ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/dentalsci.2025-111164

The Impact of Oral Health-Related Quality of Life and Psychological Factors on Xerostomia

Ağız Sağlığına İlişkin Yaşam Kalitesi ve Psikolojik Faktörlerin Kserostomiye Etkisi

Sevilay YEĞİNOĞLU[a,b], Gülden EREŞ[c]

[a]Karabük University Faculty of Dentistry, Department of Periodontology, Karabük, Türkiye
[b]Karabük University Institute of Health Sciences, Department of Medical Microbiology, Karabük, Türkiye
[c]Ankara University Faculty of Dentistry, Department of Periodontology, Ankara, Türkiye

This study was presented as an oral presentation at CED-IADR2024 Congress, September 12-14, 2024, Geneva, Switzerland.

ABSTRACT Objective: This study aimed to explore the relationship between psychological factors, quality of life, and the presence of xerostomia in patients seeking dental treatment. **Material and Methods:** Depression Anxiety Stress Scale (DASS-21), Oral Health Impact Profile (OHIP-14), and The Xerostomia Inventory (XI-11) questionnaires were sent to the patients using WhatsApp and "Google Forms" because of the coronavirus disease-2019 pandemic lockdown. Statistical analyses were performed to determine the relationship between the DASS-21, OHIP-14, and XI-11 questionnaire scores, using Pearson's correlation test. **Results:** The study revealed that the prevalence of depression was 24.1%, anxiety was 29.3%, and stress was 20.7%. An increase in depression, anxiety, and stress levels was associated with a higher likelihood of xerostomia (p=0.404; p=0.451; p=0.338). Xerostomia was present in 54.6% of the patients. There was a significant relationship between gender and xerostomia (p=0.028); women were more prone to xerostomia. Age and xerostomia were found to be significantly correlated (p=0.023); xerostomia diminished as age increased. Among the patients in this study, 99.3% had a high quality of life, and xerostomia prevalence increased as the quality of life decreased (p=0.433). **Conclusion:** However, since the quality of life was high in this study, the high prevalence of xerostomia is more related to psychological conditions such as depression, anxiety, and stress, which increased during the pandemic lockdown.

Keywords: Anxiety; depression; xerostomia; quality of life; psychology; stress

ÖZET Amaç: Bu çalışma, diş tedavisi için başvuran hastalarda psikolojik faktörler, yaşam kalitesi ve kserostomi varlığı arasındaki ilişkiyi incelemeyi amaçlamıştır. **Gereç ve Yöntemler:** Koronavirüs hastalığı-2019 pandemi karantinası nedeniyle hastalara Depresyon Anksiyete Stres Ölçeği [Depression Anxiety Stress Scale (DASS-21)], Ağız Sağlığı Etki Profili [Oral Health Impact Profile (OHIP-14)] ve Kserostomi Envanteri [Xerostomia Inventory (XI-11)] anketleri WhatsApp ve "Google Formlar" kullanılarak gönderildi. Pearson korelasyon testi kullanılarak DASS-21, OHIP-14 ve XI-11 anket puanları arasındaki ilişkiyi belirlemek için istatistiksel analizler yapıldı. **Bulgular:** Çalışma, depresyon prevalansının %24,1, anksiyetenin %29,3 ve stresin %20,7 olduğunu ortaya koydu. Depresyon, anksiyete ve stres düzeylerindeki artış, kserostomi olasılığının daha yüksek olmasıyla ilişkiliydi (p=0,404; p=0,451; p=0,338). Hastaların %54,6'sında kserostomi mevcuttu. Cinsiyet ile kserostomi arasında anlamlı bir ilişki vardı (p=0,028); kadınlar kserostomiye daha yatkındı. Yaş ve kserostomi arasında anlamlı bir korelasyon bulundu (p=0,023); kserostomi yaş arttıkça azalıyordu. Bu çalışmadaki hastaların, %99,3'ünün yaşam kalitesi yüksekti ve kserostomi prevalansı yaşam kalitesi azaldıkça artıyordu (p=0,433). **Sonuç:** Çalışmadaki katılımcıların, yaşam kalitesi yüksek olmasına rağmen kserostomi prevalansının yüksek olması pandemi karantinası sırasında artan depresyon, anksiyete ve stres gibi psikolojik durumlarla daha fazla ilişkilidir.

Anahtar Kelimeler: Anksiyete; depresyon; kserostomi; yaşam kalitesi; psikoloji; stres

Correspondence: Sevilay YEĞİNOĞLU
Karabük University Faculty of Dentistry, Department of Periodontology, Karabük, Türkiye
E-mail: sevilayyeginoglu@karabuk.edu.tr

Peer review under responsibility of Turkiye Klinikleri Journal of Dental Sciences.

