

# Prevalence and the Effecting Factors of Halitosis Among the Individuals Living in Nursing Homes in Ankara

## Ankara İli Huzurevlerinde Yaşayan Bireylerde Halitozis Sıklığının ve Bunu Etkileyen Faktörlerin Belirlenmesi

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**ABSTRACT Objective:** The aim of this study was to assess the prevalence and effecting factors associated with halitosis in nursing homes in Ankara. **Material and Methods:** The study group consisted of 287 elderly people aged ranged from 60 to 97 years old (mean 74.2, median 75). The questionnaire was obtained about age, gender, education level, using smoking cigarettes, medical conditions and medication use including this study for each person. Each person was also volatile sulphur compounds (VSC) levels measurement with a halimeter and organoleptic measurements. Halitosis was diagnosed if the average level of VSC was 125 ppb and the organoleptic measurement using 0-5 point scale was 2. Tongue scores were obtained using a tongue coating index (TCI), periodontal status was measured and assessed using the Community Periodontal Index of Treatment Needs (CPITN) and Decayed, Missing and Filled Teeth Index (DMFT) indexes were calculated. Chi-square, Mann-Whitney-U, Spearman correlation coefficient tests were used for statistical analysis. **Results:** Halitosis was significantly higher for male than female. There was significant correlation between the level of VSC and organoleptic measurements ( $p<0.001$ ,  $r=0.858$ ). Smoking and self reported halitosis were significantly associated with halitosis. A statistically significant relation was found between halitosis and tongue scores ( $p=0.000$ ) and between halitosis and CPITN scores. **Conclusion:** Elderly people who live in nursing homes might have been motivated to oral hygiene instructions and to visit dentist regularly.

**Key Words:** Halitosis; nursing homes; periodontal index

**ÖZET Amaç:** Bu çalışmanın amacı Ankara ili huzurevlerinde yaşayan bireylerin halitozis prevalansının belirlenmesi ve halitozisi etkileyen faktörlerin değerlendirilmesidir. **Gereç ve Yöntemler:** Bu çalışma 60-97 (Ortalama 74,2, Ortanca 75 yıl) yaş aralığında 287 yaşlı birey üzerinde yapıldı. Çalışmaya dahil edilen her bireyin yaşı, cinsiyeti, medeni durumu, eğitim durumu, sigara kullanımı, sistemik hastalıkları ve ilaç kullanımı bir anket formu ile tespit edildi. Her bireyin organoleptik ölçümleri ve halimeter ile uçucu sülfür bileşenleri (VSC) ölçümleri yapıldı. Halimeter ile yapılan ölçümlerde VSC seviyeleri 125 ppb ve üstü, organoleptik ölçümleri de 0-5 skalasına göre 2 ve üzeri olan bireyler halitozisli olarak değerlendirildi. Dil kaplanma indeksi (TCI) kullanılarak dil skorları elde edildi, Community Periodontal Index of Treatment Needs (CPITN) kullanılarak periodontal durum değerlendirildi ve Decayed, Missing and Filled Teeth Index (DMFT) indeksi hesaplandı. İstatistiksel analiz için ki kare testi, Mann Whitney U, Spearman korelasyon katsayısı testi kullanıldı. **Bulgular:** Halitozis erkeklerde kadınlardan belirgin düzeyde yüksektir. VSC seviyesi ve organoleptik ölçümler arasında belirgin düzeyde korelasyon vardır ( $p<0.001$ ,  $r=0.858$ ). Sigara kullanımı, halitozis şikayeti ile halitozis arasında anlamlı ilişki vardır. Dil kaplanması, CPITN skorları ve halitozis arasında belirgin şekilde ilişki bulunmuştur. ( $p=0.000$ ) **Sonuç:** Huzurevlerinde yaşayan yaşlı bireyler oral hijyen talimatları ve düzenli diş hekimine gitmeleri için motive edilmelidir.

**Anahtar Kelimeler:** Ağız kokusu; bakım evleri; periodontal endeks

**H**alitosis is the common term used to define unpleasant or an offensive odor in expired air.<sup>1</sup> Although several non-oral sites have been related to oral malodour, including the upper and lower respiratory tracts, the gastrointestinal tract, and some diseases involving the kidneys or the liver, its thought that around 90% of all bad breath odours emanate from the mouth itself.<sup>2</sup>

In 90% of cases, though, the causes of halitosis are located in the mouth and can be attributed to deep carious lesions, periodontal diseases, oral infections, pericoronitis, mucosal ulcerations, impacted food or debris, tongue coating.<sup>3</sup>

