Goliger M, Halabi M, Nasimov B, et al. Association Between Serum Testosterone Levels and Self-Reported Oral Health: Insights from a Nationally Representative Sample. *PJOM*. 2025;4:10-14. doi:10.55070/001c.134091

Medical Journal

Association Between Serum Testosterone Levels and Self-Reported Oral Health: Insights from a Nationally Representative Sample

Myles Goliger[1], Marco Halabi[2], Benjamin Nasimov[3], Samson Balakhani[3], Yaacov Fakiro[4], Esther Auerbach[1], Shmuel Halpert[2], Gavriel Hizami[1], Marc Ganz[1]

[1] SUNY Downstate Health Sciences University, [2] Technion – Israel Institute of Technology, [3] Touro College of Dental Medicine, [4] Touro University Nevada

Keywords: oral health, testosterone, NHANES

https://doi.org/10.55070/001c.134091

Physician's Journal of Medicine

Vol. 4, 2025

Introduction

Oral health is closely linked to overall health and quality of life, yet disparities persist across socioeconomic and demographic lines. Hormonal influences, particularly testosterone, may play a role in oral health via mechanisms related to immunity, bone turnover, and inflammation. While some studies have suggested a connection between low testosterone and poorer oral health, large-scale population-based data are limited. This study aims to examine the association between serum testosterone levels and self-reported poor oral health in a nationally representative sample, while adjusting for demographic and socioeconomic confounders.

Methods

Data were obtained from the 2021–2023 cycle of the National Health and Nutrition Examination Survey (NHANES). Adults aged 18 and older with available serum testosterone levels and self-reported oral health data were included. Poor oral health was defined as reporting mouth pain in the past year. A multivariable logistic regression model was used to assess the association between testosterone levels and poor oral health, adjusting for age, gender, race/ethnicity, marital status, and educational attainment.

Results

The final sample included 11,729 participants, of whom 21.3% reported poor oral health. Testosterone levels were not significantly associated with poor oral health after adjustment (OR = 0.99; 95% CI: 0.98–1.01; p = 0.116). However, increased age was associated with decreased odds of reporting poor oral health (OR = 0.99; p < 0.001), and higher educational attainment was significantly associated with lower likelihood of poor oral health. Racial disparities were also observed, with Hispanic and White participants less likely to report poor oral health than Black participants.

Conclusion

Testosterone levels were not independently associated with reported poor oral health in this nationally representative sample. Sociodemographic factors, particularly age, race, and education, were more strongly associated with oral health outcomes. These findings highlight the importance of addressing structural disparities in oral health and suggest that hormonal influences may be more nuanced or population-specific. Future research should explore testosterone's role within gender-stratified or hormone-deficient populations.

INTRODUCTION

Oral health is a key indicator of overall well-being and is closely linked to both physical and psychological health. Poor oral health—including conditions such as tooth pain, gum disease, and mouth discomfort are associated with reduced quality of life, impaired nutrition, and an increased risk of systemic illness.[1,2] Despite poor oral health being largely preventable, disparities persist across socioeconomic, racial, and demographic lines.[3,4] In recent years, there has been a growing focus of how biological and hormonal mediators influence susceptibility to oral disease.[5]

This rationale is driven by the knowledge that sex hormones have an active role in many processes that relate to oral health such as maintenance of mucus membranes, host immunity, and bone turnover.[6-8] Estrogen and progesterone effects on oral health have been observed in some previous studies but the prevalence of oral health observation looking at associations with testosterone has not been explored to the same degree.[9]

Testosterone, the primary male sex hormone, plays a well-established role in growth, metabolism, and immune function. Emerging research suggests that testosterone may also influence oral and periodontal health through mechanisms related to inflammation, bone metabolism, and mucosal immunity.[10,11] Low testosterone levels, particularly in older men, have been linked to poorer oral health outcomes in some observational studies.[12] However, the evidence remains limited, and few large-scale, population-based studies have examined this association while accounting for potential confounders. Within these confounders include gender differences in average testosterone and if this contributes to reduced or improved oral health via their metabolic processes.

Gender is also a known modifier in both hormonal physiology and oral health outcomes. Differences in sex hormone levels may help to explain biological, behavioral, and social determinant imbalances between men and women for oral health. For instance, women are more likely to seek dental care and report symptoms, whereas men may be more affected by the consequences of hormonal deficiencies.[13,14] Exploring the impacts of gender and the associated variances of testosterone with ties to oral health could provide pathways to targeted prevention and intervention for patients.