Received: 09 Apr 2025 ***Received in revised form:*** 07 Jul 2025 ***Accepted:*** 11 Aug 2025 ***Available online:*** 04 Sep 2025

Psychological factors such as stress, anxiety, and depression are closely linked to dry mouth.[1] Most of the studies in the literature investigating the connection between psychological factors and dry mouth have predominantly focused on hyposalivation or the assessment of salivary flow.[2] Xerostomia, however, differs from hyposalivation in that it is related to both the rate of salivation and an irregular thickness of the salivary film on soft and hard tissue surfaces. Variations in salivary composition, which contribute to this thickness, have also been associated with the sensation of dry mouth.[3] Importantly, patients suffering from xerostomia do not always present with hyposalivation.[4] Some studies suggest that individuals reporting xerostomia symptoms may maintain normal or even elevated salivary flow, yet still experience a dry mouth sensation.[5-7] Hyposalivation, characterized by a measurable decrease in salivary flow rate, is typically assessed using sialometry. Conversely, xerostomia should be assessed through self-reported questionnaires, as it reflects a subjective feeling of dryness in the mouth.[3] Additionally, the etiology of xerostomia may also be influenced by psychological factors and lifestyle choices.[1]

Common forms of psychological distress namely depression, stress, and anxiety significantly impair quality of life.[1] Earlier studies have identified depression as a crucial underlying cause of dry mouth.[8,9] Xerostomia can result from the physiological impact of depression on salivation.[10] Furthermore, research has shown that the sensation of dryness is closely linked to severe depression, even in the absence of salivary dysfunction.[11] Interestingly, many individuals with anxiety-related xerostomia exhibit normal salivary flow.[12]

The aim of this study was to evaluate the relationship between psychological factors, quality of life, and the presence of xerostomia in patients seeking dental treatment at Ankara University Faculty of Dentistry.

MATERIAL AND METHODS

The study adheres to the Declaration of Helsinki and was approved by the Clinical Research Ethics Committee of the Ankara University Faculty of Dentistry (date: December 9, 2020; no: 14/02). The participants, aged between 20-65 years, who agreed to participate were included in this cross-sectional study, ensuring equal representation of men and women within each age group.

The sample size was initially calculated as 266, but 300 volunteers were included in the study until the number of male and female participants was balanced. Patients whose information was obtained from the patient registration system were called to inform them about the aims of the study. A total of 300 volunteers, whose reading, listening and answering skills were found to be sufficient and who gave verbal consent, were sent survey forms created for this study via WhatsApp. Surveys prepared using Google Forms were distributed via WhatsApp between January-August 2021. All volunteers were asked to read a text explaining the study before starting the survey and to check the box next to the consent tab to indicate that they were informed and their consent was obtained. The survey system did not include any participants who did not give this consent. Thus, both verbal and written consent was obtained from the patients.

QUESTIONNAIRE FORM

The questionnaire was divided into four sections, which were adapted from previously used questionnaires (detailed in the Appendix Materials).[6,13,17]

Sociodemographic Information

The first part of the questionnaire included sociodemographic information such as first and last name, phone number, gender, date of birth, age, medical history, and medications used, as reported by the patients.

Psychometric Measurements

The 42-question Depression Anxiety Stress Scale (DASS-42), developed by Lovibond and Lovibond, is a psychometric tool used to assess emotional distress levels.[13] This scale includes 14 questions each for depression, anxiety, and stress. The 21-item version of the DASS, utilized in this study, was developed by Henry and Crawford and is designed for self-scoring of depression, anxiety, and stress indicators.[14]

The DASS-21 measures the three emotional state depression, anxiety, and stress using seven ques-

tions for each. The scale is graded on a four-point system, with ratings as follows: 0 for "not suitable for me", 1 for "somewhat suitable for me", 2 for "usually suitable for me", and 3 for "completely suitable for me".[15] In this study, the Turkish version of the DASS-21 questionnaire was used.

For the DASS-42, cut-off points have been established to assess the severity of each emotional state, and the total score is calculated by summing the scores from the subscales.[13] For depression, anxiety, and stress, the acceptable ranges are 0-9, 0-7, and 0-14, respectively. Scores above these ranges indicate increasing severity, ranging from mild to severe.[13,16] In the final computation for the DASS-21, the scores from each subscale are multiplied by 2.[17] The manual calculations for this are displayed in the Appendix Materials.[13]

Oral Health Impact Profile

The Oral Health Impact Profile (OHIP), one of the most commonly used tools for measuring quality of life, was originally developed to assist healthcare professionals in evaluating the effects of oral health on an individual's well-being. The OHIP questionnaire addresses various aspects, including functional limitations, physical pain and disability, psychological discomfort, and social disability.[18]

Slade condensed the original OHIP into a more concise version, the OHIP-14, consisting of 14 questions, which is now the most frequently used form.[18] In this version, patients are asked to select which of the five available response options best describes their symptoms in the preceding month. The response options are as follows: "Never" (0 points), "Hardly Ever" (1 point), "Occasionally" (2 points), "Fairly Often" (3 points), and "Very Often" (4 points). This scoring method produces an overall score ranging from 0 to 56.

To categorize the severity of oral health impacts, a cut-off point of 2.5 was established, where an average score of less than 2.5 was classified as low OHIP-14 and a score greater than 2.5 as high OHIP-14.[19] Based on these scores, patients were divided into 2 groups: those with lower and higher OHIP-14 scores.

The questionnaire was divided into 7 sections, with each section containing 2 questions: functional limitations, physical discomfort, physiological discomfort, physical disability, social disability, and handicap. By incorporating these seven sections, a single composite score was obtained to assess the quality of life. As the total score increased, the severity of the problem also increased, resulting in a decrease in the quality of life.[18]

Xerostomia Questionnaire

In this study, the original 11-item Xerostomia Inventory (XI-11), developed by Thomson et al. in 1999, was utilized to assess the presence and severity of xerostomia.[6] This inventory employs a 5-point Likert scale to evaluate each symptom, ranging from "never" to "always", with corresponding scores: never=0, almost never=1, sometimes=2, frequently=3, and always=4. A total score was calculated for each participant by summing the responses across all items, with higher scores reflecting more severe symptoms of xerostomia. The scoring range was from 11, indicating no xerostomia, to a maximum of 44, indicating severe xerostomia. The following score ranges were applied to categorize the severity of xerostomia:

- 0-11: no xerostomia;
- 12-22: mild xerostomia;
- 23-33: moderate xerostomia;
- 34-44: severe xerostomia.[20]

The questionnaire was designed using Google Forms, and responses were considered for statistical analysis only if the forms were fully completed in accordance with the provided instructions.