Bad breath has been attributed to volatile sulphur compounds (VSC), primarily hydrogen sulfide and methylmercaptan.<sup>4</sup> The level of intraoral VSC can be estimated chairside, using portable sulfide monitors.<sup>5</sup>

The most simple and commonly used approach to sample and measure oral malodor is direct nasal sniffing of expelled mouth air. This often referred to as 'organoleptic' assesment.<sup>6</sup>

There has been limited research into the prevalence of oral malodour. A large study performed in Japan involving 2,672 individuals indicated that 6-23% of the subjects had oral malodour as measured by volatile sulphur compounds (VSCs) higher than 75 parts per billion (ppb) in expired air at some period during the day.<sup>7</sup>

Another study in the United States involving individuals older than 60 years found 24% to have been told that they had oral malodour.<sup>8</sup> In Brazil the prevalence of persistent oral malodour was 15%.<sup>9</sup>

The aim of this study was to assess the prevalence and effecting factors associated with halitosis in nursing homes in Ankara.

## MATERIAL AND METHODS

Before starting the study, the ethical committee responsible for clinical studies conducted by the Faculty of Dentistry, University of Ankara approved the study protocol. The study protocol was approved by the ethical committee responsible for

clinical studies conducted by the Faculty of Dentistry, University of Ankara before the initiation of the study.

A total of 287 elderly people signed the informed consent form and participated in this study. The ages of participants ranged from 60 to 97 years (mean 74,2, median 75). The questionnaire inquired about sociodemographic data, including age, gender, education level, using smoking cigarettes, medical conditions and medication use. Each person was also VSC levels measurement with a halimeter (Model RH-17k, Interscan Corp., Chatsworth, CA) and organoleptic measurements. Organoleptic scores were obtained by a trained, calibrated judge. Subjects were asked to refrain from eating any meal that might generate a strong odor on the day prior to and the morning of the test date. Subjects were also asked to refrain from smoking, wearing scented personal care products, tooth brushing, oral rinsing, and eating immediately prior to the visit.

Halitosis was evaluated according to the standard definition of Rosenberg et al. Halimeter® measurements were taken according to the manufacturer's instructions.<sup>10,11</sup> Maximum VSC values were recorded in ppb from a direct reading of the digital display monitor. For organoleptic measurements, subjects were instructed to close their mouths for 30 seconds and then exhale briefly through the mouth at a distance of 10-20 cm from the nose of the judge. Oral malodor research commonly relies on a six-point scale developed by Rosenberg et al. to measure odor intensity, as follows: 0: No malodor (odor concentration below the threshold of detection); 1: Barely noticeable odor; 2: Slight odor; 3: Moderate odor; 4: Strong odor; 5: Extremely strong odor (concentration appears close to saturation).<sup>10</sup> Halitosis was diagnosed if the average VSC level was  $\geq 125$  ppb and the organoleptic measurement was  $\geq 2$ .

Tongue scores were obtained using the Tongue coating index (TCI), a visual assessment that scores the amount of coating according to the following criteria: 0: No visible tongue coating problem (normal tongue); 1: Coating covering less than one-third of the tongue dorsum surface, 2: Coating

covering less than two-thirds of the tongue dorsum surface; 3: Coating covering more than two-thirds of the tongue dorsum surface.<sup>12</sup>

Periodontal status was measured by a single examiner using a CPI probe and assessed according to the Community Periodontal Index of Treatment Needs (CPITN). Measurements were taken of index teeth in each sextant, and the highest score was recorded as the CPITN score for each subject, as follows: 0: No sign of disease; 1: Bleeding; 2: Calculus; 3: Shallow pockets of 4-5mm; 4: Deep pockets of 5-6mm or more.<sup>13</sup>

Decayed, Missing and Filled Teeth Index (DMFT Index) was calculated using the following formula:

$$\text{DMFT} = \frac{\text{Decayed (caries)} + \text{Filled} + \text{Missing}}{\text{No. of examined patients}}$$

No. of examined patients

Data analysis was conducted using the software SPSS 11.0 (SPSS, Inc., Chicago, IL, US). Chi-square tests were used to assess relationships between halitosis and age, gender, academic level. Spearman's correlation coefficient was used to assess the relationship between halitosis and tongue scores, Mann-Whitney U test was used to assess the relationship between halitosis and CPITN, and t-test was used to assess the relationship between DMFT and halitosis.

## RESULTS

The age range of all participants was 60-97 years. Sociodemographic and personal characteristics of the interviewed elderly people were shown in Table 1. The prevalence of halitosis was 90.5% according to halimeter and organoleptic measurements. Mean VSC value was  $286.0 \pm 143.5$ . There was significant correlation between the level of VSC and organoleptic measurements ( $p < 0.001$ ,  $r = 0.858$ ) (Table 2).

