	χ^2	df	p-value	Significant
BMI category × Gingival recession	59	1.28	2	0.527	No
BMI category × Self-rated gum health	59	8.06	6	0.234	No
Smoking status × Halitosis	67	11.89	6	**0.065**	**No (trend)**

Note. df = degrees of freedom. No association reached statistical significance ($p < 0.05$). The smoking–halitosis association showed a non-significant trend ($p = 0.065$). Results are descriptive; causal interpretation is not possible with this design.

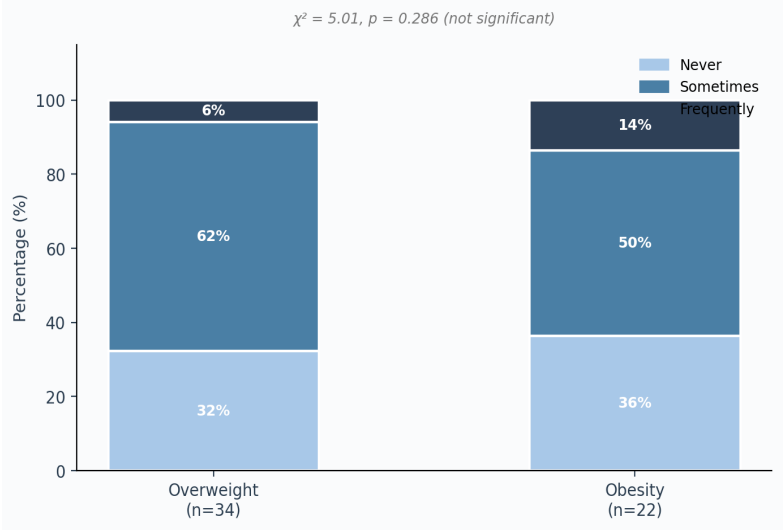


Figure 5. Distribution of gingival bleeding frequency by BMI category (n = 56). Chi-square test: $\chi^2 = 5.01$, $p = 0.286$ (not significant). Percentages within each BMI group. Own elaboration.

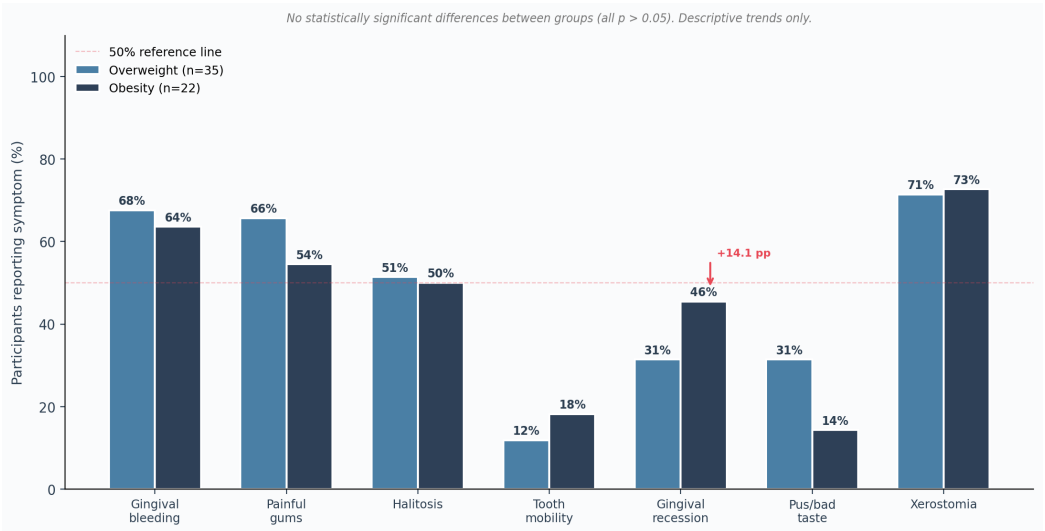


Figure 6. Descriptive comparison of self-reported oral symptoms between participants with overweight (n = 35) and those with obesity (n = 22). No statistically significant differences were found between groups (all $p > 0.05$). Results are exploratory only. Own elaboration.

5. DISCUSSION

5.1 Overall interpretation of results

The 67 participants recruited in this study showed a high prevalence of patient-reported oral symptoms, which is broadly in line with what the literature has been describing over the past decade regarding oral health in adults with excess weight [14,7]. That said, it is important to note that all data come from questionnaire responses, no clinical examination was performed, and this must be kept in mind when interpreting the findings.