No preliminary study was conducted because previous studies demonstrated the validity and reliability of the questionnaire forms that were used in this research.[15,21,22]

STATISTICAL ANALYSIS

In this study, the presence of xerostomia was assessed among participants. To determine the required sample size, the power analysis tool from the G*Power software was employed. The analysis revealed an effect size of 0.10, with an alpha (α) value of 0.05 and a power value (1-β) of 0.80. Consequently, a total of 266 samples were initially calculated, but to ensure a more robust dataset, 300 individuals were included

APPENDIX

Survey Form S1:

SOCIODEMOGRAPHIC DATA

Age

Gender: Female/male

Survey Form S2:

Depression-Anxiety-Stress Scale (DASS-21)

1. I had a hard time calming myself down (Stress 1)
2. My mouth felt dry (anxiety 1)
3. I did not feel any positive emotion (Depression1)
4. I had trouble breathing at times (such as wheezing and shortness of breath without any physical effort) (anxiety2)
5. It was difficult for me to use it in my attempt to do something (Depression2)
6. I intended to exaggerate when I reacted to situations (Stress2)
7. I felt shaky (for example, in my hands) (Anxiety3)
8. I always felt nervous (Stress3)
9. Worried about situations where I panicked and might seem ridiculous (anxiety4)
10. I felt like I had no desire for anything (Depression3)
11. I felt restless (Stress4)
12. I had a hard time relaxing (Stress5)
13. I felt depressed and unmotivated (Depression4)
14. I had no tolerance for things that prevented me from continuing to do what I was doing (Stress6)
15. I felt I was going to panic (anxiety5)
16. I did not feel enthusiastic about anything (Depression5)
17. I felt worthless as a person (Depression6)
18. I felt a little too emotional/sensitive (Stress7)
19. I knew my heart rate had changed even though I was not doing anything physically rigorous (for example, increased heart rate Irregular heartbeat) (anxiety6)
20. I am afraid for no reason (anxiety7)
21. I felt that life had no meaning (Depression7)

DEPRESSION 3, 5, 10, 13, 16, 17, 21

STRESS 1, 6, 8, 11, 12, 14, 18

ANXIETY 2, 4, 7, 9, 15, 19, 20

Survey Form S3:

OHIP (Oral Health Impact Profile) Oral Health Impact Questionnaire:

The following questions measure the impact of a person's oral health on their quality of life.

1- Have you ever had any difficulty pronouncing words due to issues with your teeth, mouth, or dentures?

A) never B) almost never C) sometimes D) often E) always

2- Have you noticed that issues with your teeth, mouth, or dentures have made your sense of taste worse?

A) never B) almost never C) sometimes D) often E) always

3- Have you ever had a severe pain in your mouth?

A) never B) almost never C) sometimes D) often E) always

4- Have you been uncomfortable eating any food due to problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

5- Have you ever lost consciousness because of your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

6-Did you feel nervous because of your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

APPENDIX *(contunied)*

7-Do you think that you cannot get enough nutrition due to problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

8-Have you had to take a break from eating due to problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

9-Do you have trouble calming down because of problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

10- Have you ever felt a little embarrassed about problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

11- Have you ever felt uncomfortable with others because of problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

12- Have you had difficulty doing your usual work because of problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

13- Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

14- Have you ever been unable to work completely due to problems with your teeth, mouth or dentures?

A) never B) almost never C) sometimes D) often E) always

Survey Form S4:

XEROSTOMIA INVENTORY (XI-11)

1. Do you need a drink to swallow food?

A) never B) almost never C) sometimes D) often E) always

2. When you eat, does your mouth feel dry?

A) never B) almost never C) sometimes D) often E) always

3. Do you awaken at night to drink water?

A) never B) almost never C) sometimes D) often E) always

4. Do you feel dryness in your mouth?

A) never B) almost never C) sometimes D) often E) always

5. Do you find it difficult to swallow dry food?

A) never B) almost never C) sometimes D) often E) always

6. Do you use candy or throat lozenges to relieve your dry mouth?

A) never B) almost never C) sometimes D) often E) always

7. Do you ever have issues with food swallowing?

A) never B) almost never C) sometimes D) often E) always

8. Do you feel dryness on your skin?

A) never B) almost never C) sometimes D) often E) always

9. Do you feel dryness in your eyes?

A) never B) almost never C) sometimes D) often E) always

10. Do you feel dryness on your lips?

A) never B) almost never C) sometimes D) often E) always

11. Do you feel dryness inside your nose?

A) never B) almost never C) sometimes D) often E) always

12. Do you have any sores in your mouth?

A) never B) almost never C) sometimes D) often E) always

13. Do you feel burning in your mouth?

A) never B) almost never C) sometimes D) often E) always

14. Do you have bad breath complaints?

A) never B) almost never C) sometimes D) often E) always

in the study. Data analysis was performed using SPSS 24.0. The margin of error was set at 5% (p=0.05), and a 95% confidence level was maintained throughout the study. The relationship between xerostomia and factors such as age and gender was evaluated using the chi-square test. Pearson's correlation test was employed to analyze the associations between the DASS-21, OHIP-14, and XI-11 questionnaire results.