Given these links, this study aims to examine whether testosterone levels are associated with reported poor oral health in a large and nationally representative sample of U.S. adults. We also evaluate how this relationship may be influenced by age, gender, education, race, and marital status. By leveraging data from the National Health and Nutrition Examination Survey (NHANES),[15] this study contributes to a growing body of literature exploring how hormonal and demographic factors impact oral health disparities.

MATERIALS & METHODS

DATA COLLECTION

This study analyzed data from the National Health and Nutrition Examination Survey (NHANES), a program administered by the CDC. We used data from the 2021–2023 NHANES cycle, specifically drawing from the Demographics, Depression, and Oral Health Examination sections, as well as the laboratory data on serum testosterone levels. NHANES provides a nationally representative sample of the U.S. population and includes a wide range of health-related variables.

VARIABLES

The primary outcome was oral health status, determined based on a self-reported measure of mouth pain experienced in the past year. Participants were categorized into two groups: those with good oral health (no reported mouth pain) and those with poor oral health (reported experiencing mouth pain).

The primary independent variable was serum testosterone level, measured in nmol/L. Additional covariates included age, gender, race/ethnicity, educational attainment, and marital status. Race was grouped into three primary categories: Black, Hispanic, and White, with all others coded as "NA." Educational attainment was categorized into five standard levels. Marital status was simplified into a binary variable: married or not married.

STATISTICAL ANALYSIS

A logistic regression model was used to evaluate the association between serum testosterone levels and the likelihood of poor oral health. The model adjusted for age, gender, marital status, educational level, and race. Odds ratios (ORs), 95% confidence intervals (CIs), and p-values were reported for each predictor. Statistical significance was set at a two-sided p-value < 0.05.

RESULTS

A total of 11,729 participants were included in the analysis, of whom 9,228 (78.7%) reported good oral health and 2,501 (21.3%) reported poor oral health (Table 1). The sample was 46.6% male and 53.4% female, with a higher proportion of females among those reporting poor oral health (57.5%) compared to those with good oral health (52.3%) (Table 1).

White participants represented the largest group overall (52.3%), followed by Hispanic (20.8%) and Black (13.4%) participants. Black participants were more represented in the poor oral health group (16.4%) than in the good oral health group (12.6%) (Table 1).

Educational attainment differed across oral health status. A greater proportion of participants with poor oral health reported lower levels of education. Participants with a college degree or higher were more likely to report good oral health (23.7%) than poor oral health (17.4%) (Table 1).

A logistic regression model was conducted to evaluate the association between testosterone levels and poor oral health, adjusting for age, gender, race, education, and marital status (Table 2). Testosterone level was not significantly associated with oral health status (OR = 0.99, 95% CI: 0.98–1.01, $p = 0.116$). Age was a significant predictor, with increasing age associated with lower odds of reporting poor oral health (OR = 0.99, $p < 0.001$).

Compared to those with less than a 9th-grade education, higher education levels were associated with significantly lower odds of poor oral health. For example, participants with some college or an AA degree had 45% lower odds (OR = 0.55, $p < 0.001$), and those with a college degree or higher had 67% lower odds (OR = 0.33, $p < 0.001$) (Table 2). Addi-

Table 1. Demographic and Clinical Characteristics of Participants by Oral Health Status

	Good Oral Health N (%)	Poor Oral Health N (%)	Total N
Total	9228 (78.7%)	2501 (21.3%)	11,729
Age (Mean ± SD)	38.56 ± 25.65	40.35 ± 24.12	—
Gender			
Male	4,399 (47.7%)	1,063 (42.5%)	5,462 (46.6%)
Female	4,829 (52.3%)	1,438 (57.5%)	6,267 (53.4%)
Race			
Black	1,160 (12.6%)	411 (16.4%)	1,571 (13.4%)
Hispanic	1,931 (20.9%)	504 (20.2%)	2,435 (20.8%)
White	4,890 (53.0%)	1,242 (49.7%)	6,132 (52.3%)
NA	1,247 (13.5%)	344 (13.8%)	1,591 (13.6%)
Education			
<9th grade	258 (2.8%)	115 (4.6%)	373 (3.2%)
9–11th grade	461 (5.0%)	204 (8.2%)	665 (5.7%)
High school/GED	1,265 (13.7%)	481 (19.2%)	1,746 (14.9%)
Some college/AA	1,789 (19.4%)	580 (23.2%)	2,369 (20.2%)
College graduate+	2,190 (23.7%)	435 (17.4%)	2,625 (22.4%)
NA	3,265 (35.4%)	686 (27.4%)	3,951 (33.7%)
Marital Status			
Married	3,237 (35.1%)	898 (35.9%)	4,135 (35.3%)
Not Married	2,725 (29.5%)	918 (36.7%)	3,643 (31.1%)
NA	3,266 (35.4%)	685 (27.4%)	3,951 (33.7%)
Testosterone Level on file	5574 (77.9%)	1583 (22.1%)	7,157