The mean BMI of 30.2 ± 4.7 kg/m² places the sample at the overweight-to-obesity boundary according to WHO criteria [2]. Almost half the participants (47.8%) had been living with excess weight for more than five years, which is clinically relevant: chronic adiposity is associated with sustained low-grade systemic inflammation rather than a transient episode [3]. This prolonged inflammatory state is thought to progressively compromise the periodontal attachment apparatus through cytokine-mediated mechanisms, even before frank metabolic disease develops [4,7].

5.2 Prevalence of symptoms and comparison with the literature

Gingival bleeding was the most frequently reported active periodontal sign, affecting 66.7% of participants to some degree. This is considerably higher than prevalences reported in non-obese adult samples across Europe, which typically range between 20% and 40% [5,6]. The difference is biologically plausible: adipose tissue releases pro-inflammatory mediators, leptin, TNF-α, IL-6, that increase vascular permeability and impair the local immune response at the gingival level [3,4]. Araújo et al. [8] and Alarcón-Sánchez et al. [9] both describe how this inflammatory environment selects for a more pathogenic subgingival microbiota, which would further explain the elevated bleeding rates in this sample.

Xerostomia was the most widely reported symptom overall, affecting 74.6% of participants to some extent. In this sample, 32.8% reported diabetes or pre-diabetes, conditions frequently treated with medications that carry xerostomic side effects, particularly antidiabetics and antihypertensives [17]. Salivary microbiome changes observed after metabolic interventions

such as bariatric surgery [11] further suggest that salivary function in this population is influenced by the metabolic environment itself. These findings are consistent with cross-sectional studies specifically linking xerostomia to obesity and associated systemic conditions [18,19]. Regardless of mechanism, the high frequency of xerostomia points to a need for routine salivary screening in obesity and endocrinology consultations, settings where oral health is rarely evaluated systematically.

Gingival recession was noted by 36.4% of participants, consistent with findings from Rajasekar et al. [15], who reported significantly higher rates of clinical attachment loss in individuals with higher BMI in a cross-sectional study. Pus or an unpleasant taste (24.2%) and tooth mobility (16.7%) were also present in a proportion that cannot be dismissed, and may reflect undiagnosed or untreated periodontitis, a disease that shares several pathophysiological pathways with obesity according to the EFP-WOF consensus [7].

5.3 Oral hygiene habits and dental attendance

The oral hygiene practices observed in this sample were largely suboptimal. Less than half of participants brushed twice or more daily (47.0%), and interdental cleaning was almost absent in nearly half (47.8% rarely or never). These figures are consistent with, although slightly lower than, data from comparable Spanish adult cohorts [12,13]. Low dental attendance is particularly concerning: nearly one in three participants (29.9%) had not visited a dentist in over 12 months. This pattern is problematic in a population where periodontal disease tends to progress silently until advanced stages [14,20], as early signs such as bleeding or mild pain rarely motivate spontaneous care-seeking.

5.4 Exploratory associations: trends and limitations

None of the four chi-square tests performed reached statistical significance, which is not surprising given the limited sample size (n = 57–67). More informative, however, is the direction of the observed trends. Gingival recession was reported by 31.4% of participants with overweight and 45.5% of those with obesity, a 14.1 percentage point difference that, while not statistically significant here, aligns with the dose-response relationship between BMI and attachment loss described in the umbrella review by Arbildo-Vega et al. [6]. The high global prevalence of gingival recession reported in systematic reviews [21,22] further contextualises these findings and reinforces the clinical relevance of monitoring this condition in metabolically

compromised populations. Tooth mobility showed a similar directional trend. These findings are exploratory and should not be interpreted causally [14,7].

The association between smoking and halitosis ($p = 0.065$) was the closest to significance. Tobacco is a recognised driver of volatile sulphur compound production and microbial dysbiosis in the gingival sulcus [10,20]. The absence of formal significance likely reflects the moderate proportion of current smokers in the sample (32.8%) and the reliance on subjectively reported halitosis rather than organoleptic measurement.