RESULTS

The study involved 300 volunteer participants, equally distributed across 5 age groups (20-29, 30-39, 40-49, 50-59, and 60-65 years), with gender distribution being balanced within each group. The mean age of the participants was 44.02±13.98 years. Sociodemographic characteristics are presented in Table 1. To evaluate stress, anxiety, and depression levels among participants, the DASS-21 questionnaire was utilized. The results, depicted in Figure 1, revealed that 24.1% of patients experienced depression, 29.3% had anxiety, and 20.7% reported high stress levels. The OHIP-14 questionnaire (provided in the Appendix Materials) was employed to assess the quality of life related to oral health. The study found that quality of life decreased as the OHIP-14 scores increased. Notably, 99.3% of patients reported a high quality of life, whereas 0.7% reported a low quality of life (Table 2).

The current study found a 54.6% presence of xerostomia (Figure 2). The chi-square test was used in this study to assess the relationship between age groups and the presence of xerostomia (Table 3). Age and xerostomia had a significant association (p=0.023). Xerostomia decreases with increasing age. Pearson's correlation test was used to assess the relationship between the XI-11, OHIP-14, and DASS-21 scores (Table 4). The results showed that the quality of life was inversely related to higher OHIP scores, meaning that as xerostomia increased, quality of life decreased (p=0.433). Additionally, depression, anxiety, stress, and total DASS scores all had direct

TABLE 1: Patients' age, gender, presence of systemic disease and medication use

		n	%
Age	20-29 years of age	60	20.0
	30-39 years of age	60	20.0
	40-49 years of age	60	20.0
	50-59 years of age	60	20.0
	60-65 years of age	60	20.0
Gender	Female	150	50.0
	Male	150	50.0
Do you have a systemic disease?	Yes	91	30.3
	No	209	69.7
Do you take any medications?	Yes	94	31.3
	No	206	68.7

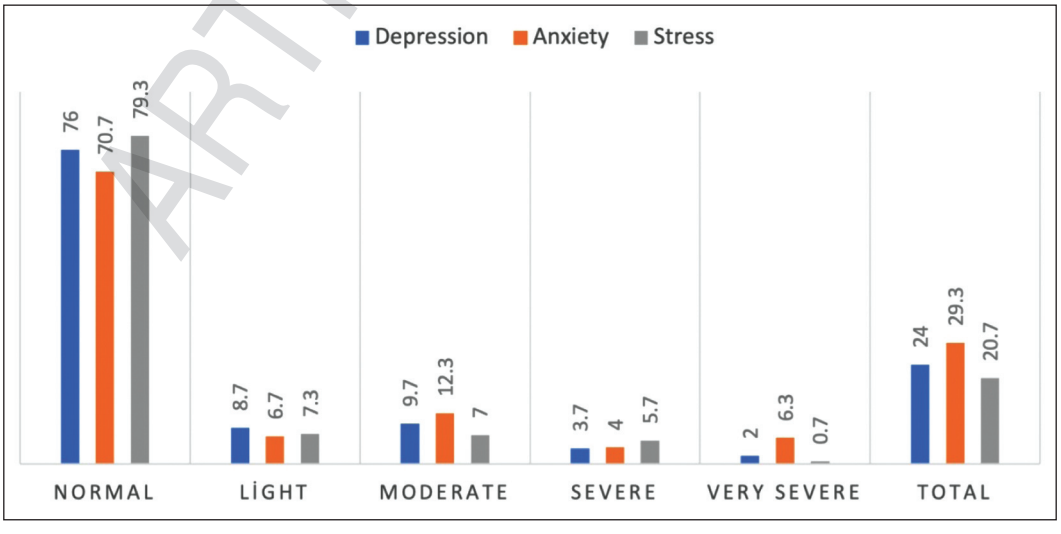

FIGURE 1: Evaluation of patients' depression, anxiety, and stress levels

TABLE 2: OHIP-14 levels of patients

		n	%
OHIP-14	Low*	298	99.3
	High**	2	0.7

*A score of less than 2.5 is classified as low level OHIP-14; **A score of more than 2.5 is classified as high level OHIP-14; OHIP-14: Oral Health Impact Profile

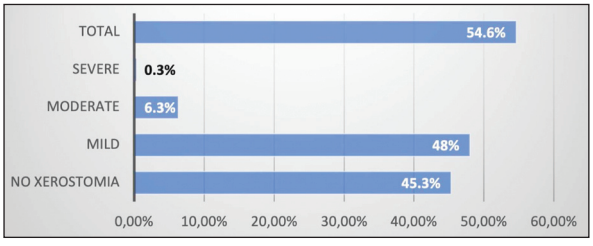

FIGURE 2: Xerostomia presence in the population

correlations with xerostomia. Specifically, as the levels of depression, anxiety, and stress increased, so did the prevalence of xerostomia (p=0.404; p=0.451; p=0.338). As depression, anxiety, and stress scores increased, OHIP-14 scores also rose. (p=0.461; p=0.431; p=0.427; p=0.481, respectively). These findings suggest that a decrease in oral health-related quality of life is associated with an increase in depression, anxiety, stress, and xerostomia.

A t-test was performed to analyze the questionnaire scores by gender (Table 5). Statistically significant differences were observed between men and women regarding xerostomia, depression, anxiety, stress, and the overall DASS-21 evaluation (p=0.004; p=0.041; p=0.016; p=0.016, respectively), with women showing higher mean scores.