Table 2. Logistic Regression Results Examining the Association Between Testosterone and Poor Oral Health

Variable	Odds Ratio (OR)	95% CI	P-value
Testosterone (nmol/L)	0.99	0.98 – 1.01	0.116
Gender: Female (vs. Male)	1.1	0.86 – 1.40	0.434
Age (years)	0.99 ***	0.99 – 0.99	<0.001
Marital Status: Not Married (vs. Married)	1.1	0.96 – 1.28	0.158
Education: 9–11th grade (vs. <9th)	0.71	0.52 – 1.01	0.062
Education: High school/GED (vs. <9th)	0.70 *	0.54 – 0.95	0.03
Education: Some college/AA (vs. <9th)	0.55 **	0.41 – 0.75	<0.001
Education: College graduate+ (vs. <9th)	0.33 ***	0.25 – 0.48	<0.001
Race: Hispanic (vs. Black)	0.66 **	0.49 – 0.81	<0.001
Race: White (vs. Black)	0.73 **	0.60 – 0.88	0.001

Significance Legend
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

tionally, Hispanic and White participants had significantly lower odds of reporting poor oral health compared to Black participants (OR = 0.66 and 0.73, respectively; $p < 0.01$ for both) (Table 2).

DISCUSSION

In our study, we investigated the association with testosterone serum levels and reported poor oral health in a nationally representative sample from NHANES. The combined demographic profile of the poor oral health cohort had a mean age of 40.35 years, and a predominance of

woman reporters which aligns with current epidemiological data on oral health.[12] Furthermore, with the natural variance in average serum testosterone levels between men and woman the majority of the patients may not reach clinical threshold for reduced or elevated testosterone for their respective groups.[16]

Through NHANES which serves as a standardized patient population, we could examine the relationship between testosterone and poor oral health. Although testosterone does have a role in oral health related metabolic processes, the hypothesized effects on poor oral health were not observed. Of those who reported poor oral health, women reported at a greater rate of 57.5% to the men at 42.5%. However, these differences in reported poor oral health were not statistically significant between the males and females of this cohort with an. This suggests that testosterone differences between groups may exert a similar impact on poor oral health rating regardless of gender.

Notably, age emerged as a strong indicator of reduced reporting of poor oral health with an OR = 0.99, which implies that older patients less frequently report poor oral health and that this trend increases with age. This is a counter-intuitive finding and may reflect a cohort effect or lifestyle modification in older individuals (adaptive coping mechanisms). This trend merits further investigation.

Patient's education level also showed significant associations with reporting of poor oral health. Patients who obtained any education at the level of a high school degree/GED or further reported significantly lower concerns about poor oral health. Patients that attained a college graduate degree or higher when compared to patients with less than a 9th grade education, scored their oral health as poor, significantly less often (OR = 0.33). These results are consistent with current literature highlighting the disparities in oral health care due to socioeconomic status.[14]

This study is limited by its cross-sectional design, which does not provide causal inferences, and its reliance on self-reported data, which can be subject to reporting bias. Another factor is that the NHANES dataset is top-coded for older ages and this may underrepresent some subgroups. Despite these limitations, this study helps this growing body of literature by providing a nuanced examination of how testosterone levels intersect with patients' oral health.

CONCLUSION

While testosterone is likely involved in some regulation of oral health, our analysis sought to determine if it played a significant role in reported poor oral health in a nationally representative model. After adjusting for key demographic factors, we found that testosterone was not significantly correlated with poor oral health reporting. This may change between grouping of males and females who have broad differences in average serum testosterone. We did observe that factors such as age and educational attainment had a stronger correlation shaping patients' perceptions of positive or negative oral health. Future research should examine whether specific variances or extremes of serum testosterone within male cohorts and female cohorts have an association with improved or worsened reports of oral health.

