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Effects of Gender and Smoking on Maximum Phonation Time: A Cross-Sectional Study Among Turkish Adults

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ABSTRACT

Objectives: This study aimed to examine how phonation duration, maximum phonation time (MPT), is affected by factors such as gender and smoking.

Methods: This cross-sectional study included 400 volunteers aged 18 years and older, who spoke Turkish and had no known vocal disorders. Participants' demographic information, smoking status, and MPT were recorded. MPT was measured using a stopwatch as the maximum time to produce the "A" sound in a single breath while sitting in a quiet environment.

Results: Participants were 56.3% male (n=225) and 43.7% female (n=175). Results showed that MPT was significantly longer in males (22.2±5.7 s) than in females (18.9±5.7 s, p<0.001). Smoking significantly shortened MPT (smokers: 17.8±6.0 s; non-smokers: 21.7±5.6 s; p<0.001). A moderate negative correlation was found between duration of smoking and MPT (r=−0.30, p=0.003).

Conclusion: MPT is significantly longer in males than in females. Smoking significantly shortens MPT, and this effect becomes more pronounced as smoking duration increases. These findings highlight the importance of considering individual risk factors in vocal health assessments.

Keywords: Gender, Maximum phonation time, Smoking, Vocal cord, Voice health

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INTRODUCTION

Maximum phonation time (MPT) refers to the length of a vowel or word that can be sustained with a breath during vocal production, and it is an important indicator of vocal health.[1] The length of MPT is related to the coordination of the vocal cords, lungs, and respiratory muscles.[2] Normal MPT may vary depending on the individual's age, gender, general health status, and lifestyle.[3] The relationship between MPT and lung function continues to be investigated. MPT has also been used as a biomarker of lung function impairment in some studies.[4]

Smoking is an important factor that directly affects vocal health.[5] Smoking can impair voice quality and shorten phonation time by causing chronic inflammation of the vocal cords.[6] Toxic substances found in cigarette smoke can reduce the flexibility and vibrating ability of the vocal cords, leading to significant changes in phonation time.[7] Research on the effects of smoking on the voice also reveals gender-specific effects.[8]

Although previous research has investigated MPT and its determinants, studies simultaneously assessing the effects of both gender and smoking within the same population are limited. Research on vocal health and MPT can also contribute to the development of special protection programs for voice-related professional groups (singers, teachers, announcers, etc.).[9,10] this study aimed to examine how MPT is affected by factors such as gender and smoking and to evaluate their effects on vocal health.

METHOD

This cross-sectional study was conducted between January and June 2025 conducted with 400 volunteers from various age groups and professions. Inclusion criteria were the ability to speak Turkish fluently, absence of any self-reported or diagnosed vocal or respiratory disorder, willingness to participate, and over 18 years of age. Individuals with recent upper respiratory tract infection, vocal fold pathology, or a history of speech therapy were excluded.

Participants were included in the study based on voluntary consent forms. Demographic data (age, gender, educational level, smoking status, duration, and daily cigarette consumption) were collected using a structured questionnaire. To measure the MPT, participants were asked to produce a sustained /a/ vowel sound at a comfortable pitch and loudness in a seated position within a quiet room.[11] Timing was performed using a calibrated stopwatch, and the duration was recorded in seconds. Each participant completed three trials with 30 s rest intervals, and the longest value was recorded as the MPT. All measurements were conducted by the same trained examiner to ensure procedural consistency.

This study received ethical approval from Hamidiye Scientific Research Ethics Committee (Approval No: 2025/6/30). The study was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki and the Good Clinical Practice Guidelines.

Research data were analyzed using Statistical Package for the Social Sciences for Windows, 27.0. Descriptive statistics are presented as mean±standard deviation, frequency distribution, and percentage. The Shapiro–Wilk test was used to examine the conformity of variables to a normal distribution.

The Mann–Whitney U test was used for statistical significance between two independent groups for variables found not to be normally distributed, and the Student's t-test was used for variables found to be normally distributed. The relationship between duration of smoking and daily smoking, and phonation time was analyzed using Pearson correlation tests. A $p<0.05$ was considered statistically significant.

RESULTS

Of the 400 individuals who participated in the study, 56.3% were male (n=225) and 43.7% were female (n=175). The largest age group was 18–25 years (n=225, 56.3%) followed by 26–35 years (n=53, 13.3%). Most participants were university graduates (n=288, 72.0%), and students constituted the largest occupational group (n=223, 55.8%).