A one-way analysis of variance was conducted to assess the relationship between DASS scores and age. The results revealed a statistically borderline difference in depression scores among the different age groups (p=0.036). Upon further examination, it was observed that the highest mean depression scores

TABLE 3: Relationship of xerostomia with age, gender, presence of systemic disease and medication use

		Xerostomia					
		None		Yes			
		n	%	n	%	Chi-square	p value
Age	20-29 years of age	18	30	42	70	17.813	**0.023***
	30-39 years of age	26	43.3	34	56.6		
	40-49 years of age	27	45	33	55		
	50-59 years of age	29	48.3	31	59.9		
	60-65 years of age	36	60	24	40		
Gender	Female	60	40.0	90	60	7.132	0.028
	Male	76	50.7	74	49.3		
Do you have a systemic disease?	Yes	37	40.7	54	59.4	1.198	0.549
	No	99	47.4	110	52.6		
Do you take any medications?	Yes	37	39.4	57	60.6	1.970	0.373
	No	99	48.1	107	51.9		

*p<0.05

TABLE 4: The relationship between the XI, the OHIP, and the DASS-21

	Xerostomia Inventory	Quality of life	Stress	Depression	Anxiety	DASS total
XI	1	0.433**	0.338**	0.404**	0.451**	0.431**
Quality of life		1	0.427**	0.461**	0.431**	0.481**
Stress			1	0.742**	0.757**	0.926**
Depression				1	0.742**	0.905**
Anxiety					1	0.904**
DASS total						1

*p< 0.05; ** p<0.01; XI: Xerostomia Inventory; OHIP: Oral Health Impact Profile; DASS: Depression Anxiety Stress Scale

TABLE 5: Examination of questionnaire scores in terms of gender

Gender		n	$\bar{X}$	SD	t value	p value
XI	Female	150	14.05	7.28	2.894	**0.004***
	Male	150	11.81	6.10		
Functional restriction	Female	150	0.68	0.79	0.314	0.754
	Male	150	0.65	0.68		
Physical pain	Female	150	1.12	0.95	0.098	0.922
	Male	150	1.11	0.81		
Physiological discomfort	Female	150	0.59	0.63	0.805	0.422
	Male	150	0.53	0.58		
Physical disability	Female	150	0.76	0.88	1.196	0.232
	Male	150	0.64	0.81		
Physiological disability	Female	150	0.80	0.85	0.101	0.919
	Male	150	0.79	0.86		
Social disability	Female	150	0.83	0.95	0.384	0.701
	Male	150	0.79	0.85		
Handicap	Female	150	0.56	0.75	-1.060	0.290
	Male	150	0.66	0.83		
Life quality	Female	150	0.76	0.67	0.316	0.752
	Male	150	0.74	0.61		
Stress	Female	150	4.49	4.77	2.181	**0.030***
	Male	150	3.38	3.98		
Depression	Female	150	3.12	4.02	2.055	**0.041***
	Male	150	2.23	3.43		
Anxiety	Female	150	3.33	3.73	2.415	**0.016***
	Male	150	2.37	3.13		
DASS total	Female	150	10.93	11.51	2.426	**0.016***
	Male	150	7.98	9.47		

*p<0.05; SD: Standard deviation; XI: Xerostomia Inventory; DASS: Depression Anxiety Stress Scale

were found in the 20-29 age group, with a gradual decrease in scores as age increased (Table 6).

DISCUSSION

Depression, stress, and anxiety are key psychological factors that influence the onset of xerostomia.[1,23] While many studies investigating the causes of hyposalivation and xerostomia have primarily focused on the impact of medications, psychological factors have often been overlooked. This study aimed to assess the correlation between xerostomia and psychological conditions such as depression, anxiety, and stress, finding no significant correlation between xerostomia and the presence of systemic disease or medication usage. Additionally, 99.3% of participants reported a high quality of life related to their oral health, suggesting that psychological factors contributed significantly to the high prevalence of xerostomia in this study. Bergdahl and Bergdahl also found that depression, anxiety, and stress are critical factors in the experience of subjective dry mouth.[24]

Ohara et al. specifically examined the impact of depression on xerostomia in an elderly population, finding that depressed individuals had a higher likelihood of experiencing xerostomia.[25] The DASS-21 questionnaire was used for psychometric data collection, revealing a positive correlation between the Xerostomia Inventory and DASS-21 scores.[21] Consistent with existing literature, this study found that the presence of xerostomia increased as depression, anxiety, and stress levels rose. Interestingly, although the existing literature suggests that xerostomia increases with age, our findings revealed the opposite trend. This unexpected increase in xerostomia among

TABLE 6: The relationship between age and DASS-21 scores

Age		n	$\bar{X}$	SD	F	p value
Stress	20-29 years old	54	3.74	4.22	0.937	0.443
	30-39 years old	56	3.79	4.24		
	40-49 years old	43	2.95	3.63		
	50-59 years old	44	2.64	3.52		
	60-65 years old	34	3.97	4.20		
Depression	20-29 years old	54	2.91	3.58	2.623	0.036*
	30-39 years old	56	2.80	3.51		
	40-49 years old	43	2.14	2.70		
	50-59 years old	44	1.39	2.35		
	60-65 years old	34	1.38	2.67		
Anxiety	20-29 years old	54	3.07	3.62	2.090	0.083
	30-39 years old	56	2.96	3.70		
	40-49 years old	43	2.44	2.75		
	50-59 years old	44	1.41	1.97		
	60-65 years old	34	2.88	3.41		
DASS total	20-29 years old	54	9.72	10.80	1.686	0.154
	30-39 years old	56	9.55	10.50		
	40-49 years old	43	7.53	8.11		
	50-59 years old	44	5.43	6.77		
	60-65 years old	34	8.24	8.84		

