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Relationship Between Drug Burden Index And Oral Health-Related Quality Of Life In The Elderly In Amirkola

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ABSTRACT

Introduction: Drugs with anticholinergic and sedative effects have dangerous side effects in the elderly and are associated with xerostomia. The aim of this study was to investigate the relationship between Drug Burden Index (DBI) and Oral Health-Related Quality of Life (OHRQoL) in the elderly in Amirkola city.

Materials & Methods: The present study was conducted on 800 patients from old people in Amirkola with a mean age of 70.13±7.39 years of which 400 were male (50%). Baseline and demographic information of the subjects, oral health-related quality of life status using the Geriatric Oral Health Assessment Index (GOHAI) questionnaire, presence or absence of dry mouth using the standard xerostomia questionnaire, and information on patients' medication using the standard medication history questionnaire were collected. Then, the exposure of each individual to anticholinergic and sedative medications was calculated based on the DBI criterion.

Results: The mean DBI_{Total} score was 0.37±0.55 and the mean OHRQoL score was 51±7.37. OHRQoL was higher in men than in women ($p<0.001$). However, xerostomia and mean DBI_{Total} score were significantly higher in women than in men ($p<0.001$ and $p<0.001$, respectively). No significant correlation was found between DBI_{Total} and OHRQoL. However, a weak significant correlation between xerostomia and DBI_{Total} was seen ($r=0.141$, $p<0.001$). In individuals with xerostomia, mean age, DBI_{Ach} and DBI_{Total} scores were significantly higher and OHRQoL scores were significantly lower than in individuals without xerostomia. The prevalence of xerostomia was higher in women (22.5%) than in men (7.8%) ($p<0.001$).

Conclusion: Although DBI did not directly affect oral-related quality of life, it increased xerostomia. In addition, xerostomia significantly reduced OHRQoL. Therefore, it is recommended that physicians consider the possibility of xerostomia in the elderly when prescribing medications with anticholinergic effects.

Keywords: Xerostomia, Cholinergic antagonists, Aged, Oral Health, Quality of Life

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Introduction

According to studies, the percentage of the Iran elderly population (people aged ≥60 years) in 2016 was 6.3 times more than that of 1956. The ratio of the elderly population to the total population is expected to increase from 6.09% in 2016 to 19.92% in 2051 [1].

Current evidence suggests that older adults have the highest per capita drug use, which exposes the elderly to adverse drug reactions [2, 3]. Medications with anticholinergic and sedative effects have dangerous side effects in older adults. However, these medications are prescribed to treat a variety of conditions that are common in the elderly [4, 5]. One of the most common side effects of medications, especially sedatives and anticholinergics, is xerostomia [6].

Xerostomia can disrupt the function of the salivary glands, causing difficulties in speaking, chewing, tasting, and swallowing. It may also affect a person's quality of life and social role. People who complain of xerostomia are at a higher risk of oral diseases, indigestion, and dysphagia (difficulty swallowing). Overall, the oral health-related quality of life (OHRQoL) of patients with xerostomia can be impaired [3, 7, 8]. According to a study in Tehran, 24.2% of the elderly population studied suffered from xerostomia [9].

To develop strategies to minimize the inappropriate use of anticholinergics and sedatives in the elderly, a reliable measure to describe the extent of the problem and accurately identify the target population is essential to improve prescribing of these medications [4]. The drug burden index (DBI) is a new, evidence-based tool for assessing risk and determining the cumulative exposure of older adults to medications with clinically significant anticholinergic and sedative effects [10, 11, 12].

This index was developed and published in 2007 by Hilmer et al. to calculate drug burden [5, 12]. It is non-invasive, as it is calculated by reviewing prescriptions. In addition, it takes into account the dosage of each anticholinergic and sedative drug. It is also unique compared to other tools in that it calculates both the cumulative drug exposure and the drug dose to the patient [4, 13].

Although a search of sources revealed that drugs with anticholinergic and sedative effects are associated with xerostomia[5, 14], no study was found that examined the relationship between the DBI index and OHRQoL in elderly population. Therefore, the aim of the present study was to investigate the relationship between the DBI and OHRQoL in the elderly in Amirkola city.

Materials & Methods

The present study was part of the second phase of the Amirkola Comprehensive Elderly Project (AHAP). This project was conducted in the second half of 2016 among the elderly in Amirkola. The study population of this project was all elderly people in the city of Amirkola (including 2200 people over the age of 60). The inclusion criteria were all elderly people aged 60 years and older in the city of Amirkola, and people with incomplete files were not included in the study. The required sample size was calculated to be 800 people.

$$n = \frac{\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2}{(\omega)^2} + 3 \Rightarrow n = \frac{(1.96 + 0.86)^2}{(0.1)^2} + 3 = 798 \sim 800$$

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After the researchers explained the study objectives and the method of conducting the study, written informed consent was obtained from the elderly. The elderly in this study were also assured that their information would be kept confidential. In addition, the elderly were able to leave the study at any time if they were not willing to do so. This study was approved by the Ethics Committee of Babol University of Medical Sciences (IR.MUBABOL.HRI.REC.1400.017).