The mean age was  $74.21 \pm 7.9$  year. Halitosis prevalence did not vary significantly among age groups ( $p = 0.694$ , Mann Whitney U test).

Halitosis prevalence was statistically higher ( $p = 0.00$ ) among male than female (Table 3).

**TABLE 1:** Percentage distribution of sociodemographical and personal characteristics of the elderly subjects.

Characteristics	(n=287)	%
<b>Age (year)</b>		
60-69	84	142
70-79	129	145
≥ 80	74	29.3
<b>Gender</b>		
Male	44.9	49.8
Female	25.8	50.2
<b>Education</b>		
Illiterate	87	30.3
Literate	32	11.1
Primary school	84	29.3
Secondary school	27	9.4
High school	34	11.8
University	23	8
<b>Nursing Homes</b>		
Akyurt	25	8.7
Emekli Sandığı	39	13.6
Keçiören Güçsüzler	41	14.3
Seyranbağları	51	17.8
Güçsüzler yurdu	7	2.4
Süleyman Demirel	70	24.4
Polatlı	19	6.6
Ümitköy	35	12.2
<b>Marital status</b>		
Married	17	5.9
Single	34	11.8
Divorced	236	82.2
<b>Systemic disorders</b>		
Presence	235	81.9
Absent	52	18.1
<b>Medication</b>		
Presence	224	78
Absent	63	22

**TABLE 2:** Distribution of elderly subjects by organoleptic scores and VSC.

Organoleptic scores	N=260 (ppb)	Mean±sd (ppb)	Median (ppb)	Min-Max (ppb)
2	65	176.27±29.93	173.00	127.00-241.67
3	110	252.32±53.76	248.50	135.67-418.33
4	65	410.93±99.50	400.00	186.00-702.00
5	20	598.05±154.89	633.16	354.67-875.00

Volatile sulphur compounds (VSC).

There was significant correlation between the level of VSC and self reported halitosis (Table 4).

Statistically significant relationships were found between halitosis and tongue coating (p=0.000) (Table 5) and halitosis and CPITN (p=0.004) (Table 6). No statistical significance (p=0.5) was found between halitosis and DMFT index. Statistically significant relationships were found between halitosis and smoking cigarettes (p=0.012) (Table 7).

## DISCUSSION

A number of studies have examined the prevalence of halitosis in different populations. In a study evaluating the prevalence of halitosis among general population in Japan, 6-23% of subjects showed VSC values above the suggested socially acceptable limit of 75 ppb.<sup>7</sup>

Another study in Brazil, found that in a general population in Rio de Janeiro, 15% presented persistent oral malodour.<sup>9</sup> In a study by Al-Ansari et al., the prevalence of halitosis in Kuwaiti patients was found to be 23,3%.<sup>14</sup> Liu et al., reported that 27,5% of the population had halitosis when they employed the organoleptic measurement and 20,3% of the subjects exhibited VSCs values higher than 110 ppb.<sup>15</sup> Aizawa et al., found 7 subjects with oral malodor in a study group of 115 elderly people.<sup>16</sup>

In our study a somewhat higher prevalence than usual is reported. The higher prevalence reported may be related to the age and the education level of the subjects in the study group.

The prevalence of self reported halitosis in

**TABLE 3:** The prevalence of persistent halitosis, according to gender (Mann Whitney U test, p=0.000).

Gender	N=260	Mean±SD (ppb)	Median (ppb)	Min-Max (ppb)
Male	n=138	333.76±164.11	276.33	128.67-875.0
Female	n=122	260.86±101.62	232.50	127.0-666.67

**TABLE 4:** Distribution of elderly subjects by self reported of halitosis and VSC (Mann-Whitney U testi, p=0.019).

Self reported	N=260	Mean±SD (ppb)	Median (ppb)	Min-Max (ppb)
Halitosis(+)	18	355.83±129.01	336.66	156.0±666.67
Halitosis(-)	242	295.37±143.16	249.66	127.0±875.00

Volatile sulphur compounds (VSC).

**TABLE 5:** Distribution of elderly subjects by tongue coating scores and VSC.

(TCI)	N=260	Mean±SD (ppb)	Median (ppb)	Min-Max (ppb)
1	32	228.60±112.63	190.50	127.00-704.33
2	47	239.89±104.71	217.66	128.67-702.33
3	181	327.59±147.48	291.00	133.00-875.00

Volatile sulphur compounds (VSC), Tongue coating scores (TCI).