*p<0.05; DASS: Depression Anxiety Stress Scale; SD: Standard deviation

TABLE 7: DASS-42 manual calculation chart

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Light	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Very severe	28+	20+	34+

DASS: Depression Anxiety Stress Scale

younger individuals may be explained by the significantly higher depression scores observed in this age group. Since psychological distress including depression is known to reduce salivary flow and increase the perception of dry mouth, it is plausible that elevated depression levels among younger participants contributed to the increased prevalence of xerostomia in this population (p=0.036). Several studies focusing on younger populations, similar to this one, have also observed an association between xerostomia and depressive states.[26-28] Atif et al., in their 2021 study with students, found stress to be associated with xerostomia.[1] A study have shown that depressive disorders are prevalent, can reduce salivary flow rates, and that many patients with depression experience subjective dry mouth symptoms unrelated to xerostomia. It is important to note that Ohara et al. included objective assessments of salivary flow rate in their study, whereas our research relied on self-reported xerostomia symptoms based on questionnaire data.[25] This methodological difference may explain the contrast in findings, as our results reflect perceived xerostomia rather than measured salivary hypofunction. Abetz et al., in 2011, also found correlations between oral signs and symptoms and psychological distress, using the DASS-21 questionnaire to assess psychometric parameters, similar to this study.[23] The high prevalence of xerostomia and depression among young individuals may be associated with common age-related factors such as academic and social stress, life uncertainties, and increased psychological sensitivity.

Saliva plays a crucial role in maintaining and regulating oral health.[29] In cases of prolonged xerostomia, it not only causes discomfort to the patient but also diminishes the overall quality of life. Thus, it is essential to explore the psychogenic effects, which

are considered as etiological factors, in the development of xerostomia.[30] The study found a higher prevalence of xerostomia in females compared to males, with a statistically significant correlation between gender and xerostomia (p=0.028). This finding aligns with the results reported by Nederfors et al., where the prevalence of xerostomia was found to be 23.1% in males and 28.3% in females.[31] In this study, females also exhibited higher levels of depression, anxiety, and stress than males, with statistical significance (p=0.041, p=0.016, p=0.030, respectively). A t-test analysis of the questionnaire scores by gender showed statistically significant differences in terms of xerostomia, depression, anxiety, stress, and the overall DASS-21 score. As quality of life decreased, there was an increase in depression, anxiety, and stress scores ($p<0.05$). Other studies in the literature also report a higher incidence of xerostomia in females.[19,31,32] Psychological distress is known to reduce salivary flow and enhance the perception of dry mouth. Furthermore, women may be more emotionally responsive and more likely to report both psychological and somatic symptoms. Hormonal influences, such as fluctuations in estrogen levels, may also contribute to alterations in salivary gland function. Additionally, the higher prevalence of antidepressant use among women, as reported in the literature, may further support this association. These factors may collectively explain the elevated rates of xerostomia among female participants in our sample.

Many studies have linked the high prevalence of xerostomia in the elderly population to systemic diseases and medication use.[7,31-34] However, in this study, no significant correlation was found between the presence of systemic disease, medication usage, and xerostomia (p=0.549, p=0.373, respectively). Perotto et al. found that 24.8% of the patients in a population of 117 experienced xerostomia due to medication use.[33] Similarly, Freitas et al. reported that 59.0% of participants in their study experienced dry mouth most of the day, which was associated with the medication they used.[34] It is important to emphasize that these studies mostly included older populations, specifically those aged over 65 years. Considering the relatively young age of the study population and the overall low frequency of systemic disease and medication use, these variables are unlikely to have significantly influenced the presence of xerostomia in this sample. However, their potential role should not be completely disregarded and warrants further investigation in future studies.

Xerostomia is not classified as a disease, but rather as a set of pathological conditions that considerably impact patients' quality of life. It can affect various oral functions such as chewing, swallowing, prosthetic use, and speech.[30] In this study, patients with xerostomia exhibited higher OHIP-14 scores and lower quality of life compared to those without xerostomia. These findings align with previous research, which demonstrated a strong correlation between xerostomia and quality of life in adults, and several studies have noted that xerostomia significantly diminishes oral-health-related quality of life.[4,35] Additionally, Bulthuis et al. found a significant correlation between stress and xerostomia, suggesting that it impacts overall quality of life.[2]

A limitation of this study is the inability to conduct an oral examination due to the coronavirus disease-2019 pandemic. Furthermore, salivary flow rates could have been assessed, and hyposalivation states could have been incorporated into the study to provide a more comprehensive understanding of xerostomia. The study's population was also limited to patients who had previously sought dental examination, potentially introducing selection bias. However, it is well established that the pandemic exacerbates psychological conditions such as stress, anxiety, and depression. The depressive states evaluated in this study were not limited to clinical depression alone. Only a few patients were using antidepressants, which can cause xerostomia. The positive correlation observed between the Xerostomia Inventory and depression indicates that xerostomia is not solely attributed to antidepressant use. The use of a comprehensive questionnaire to evaluate symptoms of depression, anxiety, and stress helped raise awareness among the patients, leading many of them to seek consultations with the appropriate clinical specialists.