Published: January 02, 2025 EDT.

REFERENCES

1. Shwe PS, Ward SA, Thein PM, Junckerstorff R. Frailty, oral health and nutrition in geriatrics inpatients: A cross-sectional study. *Gerodontology*. 2019;36(3):223-228. doi:10.1111/ger.12397

2. Natarajan P, Madanian S, Marshall S. Investigating the link between oral health conditions and systemic diseases: A cross-sectional analysis. *Sci Rep*. 2025;15:10476. doi:10.1038/s41598-025-92523-6

3. Singhal A, Jackson JW. Perceived racial discrimination partially mediates racial-ethnic disparities in dental utilization and oral health. *J Public Health Dent*. 2022;82 Suppl 1(Suppl 1):63-72. doi:10.1111/jphd.12515

4. Chari M, Ravaghi V, Sabbah W, Gomaa N, Singhal S, Quiñonez C. Oral health inequality in Canada, the United States and United Kingdom. *PLoS One*. 2022;17(5):e0268006. doi:10.1371/journal.pone.0268006

5. Cornejo Ulloa PE, Krom BP, Schoonmade LJ, van der Veen MH. Sex steroid hormones: an overlooked yet fundamental factor in oral homeostasis in humans. *Front Endocrinol (Lausanne)*. 2024;15:1400640. doi:10.3389/fendo.2024.1400640

6. Engeland CG, Sabzehei B, Marucha PT. Sex hormones and mucosal wound healing. *Brain Behav Immun*. 2009;23(5):629-635. doi:10.1016/j.bbi.2008.12.001

7. Foo YZ, Nakagawa S, Rhodes G, Simmons LW. The effects of sex hormones on immune function: a meta-analysis. *Biol Rev*. 2017;92(2):551-571. doi:10.1111/brv.12243

8. Tenuta M, Hasenmajer V, Gianfrilli D, Isidori AM. Testosterone and male bone health: a puzzle of interactions. *J Clin Endocrinol Metab*. Published online 2025:dgaf191. doi:10.1210/clinem/dgaf191

9. Kuchuk NO, Van Schoor NM, Pluijm SMF, Smit JH, De Ronde W, Lips P. The association of sex hormone levels with quantitative ultrasound, bone mineral density, bone turnover and osteoporotic fractures in older men and women. *Clin Endocrinol (Oxf)*. 2007;67(3):295-303. doi:10.1111/j.1365-2265.2007.02882.x

10. Kellesarian SV, Malmstrom H, Abduljabbar T, et al. Low Testosterone Levels in Body Fluids Are Associated With Chronic Periodontitis: A Reality or a Myth? *Am J Mens Health*. 2016;11(2):443-453. doi:10.1177/1557988316667692

11. Doughan M, Chehab O, Doughan B, Lima JAC, Michos E. Association of endogenous sex hormone levels with tooth loss due to periodontitis in men and post-menopausal women: The multi-ethnic study of atherosclerosis. *J Periodont Res*. 2025;60:166-176. doi:10.1111/jre.13312

12. Li T, Shen Y, Leng Y, et al. The prevalence of oral frailty among older adults: a systematic review and meta-analysis. *Eur Geriatr Med*. 2024;15:645-655. doi:10.1007/s41999-023-00930-7

13. Blasi AM, Vonhoegen L, Herrler A, Wicht MJ, Barbe AG. Older people's preferences and expectations of preventive oral care in the home. *Gerodontology*. 2024;41:241-250. doi:10.1111/ger.12698

14. Gillani B, Prince DM, Ray-Novak M, et al. Mapping the Dynamic Complexity of Sexual and Gender Minority Healthcare Disparities: A Systems Thinking Approach. *Healthcare*. 2024;12(4):424. doi:10.3390/healthcare12040424

15. National Health and Nutrition Examination Survey (NHANES). 2023. Accessed April 2, 2025. https://www.cdc.gov/nchs/nhanes/about/index.html

16. Kanakis GA, Tsametis CP, Goulis DG. Measuring testosterone in women and men. *Maturitas*. 2019;125:41-44. doi:10.1016/j.maturitas.2019.04.203