Baseline data and demographic information of all study participants, including age, gender, marital status, etc., were collected using a questionnaire. Subsequently, OHRQoL was assessed using the Geriatric Oral Health Assessment Index (GOHAI) questionnaire. This questionnaire contains 12 questions that are asked in the form of an interview about the patient's condition. In this questionnaire, three areas are examined: physical, social-spiritual-psychological, and pain and discomfort. The answers to the 12 questions were recorded on a Likert scale in the form of five options. The total score for the 12 questions ranged from 12-60. The lower the total score given, the lower the quality of life related to the individual's oral health, and the higher the total score, the fewer problems are caused by the mouth and teeth in the individual's life. The validity and reliability of the Persian version of this questionnaire were confirmed by Motallebnejad et al. [15].

All subjects were also assessed for the presence or absence of xerostomia using a standard xerostomia questionnaire. This questionnaire consists of nine questions, and if at least five questions are answered positively, xerostomia is confirmed [16].

Patients' medication information was also collected using a standard 12-question medication history questionnaire, which included questions on the type of medication used, duration of medication use, and type of medication taken. To investigate each individual's exposure to anticholinergic and sedative drugs, medications with anticholinergic and sedative properties and their daily doses were extracted from each patient's medication list. If the patient's dose was not known, the average value was recorded.

Then, each person's exposure to these drugs was calculated using the DBI criterion according to the following formula, where D is the daily dose, δ represents the minimum effective dose, DBI_{Ach} is the anticholinergic drug burden index, and DBI_S represents the sedative drug burden index.

$$DBI_{Ach}=\Sigma[D_{Ach}/(D_{Ach}+\delta)]$$
$$DBI_S=\Sigma[D_S/(D_S+\delta)]$$
$$DBI_{Total} = DBI_{Ach} + DBI_S$$

Individuals were divided into three categories based on DBI criteria: no exposure (DBI = 0), low exposure (DBI<1), and high exposure (DBI≥1) to anticholinergics [21,22]. The percentage of xerostomia and the mean score of the GOHAI questionnaire, related to the OHRQoL questionnaire, were calculated in each group, and then the level of OHRQoL was compared between the three groups. Finally, the relationship between OHRQoL and xerostomia was examined.

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Statistical analysis

Data were analyzed using SPSS 18 (IBM, Armonk, New York, USA) and an independent-sample t-test, chi-square, and Pearson correlation coefficient. A value of $P<0.05$ was statistically considered significant.

Results

In the current study, the records of 800 patients with a mean age of 70.13±7.39 years were reviewed, 400 (50%) of whom were male and 400 (50%) female. Information on the age groups, smoking, and xerostomia of the participants is given in Table 1.

Table 1. Frequency of subjects by age group, smoking, and xerostomia

Variables		Frequency (Percentage %)
Age group	60-64	199 (24.9%)
	65-69	243 (30.4%)
	70-74	155 (19.4%)
	75-79	101 (12.6%)
	80-84	69 (8.6%)
	85-99	33 (4.1%)
Smoking	Yes	119 (14.9%)
	No	681 (85.1%)
Xerostomia	Yes	121 (15.1%)
	No	679 (84.9%)

The treatment information of the patients is illustrated in Table 2. The mean DBI_{Total} score was 0.37± 0.55 and the mean OHRQoL score was 51± 7.37. OHRQoL was higher in men than in women ($p<0.001$). However, xerostomia and mean DBI_{Total} score were significantly higher in females than in males ($p<0.001$ and $p<0.001$, respectively).