CONCLUSION

The current study investigated the association between psychological factors, quality of life, and xe-

rostomia by employing a range of questionnaires. As the levels of depression, anxiety, and stress increased, the presence of xerostomia also correspondingly increased. These results indicate that psychological factors have a significant impact on the presence of xerostomia, at least within the studied group, and potentially in the broader population as well. Additionally, xerostomia was more prevalent among females, with a significant correlation observed between gender and xerostomia. Furthermore, depression, anxiety, and stress were notably higher in females compared to males. It can be inferred that the higher prevalence of xerostomia in women is likely associated with these psychological factors.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Sevilay Yeğinoğlu, Gülden Ereş;* ***Design:*** *Sevilay Yeğinoğlu, Gülden Ereş;* ***Control/Supervision:*** *Sevilay Yeğinoğlu, Gülden Ereş;* ***Data Collection and/or Processing:*** *Gülden Ereş;* ***Analysis and/or Interpretation:*** *Sevilay Yeğinoğlu, Gülden Ereş;* ***Literature Review:*** *Sevilay Yeğinoğlu, Gülden Ereş;* ***Writing the Article:*** *Sevilay Yeğinoğlu;* ***Critical Review:*** *Gülden Ereş;* ***References and Fundings:*** *Sevilay Yeğinoğlu;* ***Materials:*** *Sevilay Yeğinoğlu.*

REFERENCES

1. Atif S, Syed SA, Sherazi UR, Rana S. Determining the relationship among stress, xerostomia, salivary flow rate, and the quality of life of undergraduate dental students. J Taibah Univ Med Sci. 2020;16(1):9-15. PMID: 33603626; PMCID: PMC7858027.
2. Bulthuis MS, Jan Jager DH, Brand HS. Relationship among perceived stress, xerostomia, and salivary flow rate in patients visiting a saliva clinic. Clin Oral Investig. 2018;22(9):3121-27. PMID: 29520470; PMCID: PMC6224012.
3. Assy Z, Jager DHJ, Mashhour E, Bikker FJ, Brand HS. Regional differences in perceived oral dryness as determined with a newly developed questionnaire, the Regional Oral Dryness Inventory. Clin Oral Investig. 2020;24(11):4051-60. PMID: 32382921; PMCID: PMC7544722.
4. Hahnel S, Schwarz S, Zeman F, Schäfer L, Behr M. Prevalence of xerostomia and hyposalivation and their association with quality of life in elderly patients in dependence on dental status and prosthetic rehabilitation: a pilot study. J Dent. 2014;42(6):664-70. PMID: 24632475.
5. de Almeida Pdel V, Grégio AM, Machado MA, de Lima AA, Azevedo LR. Saliva composition and functions: a comprehensive review. J Contemp Dent Pract. 2008;9(3):72-80. PMID: 18335122.
6. Thomson WM, Chalmers JM, Spencer AJ, Ketabi M. The occurrence of xerostomia and salivary gland hypofunction in a population-based sample of older South Australians. Spec Care Dentist. 1999;19(1):20-3. PMID: 10483456.
7. Villa A, Polimeni A, Strohmenger L, Cicciù D, Gherlone E, Abati S. Dental patients' self-reports of xerostomia and associated risk factors. J Am Dent Assoc. 2011;142(7):811-6. PMID: 21719803.
8. Nederfors T. Xerostomia and hyposalivation. Adv Dent Res. 2000;14:48-56. PMID: 11842923.
9. Stevenson HA, Jones ME, Rostron JL, Longman LP, Field EA. UK patients with primary Sjögren's syndrome are at increased risk from clinical depression. Gerodontology. 2004;21(3):141-5. PMID: 15369016.
10. Cassano P, Fava M. Depression and public health: an overview. J Psychosom Res. 2002;53(4):849-57. PMID: 12377293.
11. Guggenheimer J, Moore PA. Xerostomia: etiology, recognition and treatment. J Am Dent Assoc. 2003;134(1):61-9; quiz 118-9. PMID: 12555958.
12. Montgomery-Cranny J, Hodgson T, Hegarty AM. Aetiology and management of xerostomia and salivary gland hypofunction. Br J Hosp Med (Lond). 2014;75(9):509-10, 511-4. PMID: 25216167.
13. Lovibond SH, Lovibond PF. Manual for the Depression, Anxiety, and Stress Scales. 2nd ed. Sydney, Australia: Sydney Psychology Foundation; 1995.
14. Henry JD, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): construct validity and normative data in a large non-clinical sample. Br J Clin Psychol. 2005;44(Pt 2):227-39. PMID: 16004657.
15. Yılmaz O, Boz H, Arslan A. Depresyon Anksiyete Stres Ölçeğinin (Dass 21) Türkçe kısa formunun geçerlilik-güvenilirlik çalışması [The validity and reliability of DEPRESSION STRESS AND ANXIETY SCALE (DASS21) TURKISH short form]. Finans Ekon Sos Araştırmalar Derg. 2017;2(2):78-91. https://dergipark.org.tr/tr/download/article-file/354106
16. Silva HA, Passos MH, Oliveira VM, Palmeira AC, Pitangui AC, Araújo RC. Short version of the Depression Anxiety Stress Scale-21: is it valid for Brazilian adolescents? Einstein (Sao Paulo). 2016;14(4):486-93. PMID: 28076595; PMCID: PMC5221374.
17. Alencar CM, Silva AM, Jural LA, Magno MB, Campos EA, Silva CM, et al. Factors associated with depression, anxiety and stress among dentists during the COVID-19 pandemic. Braz Oral Res. 2021;35:e084. PMID: 34431849.
18. Slade GD. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol. 1997;25(4):284-90. PMID: 9332805.
19. Willumsen T, Fjaera B, Eide H. Oral health-related quality of life in patients receiving home-care nursing: associations with aspects of dental status and xerostomia. Gerodontology. 2010;27(4):251-7. PMID: 19780842.
20. Pérez-González A, Suárez-Quintanilla JA, Otero-Rey E, Blanco-Carrión A, Gómez-García FJ, Gándara-Vila P, et al. Association between xerostomia, oral and general health, and obesity in adults. A cross-sectional pilot study. Med Oral Patol Oral Cir Bucal. 2021;26(6):e762-9. PMID: 34023839; PMCID: PMC8601639.