The mean MPT was significantly longer in males than in females (22.2±5.7 s vs. 18.9±5.7 s; $p<0.001$) (Fig. 1). This finding indicates that males, on average, can sustain phonation

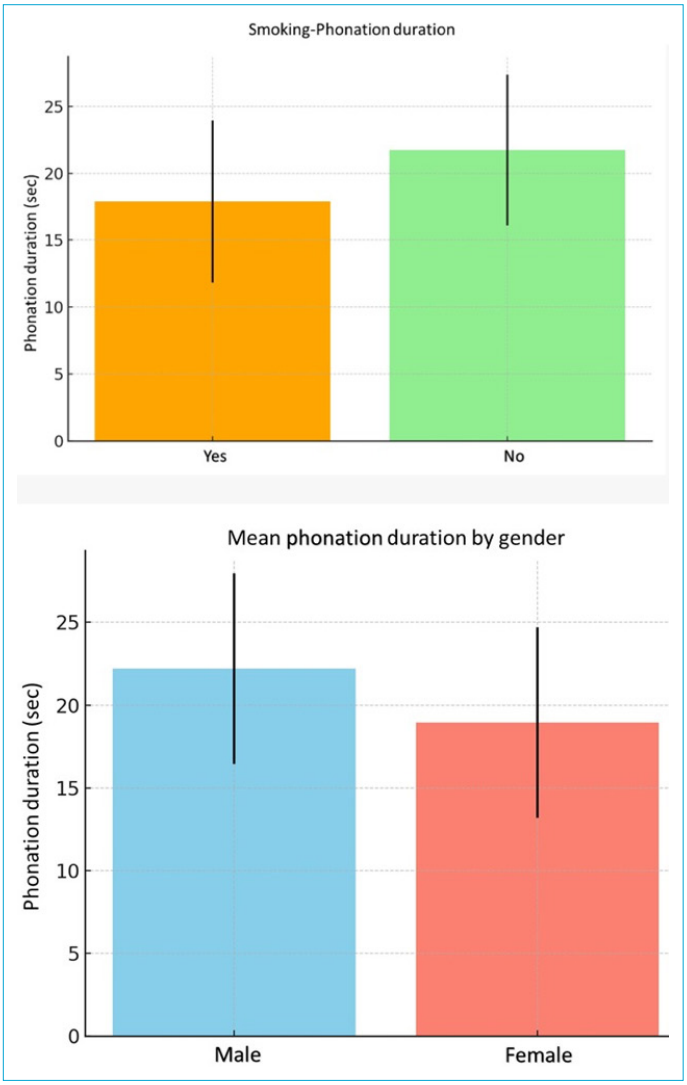

Figure 1. Maximum phonation time by smoking and gender. This illustrates the mean phonation duration (in seconds) for participants, categorized by their smoking status (top panel) and gender (bottom panel). The standard deviation for each group is indicated by the error bars.

approximately 3.3 seconds longer than females. Smokers had a significantly shorter MPT compared with non-smokers (17.8±6.0 s vs. 21.7±5.6 s; p<0.001) (Fig. 1). This result demonstrates a clear negative effect of smoking on phonation duration.

A moderate negative correlation was found between duration of smoking and MPT (r=–0.30, p=0.003). A weak negative correlation was found between the number of cigarettes smoked daily and MPT, but this relationship was not statistically significant (r=–0.12, p=0.24) (Fig. 2).

DISCUSSION

This study demonstrated that MPT was significantly longer in males than in females and that smoking had a negative impact on phonation duration. In addition, a moderate negative correlation was found between smoking duration and MPT, suggesting a cumulative dose–response relationship.