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Table 2. Mean medical information of participants, total and by gender

	Total			By gender		
Variables	**Minimum**	**Maximum**	**Mean ± SD**		**Mean ± SD**	**P-value***
DBI_{Ach}	0	3.39	0.31 ± 0.48	Male	0.24 ± 0.43	<0.001**
				Female	0.39 ± 0.38	
DBI_{S}	0	1.91	0.06 ± 0.2	Male	0.05 ± 0.18	0.197
				Female	0.07 ± 0.22	
DBI_{Total}	0	3.65	0.37 ± 0.55	Male	0.29 ± 0.33	<0.001**
				Female	0.46 ± 0.27	
OHRQoL	21	60	51 ± 7.37	Male	51.86 ± 6.96	<0.001**
				Female	50.14 ± 7.67	
Xerostomia	0	9	1.81 ± 2.35	Male	1.33 ± 1.97	<0.001**
				Female	2.92 ± 2.59	

* Independent-sample T test - Man-Whitney
** Statistically significant

Based on DBI_{Total}, 468 (58.5%) subjects were unexposed, 242 (30.25%) persons were low exposed, and 90 (11.25%) old people were high exposed. The mean score of OHRQoL in unexposed, low-exposed, and high-exposed subjects was 50.99±7.56, 51.37±7.14, and 50.80±6.99, respectively. However, no statistically significant difference was observed between the mean score of OHRQoL in the three groups.

No significant relationship was found between DBI_{Total} and OHRQoL (Figure 1). However, a statistically significant inverse linear relationship was observed between xerostomia and OHRQoL. The strong linear relationship between DBI_{Total} and DBI_{Ach} indicates that DBI_{Total} was more affected by anticholinergics. There was also a weak direct linear statistical relationship between xerostomia and DBI_{Total} (Table 3 and Figure 2).

When examining the difference between the mean age, DBI score, and OHRQoL score between individuals with and without xerostomia, it was also observed that the mean age, DBI_{Ach} and DBI_{Total} scores were significantly higher and the OHRQoL score was significantly lower in individuals with xerostomia than in individuals without xerostomia (Table 4).

A statistically significant relationship was found between gender and xerostomia ($p<0.001$), with the prevalence of xerostomia being higher in women (22.5%) than in men (7.8%). In addition, 74.4% of patients with xerostomia were female.

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Table 3. Examining the correlation between DBI, xerostomia, OHRQoL, and age

Variables		DBI_{Ach}	DBI_{S}	DBI_{Total}	Xerostomia	OHRQoL	Age
DBI_{Ach}	Correlation coefficient	1					
	P-value*	-					
DBI_{S}	Correlation coefficient	0.163**	1				
	P-value	<0.001	-				
DBI_{Total}	Correlation coefficient	0.933**	0.506**	1			
	P-value	<0.001	<0.001	-			
Xerostomia	Correlation coefficient	0.141**	0.048	0.141**	1		
	P-value	<0.001	0.177	<0.001	-		
OHRQoL	Correlation coefficient	-0.038	-0.03	-0.044	-0.303**	1	
	P-value	0.285	0.402	0.21	<0.001	-	
Age	Correlation coefficient	0.056	-0.008	0.047	0.182**	-0.027	1
	P-value	0.111	0.813	0.184	<0.002	0.445	-

* Pearson correlation test
** Statistically significant

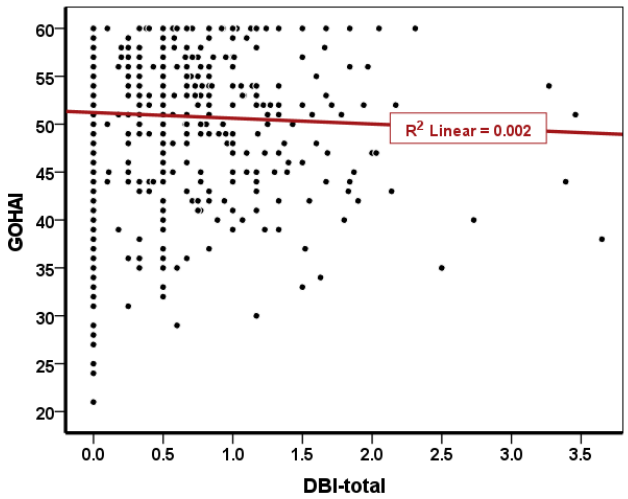

Figure 1. Relationship between the mean DBI score and OHRQoL

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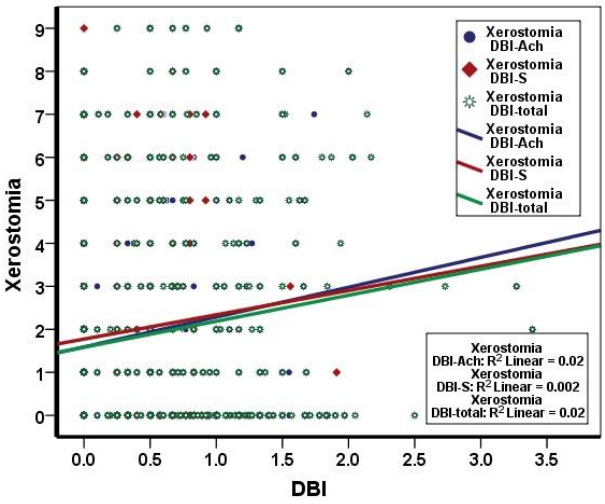