21. Başol ME, Karaagaçlıoğlu L, Yılmaz B. Türkçe Ağız Sağlığı Etki Ölçeğinin geliştirilmesi-OHIP-14-TR [Developing a Turkish Oral Health Impact Profile-OHIP-14TR]. Turkiye Klinikleri J Dental Sci. 2014;20(2):85-92. https://tr-scales.arabpsychology.com/wp-content/uploads/pdf/agiz-sagligi-etki-olcegi-toad.pdf

22. Başakcı Çalık B, Gür Kabul E, Keskin A, Bozcuk S, Şenol H, Çobankara V. Translation and validation of a Turkish version of the Xerostomia Inventory XI in patients with primary Sjögren's syndrome. Turk J Med Sci. 2021;51(5):2477-84. PMID: 34165270; PMCID: PMC8742486.

23. Abetz LM, Savage NW, Kenardy J. Changes in the oral cavity might reflect psychological disorders in some patients. J Investig Clin Dent. 2011;2(2):128-34. PMID: 25426606.

24. Bergdahl M, Bergdahl J. Low unstimulated salivary flow and subjective oral dryness: association with medication, anxiety, depression, and stress. J Dent Res. 2000;79(9):1652-8. PMID: 11023259.

25. Ohara Y, Hirano H, Yoshida H, Obuchi S, Ihara K, Fujiwara Y, et al. Prevalence and factors associated with xerostomia and hyposalivation among community-dwelling older people in Japan. Gerodontology. 2016;33(1):20-7. PMID: 24304087.

26. Anttila SS, Knuuttila ML, Sakki TK. Depressive symptoms as an underlying factor of the sensation of dry mouth. Psychosom Med. 1998;60(2):215-8. PMID: 9560872.

27. Bergdahl M, Bergdahl J, Johansson I. Depressive symptoms in individuals with idiopathic subjective dry mouth. J Oral Pathol Med. 1997;26(10):448-50. PMID: 9416574.

28. Hugo FN, Hilgert JB, Corso S, Padilha DM, Bozzetti MC, Bandeira DR, et al. Association of chronic stress, depression symptoms and cortisol with low saliva flow in a sample of south-Brazilians aged 50 years and older. Gerodontology. 2008;25(1):18-25. PMID: 18289129.

29. Shetty SR, Bhowmick S, Castelino R, Babu S. Drug induced xerostomia in elderly individuals: an institutional study. Contemp Clin Dent. 2012;3(2):173-5. PMID: 22919217; PMCID: PMC3425100.

30. Fornari CB, Bergonci D, Stein CB, Agostini BA, Rigo L. Prevalence of xerostomia and its association with systemic diseases and medications in the elderly: a cross-sectional study. Sao Paulo Med J. 2021;139(4):380-7. PMID: 34190871; PMCID: PMC9615591.

31. Nederfors T, Isaksson R, Mörnstad H, Dahlöf C. Prevalence of perceived symptoms of dry mouth in an adult Swedish population--relation to age, sex and pharmacotherapy. Community Dent Oral Epidemiol. 1997;25(3):211-6. PMID: 9192149.

32. Johansson AK, Johansson A, Unell L, Ekbäck G, Ordell S, Carlsson GE. A 15-yr longitudinal study of xerostomia in a Swedish population of 50-yr-old subjects. Eur J Oral Sci. 2009;117(1):13-9. PMID: 19196313.

33. Perotto JH, Andrades KMR, Paza AO, Avila LFC. Xerostomy prevalence related to medication on patients assisted by the dentistry area of the UNIVILLE. Rev Sul-Bras Odontol. 2007;4(2):16-9. https://www.researchgate.net/publication/43335906_Xerostomy_prevalence_related_to_medication_on_patients_assisted_by_the_dentistry_area_of_the_UNIVILLE

34. Freitas DN, Lock NC, Unfer B. Hipofunção das glândulas salivares emidosos hospitalizados relacionada a medicamentos [Salivary gland hypofunction in elderly people hospitalized related to drugs]. Rev Geriatr Gerontol. 2013;7(3):179-83. https://www.ggaging.com/details/138/pt-BR/salivary-gland-hypofunction-in-elderly-people-hospitalized-related-to-drugs

35. Nascimento ML, Farias AB, Carvalho AT, Albuquerque RF, Ribeiro LN, Leao JC, et al. Impact of xerostomia on the quality of life of patients submitted to head and neck radiotherapy. Med Oral Patol Oral Cir Bucal. 2019;24(6):e770-5. PMID: 31655838; PMCID: PMC6901149.