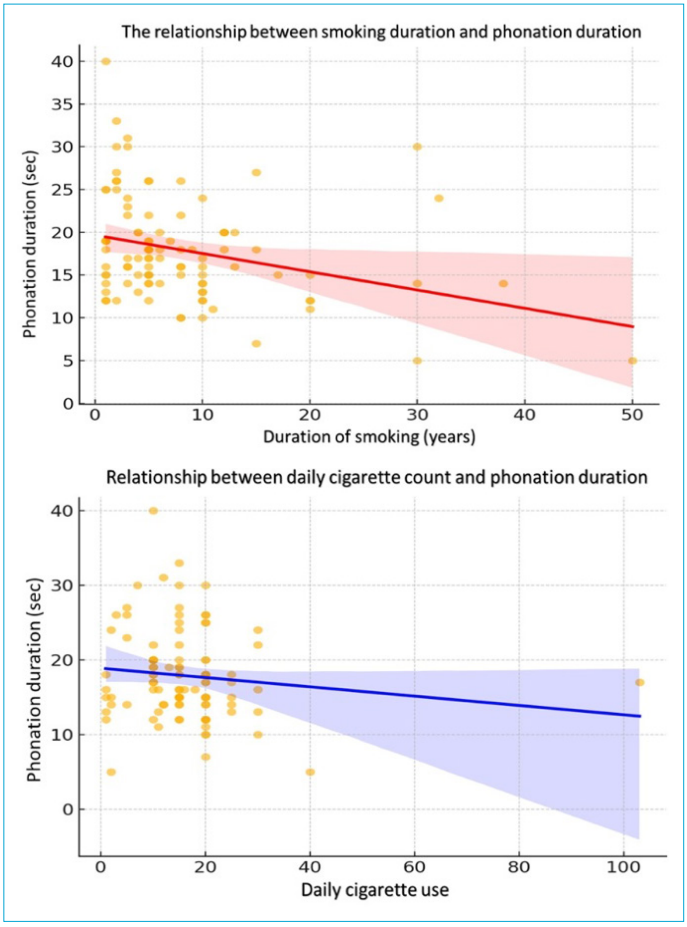

Figure 2. Relationship between smoking duration and daily cigarette count on phonation duration. This presents two scatter plots illustrating the association between different aspects of smoking behavior and phonation duration (in seconds), along with a fitted linear regression line and its 95% confidence interval (shaded area).

In the "Healthy Older Adults" study conducted by MPT was found to be longer in males than in females in older adults; this difference becomes more pronounced with age.[4] Another study reported that male's MPT values decreased significantly with age, while in females the effect of age was more limited.[12] The physiological advantage of males in terms of lung capacity and vocal fold length may explain this difference.[13] In addition, male's higher respiratory function test parameters may provide an advantage in terms of the pressure required to occur in the phonation pathways and the sustainability of phonation.[14] In our study, the average phonation time of male participants was found to be significantly longer than that of female participants. However, it should be noted that the factors contributing to this difference are multifactorial. Laryngeal size/laxity, vocal fold structure, neuromuscular control, phonation strategies, and training/voice use also influence MPT. Some studies examine nuances that cannot be generalized simply by classifying males or females.[15]

The effects of smoking on vocal health have been highlighted in many studies. Awan et al. have shown that smoking reduces vital capacity and decreases MPT.[16] Some studies have reported that toxins in cigarette smoke cause edema,[17] inflammation, and mucosal damage in the vocal cords, leading to a shortening of phonation time.[18,19] he reduction in phonation time in smokers is consistent with the literature. Similarly, a meta-analysis by Byeon and Cha[20] showed that smoking significantly reduces phonation time. It was stated that long-term smoking, in particular, significantly reduces voice production capacity.

These findings highlight the importance of early preventive counseling regarding smoking and voice hygiene, particularly for individuals in voice-dependent professions such as teachers, singers, and broadcasters. MPT can serve as a simple, noninvasive clinical screening tool for early detection of subclinical voice impairment in primary care and otolaryngology settings.

Study Limitations

The design and cross-sectional nature of our study may prevent us from clearly assessing the long-term (cumulative) effects of smoking. Long-term follow-up studies are needed to evaluate the results from this perspective. Furthermore, other factors that may affect phonation time (such as age, height, weight, and lung capacity) were not analyzed in detail. A limitation of this study is that MPT was measured using only a stopwatch, without the use of acoustic analysis tools, which may reduce the precision of the measurement. Future studies, including aerodynamic and acoustic measurements, are recommended.

CONCLUSION

This study monitored changes in MPT based on gender and smoking. While MPT was found to be longer in males than in females, it was significantly shorter in smokers. Furthermore, statistically, MPT decreased with increasing duration of smoking.

These findings highlight the importance of considering individual risk factors in vocal health assessments. Understanding the negative effects of smoking on vocal health is particularly important for supporting smoking cessation programs and improving vocal health education.

Future studies, more comprehensive studies that analyze other factors that may influence MPT, will contribute to the expansion of scientific knowledge in the field of vocal health.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Funding: None.

Ethics Committee Approval: The study was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki and Good Clinical Practice Guidelines, and ethical approval was obtained from the Health Sciences University Hamidiye Scientific Research Ethics Committee (Approval No: 2025/6/30). Informed consent was obtained from all participants.

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