Kuwaiti patients was 23.3%. No significant differences were found between males and females in the prevalence of halitosis.<sup>14</sup> The prevalence of self reported halitosis in Turkish people was 28,3%.<sup>17</sup> In adequate oral hygiene habits were the most important factors associated with self reported halitosis in this study.

**TABLE 6:** Distribution of elderly subjects by periodontal status Community Periodontal Index of Treatment Needs (CPITN) and Volatile sulphur compounds VSC (Spearman's correlation).

CPITN	N=260	Mean±SD (ppb)	Median (ppb)	Min-Max (ppb)	r	p
1	n=47	275.51±134.76	228.66	128.67-707.67	0,444**	0.002
2	n=59	276.74±130.10	233.33	127.00-707.67	0,308*	0.018
3	n=48	262.44±114.78	225.16	128.67-633.33	0,283	0.051
4	n=46	306.89±175.63	234.00	127.00-875.00	0,642**	0.000
5	n=62	287.75± 146.64	234.83	128.67-875.00	0,402**	0.001
6	n=38	292.58±176.81	227.83	128.67-875.00	0,467**	0.003

Community Periodontal Index of Treatment Needs Scores (CPITN).

**TABLE 7:** Distribution of elderly subjects by smoking status and Volatile sulphur compounds (VSC) (Mann-Whitney U test,  $p=0,012$ ).

Smoking status	N=260	Mean±Sd (ppb)	Median (ppb)	Min-Max (ppb)
Currently	n=61	344.34±169.13	313.66	132.00-875.00
Never smoker	n=199	285.82±131.17	245.00	127.00-756.67

In our study the rate of self reported halitosis was 6.2%. There was significant correlation VSC values and self reported halitosis. Similarly, the previous investigations by Iwanicka-Grzegorek et al.<sup>18</sup> analysed the statistical correlation between organoleptic measurements and VSC level by halimeter.

In contrast to Rosenberg et al., subjects' pre-conception scores, recorded prior to self-measurement, were not associated with the scores of the odor judge, laboratory tests, or the dental measurements.<sup>19</sup>

Our data in contrast with those by Oho et al., Iwakura et al., who observed a prevalence of self reported of halitosis ranging between 25% and 50%.<sup>20,21</sup> Our finding was below, it may be related to age and adaptation their odor.

The two anatomical sources of VSC identified in the oral cavity are gingival sulcus and the tongue.<sup>20</sup> Tongue coating has components, such as blood debris, nutrients, large amounts of desquamated cells and bacteria. These substances are responsible for putrefaction and strongly correlate with oral malodour.<sup>3</sup>

Takeuchi et al., have reported that oral malodor is associated with periodontal status. Moreover there were significant correlations between organoleptic measurements and VSC levels.<sup>22</sup> Calil et al., suggested that oral malodour problems might not occur in older people having healthy periodontal conditions and little tongue coating.<sup>23</sup> Another study found the accumulation of bacterial plaque on the tongue significantly related to oral malodor.<sup>24</sup>

Miyazaki et al. surveyed VSC levels, tongue coating and periodontal conditions in 2,672 indi-

viduals from the general Japanese population.<sup>7</sup> In line with the present study, a significant correlation was observed among VSC levels, periodontal conditions and tongue coating volume.

Another study assessed oral malodor in children using a portable sulfide monitor and the organoleptic method.<sup>25</sup> Tongue coating and CPITN scores were also obtained in a manner similar to that of the present study. Tongue coating and CPITN were significantly correlated with VSC level which is in line with the present study.

In a study evaluating the prevalence of halitosis in Switzerland, halitosis was found to be a problem for about one-fifth of the study population.<sup>26</sup> Clinical examination included objective measurement of VSCs through organoleptic assessment of breath odor as well as quantification of tongue coating, plaque index and probing depths for each subject. Study data showed tongue coating to be the only factor to increase organoleptic scores and VSC values.

A study by Quirynen et al., examined the interaction between halitosis, tongue coating and periodontal condition in 2000 patients.<sup>27</sup> Oral malodor was found to be primarily associated with tongue coating and pocket probing depth.

There were no significant correlation found between smoking, presence of a medical condition, regular medication usage and VSC levels in mouth air. Smoking, presence of halitosis were significantly associated with self reported halitosis.<sup>16</sup>

In the present study smoking, presence of a diabetes mellitus and antidiabetic medication usage were found to be significant correlated with VSC levels.

In conclusion, within the limits of this study, halitosis in elderly is related to self reported halitosis, smoking, periodontal parameters and tongue coating. In this study the main etiological factors include bacteria in the oral cavity related to periodontal diseases and the dorsum of the tongue. Elderly people who live in nursing homes might have been motivated to oral hygiene instructions and to visit dentist regularly.

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