5.5 Discordance between symptom burden and self-rated oral health

One of the most notable findings is the contrast between the high symptom prevalence and the relatively positive self-rated gum health: 68.6% of participants considered their gum health good or excellent, despite the majority reporting gingival bleeding and more than half reporting painful gums. This discordance has been documented in general population studies [16] and reflects low oral health literacy, people normalize symptoms they have experienced for years and do not associate them with disease. Studies have consistently shown that low oral health literacy is associated with an inability to correctly interpret periodontal symptoms, leading to underestimation of disease severity [23,24]. From a clinical standpoint, the high proportion of participants willing to attend a periodontal referral if recommended (64.2%) suggests that professional guidance could be an effective lever for increasing care-seeking behaviour in this population.

5.6 Feasibility of the questionnaire

The self-administered questionnaire demonstrated good feasibility across all three recruitment settings. The online response rate (91.0%), the low proportion reporting difficulty (9.0%), and the minimal item-level missing data all support its practical usability. This is relevant because most existing oral health tools, such as the OHIP-14, were not developed specifically for patients with overweight or obesity [16], and their length or language may be unsuitable in non-dental clinical contexts. The questionnaire's ability to capture a broad range of symptoms within a brief format strengthens its potential as a first-line screening instrument in obesity clinics or primary care.

5.7 Limitations

This study has several limitations. The cross-sectional design precludes causal inference; all observed associations are descriptive and may reflect unmeasured confounders. All data,

including weight, height, and symptoms, are self-reported, introducing potential recall bias and underreporting of adiposity, which is well-documented in the literature [25,13]. The sample of 67 participants was sufficient for descriptive purposes but limited for reliable inferential analysis. Two participants recorded a BMI below 25 kg/m² (18.5–24.9 kg/m²) despite meeting the self-reported inclusion criterion of BMI ≥25 kg/m²; this discrepancy most likely reflects the well-documented tendency to underestimate body weight in self-reported anthropometric data [25], and these participants were retained in the available-case analysis. Recruitment across three different settings introduces heterogeneity in disease severity, health literacy, and access to care. The absence of a clinical periodontal examination means that self-reported symptoms could not be validated against objective criteria such as probing depth or clinical attachment level [7,20]. Notwithstanding these limitations, this study provides an initial characterisation of self-reported oral health in a real-world sample of patients with overweight or obesity, and demonstrates the feasibility of collecting this information through a brief instrument across multiple healthcare settings.

5.8 Future perspectives

Several directions emerge from this study for future research. A primary priority would be to integrate the questionnaire with a comprehensive clinical periodontal examination, thereby enabling direct comparison between patient-reported symptoms and objective clinical parameters such as probing depth and clinical attachment level, an approach that was not feasible within the scope of the present study.

. Beyond that, studies with larger samples and longitudinal designs would be needed to move from description to causal analysis, and to better understand whether the trends observed here, particularly for gingival recession and tooth mobility across BMI categories, reflect a true dose-response pattern. The screening questionnaire itself could also be refined and tested in other clinical contexts, with the goal of evaluating its usefulness as a first-line oral health assessment tool in obesity units or primary care settings where dentists are not routinely present.

6. CONCLUSIONS

The following conclusions are drawn in response to the specific objectives of this study:

1. Gingival bleeding (66.7%), xerostomia (74.6%), and painful or inflamed gums (58.2%) were the most frequently reported oral symptoms among patients with overweight or obesity in this sample, indicating a high self-reported oral symptom burden in this population.

2. No statistically significant associations were found between BMI category and oral symptom patterns. However, descriptive trends were observed for gingival recession (+14.1 percentage points between overweight and obesity groups) and tooth mobility, which are consistent with a possible dose-response pattern described in the existing literature. The smoking–halitosis association approached significance ($p = 0.065$) but did not reach the $\alpha = 0.05$ threshold, likely due to the limited statistical power of the present sample.

3. The self-administered questionnaire proved feasible and well-accepted across all three recruitment settings (public health centres, private obesity units, and teleconsultation), with 91.0% of responses collected online and 59.7% of participants rating it as easy to complete, supporting its potential as a first-line oral health screening tool in non-dental clinical contexts.

7. SUSTAINABILITY

This study contributes to sustainable development across three dimensions, aligned with the United Nations Sustainable Development Goals (SDGs). From a social perspective, it directly addresses SDG 3 (Good Health and Well-being) by investigating the oral health of patients with overweight or obesity, a chronically ill population in whom oral health needs are systematically underestimated. The self-administered questionnaire provides a low-cost screening tool reducible inequality in access to oral health assessment (SDG 10). From an environmental perspective, the predominantly digital data collection format (91.0% online) minimised paper consumption and supports environmentally responsible research practices. From an economic perspective, early identification of periodontal risk through a brief questionnaire has the potential to reduce long-term healthcare costs associated with advanced periodontitis treatment. Integrating oral health screening into obesity or primary care consultations at minimal additional cost contributes to the prevention-oriented health systems envisioned under SDG 3 and SDG 8 (Decent Work and Economic Growth).