Figure 2. Relationship between the mean DBI score and xerostomia

Table 4. Comparison of studied variables between individuals with and without xerostomia

Xerostomia / Variables	Yes Mean ± SD	No Mean ± SD	P-value*
DBI_{Ach}	0.47 ± 0.56	0.28 ± 0.46	<0.001**
DBI_{S}	0.08 ± 0.22	0.06 ± 0.19	0.288
DBI_{Total}	0.55 ± 0.65	0.34 ± 0.52	0.001**
Age	72.86 ± 8.31	69.65 ± 7.11	<0.001**
OHRQoL	46.03 ± 7.71	51.89 ± 6.95	<0.001**

* Independent-sample T test
** Statistically significant

Discussion

According to the results of the current study, there was no statistically significant relationship between DBI_{Total} and OHRQoL neither in total nor in gender separated groups. Urine et al. showed in their study that anticholinergics were inversely associated with OHRQoL. However, they studied schizophrenia patients which is different from our study group [19]. Nevertheless, the results of both studies are in accordance. In addition, Stewart et al. showed in a systematic review that an increase in the anticholinergic burden index was

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associated with impaired function and reduced quality of life [20]. The results of this study and similar papers [8] are consistent with those of the present study.

Despite extensive database searches, no relevant studies were found that assessed the relationship between DBI and OHRQoL in elderly population. Most studies that examined DBI examined the association between DBI and quality of life or physiological and functional conditions in the elderly. Although DBI studies indicated a decrease in physical performance indicators such as walking speed and balance and an increase in fall risk in the elderly, most studies did not mention OHRQoL in the elderly. In addition, a number of the papers on anticholinergic drugs did not use any indices let alone DBI to report drug intake. Therefore, it is recommended that this issue be investigated in future studies in different populations.

The results of the present study showed that the mean DBI_{Ach} score and DBI_{Total} were significantly higher in people with xerostomia. Moreover, the mean DBI_{Ach} score and DBI_{Total} had a statistically significant linear relationship with xerostomia. Espada-Salgado et al. reported in their study that taking anticholinergic drugs appears to be an important factor causing salivary disfunction [14], which is in accordance to our results. Moreover, Schoppmeier et. al showed a correlation between anticholinergic intake, xerostomia, and hyposalivation [21], which in addition to other papers [22, 23, 24, 25], is consistent with the results of the current study.

According to the results of the present study, xerostomia had a statistically significant inverse relationship with OHRQoL. Moreover, the mean score of OHRQoL was significantly lower in people with xerostomia. Chapuis et al. also showed in their study that there is a very strong statistical relationship between xerostomia and OHRQoL, and their results are consistent with the present study [8]. Other studies also confirm the effect of xerostomia on reducing OHRQoL [3, 7, 26, 27].

In the current study, it was observed that xerostomia was significantly more common in women than in men. Age also had a significant direct linear relationship with xerostomia, although this relationship was very weak. Ringstad et al. showed in their study that dry mouth severity was higher in women [25]. In another study by Botelho et al. on the effects of xerostomia, stress and periodontal status on OHRQoL, xerostomia was also significantly higher in women [28]. The results of these studies alongside other papers are consistent with that of the current study [7, 29].

One of the limitations of this study was using a cross-sectional methodology to acquire data. Although these data were related to Amirkola Comprehensive Elderly Project [30], we used a cross-section of the available data. In addition, in this study xerostomia was measured in a subjective manner and no indices were used to quantify xerostomia or hyposalivation.

Conclusion

Although DBI had no direct effect on OHRQoL in the present study, it increased xerostomia. In addition, xerostomia significantly reduced OHRQoL. It is therefore recommended that physicians consider the possibility of xerostomia in the elderly when prescribing medications with anticholinergic effects.

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Conflict of interest:

The authors have declared no conflicts of interest.

Author's Contribution

Fatemeh Asadi: Designing the study, Data collection and Writing original draft. Fatemeh Sayyadi: Investigation, Conceptualization and study supervision. Atena Rahimi: Writing Methodology and Investigation. Mina Motallebnejad, Niloofar Jenabian, Zahra Sadat Madani, Mohamad Mehdi Naghibi Sistani, Atena Shirzad, Elham Mahmoudi, Reza Ghadimi, Seyed Reza Hosseini, Ali Bijani, and Fatemeh Baladi: Data collection**.** Ali Bijani and Seyed Reza Hosseini: Statistical analysis and interpretation of the data. The study supervised by Fatemeh Sayyadi and Seyed Reza Hosseini. All the authors have read and approved the final version of the manuscript.

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