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9. ANNEXES

ANNEX I. Informed consent and self-administered questionnaire (Spanish version)

Consentimiento

Este cuestionario forma parte de un Trabajo de Fin de Grado (TFG) aprobado por la Universidad Europea de Madrid. El estudio ha sido evaluado y autorizado por la Comisión de Investigación de la Universidad (Código de aprobación: CI 2025-746). El objetivo es analizar la relación entre el sobrepeso y la salud bucodental en población adulta. La participación es voluntaria y anónima. No se recogerán datos personales identificativos como nombre, correo electrónico, número de teléfono ni dirección IP. El cuestionario puede realizarse en centros sanitarios públicos, centros privados o mediante consultas presenciales y por videoconsulta. Las respuestas serán utilizadas exclusivamente con fines docentes y de investigación académica, de acuerdo con los principios éticos y la normativa vigente en protección de datos. Al continuar con el cuestionario, usted confirma que: tiene 18 años o más; ha leído y comprendido la información proporcionada; acepta participar de forma libre y voluntaria. Tiempo estimado de cumplimentación: 5–7 minutos.

Consentimiento informado

□ Confirmo que tengo 18 años o más y acepto participar voluntariamente.

□ No deseo participar.

Cuestionario

2. Tipo de centro o modalidad de atención

□ Centro sanitario público

□ Centro sanitario privado (incluye unidades especializadas)

□ Teleconsulta (incluye videollamadas y consultas telefónicas)

□ Otros

3. Edad

□ 18-29 años □ 30-44 años □ 45-59 años □ 60 años o más

4. Sexo

□ Hombre □ Mujer □ Otro □ Prefiero no responder

5. Nivel educativo

□ Estudios primarios o sin estudios □ Educación secundaria □ Estudios universitarios

6. Altura (en centímetros): _____

7. Peso (en kilogramos): _____

8. ¿Cuánto tiempo lleva con sobrepeso?

□ Menos de 1 año □ Entre 1 y 5 años □ Más de 5 años □ No estoy seguro/a

9. Situación respecto al tabaco

□ No fumo □ Fumo a diario □ Fumo de forma ocasional □ Ex-fumador/a

10. Situación respecto a la glucosa o diabetes

□ No tengo alteraciones conocidas □ Pre-diabetes □ Diabetes □ No lo sé

11. ¿Siente sensación de boca seca con frecuencia?

□ Nunca □ A veces □ Con frecuencia

12. En una semana normal, ¿con qué frecuencia realiza actividad física o ejercicio?

□ Nunca o casi nunca □ 1-2 días por semana □ 3-5 días por semana □ Todos o casi todos los días

13. ¿Con qué frecuencia realiza ejercicios de fuerza o tonificación muscular?

□ Nunca o casi nunca □ 1 día por semana □ 2 o más días por semana

14. Frecuencia de cepillado dental

□ Dos o más veces al día □ Una vez al día □ Menos de 1 vez al día

15. Uso de hilo dental o cepillos interdentales

□ A diario □ 2-3 veces por semana □ Rara vez o nunca

16. Uso de enjuague bucal

□ A diario □ 2-3 veces por semana □ Rara vez o nunca

17. ¿Cuándo fue la última visita al dentista?

□ Hace menos de 6 meses □ Entre 6 y 12 meses □ Hace más de 12 meses □ No estoy seguro/a

18. Si no acude al dentista con regularidad, ¿cuál es el principal motivo?

□ Coste económico □ Falta de tiempo □ Ansiedad o miedo al dentista □ Dificultad para conseguir una cita □ No lo considero necesario □ Otro

19. ¿Le sangran las encías al cepillarse o al usar hilo dental?

□ Nunca □ A veces □ Con frecuencia

20. ¿Ha notado encías doloridas o inflamadas durante el último año?

□ No □ Sí, de forma leve □ Sí, de forma importante

21. ¿Presenta mal aliento persistente a pesar del cepillado?

□ No □ A veces □ Con frecuencia

22. ¿Ha notado que algún diente se mueve o está flojo?

□ No □ Sí

23. ¿Ha notado que las encías se han reteído o que los dientes se ven más largos?

□ No □ Sí

24. ¿Ha notado pus o un sabor desagradable alrededor de un diente?

□ No □ Sí

25. ¿Cómo calificaría su salud de encías?

□ Excelente □ Buena □ Regular □ Mala

26. Si un profesional le recomendara una revisión periodontal, ¿acudiría?

□ Sí □ No □ No estoy seguro/a

27. ¿Qué tal fácil le resultó entender este cuestionario?

□ Fácil □ Ni fácil ni difícil □ Difícil

28. Tiempo aproximado empleado en responder el cuestionario (en minutos): _____

ANNEX I (continued). Informed consent and self-administered questionnaire (English version)

Informed Consent

This questionnaire is part of a Final Degree Project (TFG) approved by Universidad Europea de Madrid. The study has been reviewed and authorised by the University's Research Ethics Committee (Approval code: CI 2025-746). The aim is to analyse the relationship between overweight and oral health in the adult population. Participation is voluntary and anonymous. No personal identifying data will be collected such as name, email address, telephone number or IP address. The questionnaire may be completed at public health centres, private centres, or through face-to-face or video consultations. Responses will be used exclusively for academic teaching and research purposes, in accordance with ethical principles and applicable data protection regulations. By continuing with the questionnaire, you confirm that: you are 18 years of age or older; you have read and understood the information provided; you agree to participate freely and voluntarily. Estimated completion time: 5–7 minutes.

Informed consent

□ I confirm that I am 18 years of age or older and agree to participate voluntarily.

□ I do not wish to participate.

Questionnaire

2. Type of centre or mode of care

□ Public health centre □ Private health centre (including specialist units) □ Teleconsultation (including video calls and telephone consultations) □ Other

3. Age

□ 18-29 years □ 30-44 years □ 45-59 years □ 60 years or older

4. Sex

□ Male □ Female □ Other □ Prefer not to say

5. Level of education

□ Primary education or no schooling □ Secondary education □ University education

6. Height (in centimetres): _____

7. Weight (in kilograms): _____

8. How long have you been overweight?

□ Less than 1 year □ Between 1 and 5 years □ More than 5 years □ Not sure

9. Smoking status

□ Non-smoker □ Daily smoker □ Occasional smoker □ Ex-smoker

10. Glycaemic status / diabetes

□ No known alteration □ Pre-diabetes □ Diabetes □ Not sure

11. Do you frequently experience a sensation of dry mouth?

□ Never □ Sometimes □ Frequently

12. In a normal week, how often do you engage in physical activity or exercise?

□ Never or almost never □ 1-2 days per week □ 3-5 days per week □ Every or almost every day

13. How often do you do strength or muscle-toning exercises?

□ Never or almost never □ 1 day per week □ 2 or more days per week

14. Toothbrushing frequency

□ Twice or more per day □ Once a day □ Less than once a day

15. Use of dental floss or interdental brushes

□ Daily □ 2-3 times per week □ Rarely or never

16. Use of mouthwash

□ Daily □ 2-3 times per week □ Rarely or never

17. When was your last dental visit?

□ Less than 6 months ago □ Between 6 and 12 months ago □ More than 12 months ago □ Not sure

18. If you do not visit the dentist regularly, what is the main reason?

□ Financial cost □ Lack of time □ Dental anxiety or fear □ Difficulty getting an appointment □ I do not consider it necessary □ Other

19. Do your gums bleed when you brush or floss?

□ Never □ Sometimes □ Frequently

20. Have you noticed sore or swollen gums in the past year?

□ No □ Yes, mildly □ Yes, severely

21. Do you have persistent bad breath despite brushing?

□ No □ Sometimes □ Frequently

22. Have you noticed any loose or mobile teeth?

□ No □ Yes

23. Have you noticed that your gums have receded or that your teeth look longer?

□ No □ Yes

24. Have you noticed pus or an unpleasant taste around a tooth?

□ No □ Yes

25. How would you rate your gum health?

□ Excellent □ Good □ Fair □ Poor

26. If a clinician recommended a periodontal review, would you attend?

□ Yes □ No □ Not sure

27. How easy did you find this questionnaire to understand?

□ Easy □ Neither easy nor difficult □ Difficult

28. Approximate time taken to complete the questionnaire (in minutes): _____