

# Relationship between Smoking and Vocal Self-perception of Trans Women

## Relación entre el tabaquismo y la autopercepción vocal de las mujeres trans

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## Abstract

**Objective.** To verify the relationship between smoking, age, schooling, and the vocal self-perception of trans women.

**Methods.** Cross-sectional observational quantitative study conducted with 24 trans women over 18 years old, living in their affirmed gender for a minimum of 6 months. Data collection involved selected questions from the translated and authorized Portuguese version of the Trans Woman Voice Questionnaire (TWVQ) and information regarding age, education, occupation, and smoking status. All variables were analyzed descriptively, and the association with smoking was assessed using Pearson's Chi-square, Fisher's Exact, Student's T, and Mann-Whitney tests, with a significance level of 5%.

**Results.** The mean age of trans women was 28.2 +/- 6.5 years (range: 21 - 48). Most participants (41.6%) had completed their high school education and pursued diverse careers. Regarding smoking habits, 58.3% of women were either current smokers or had smoked at least 100 cigarettes in their lifetime. A statistically significant association was found between smoking and age ( $p = 0.001$ ), with smokers having a lower average age (24.9 years) compared to nonsmokers (32.9 years). However, no statistical significance was observed between smoking, education, and self-perception of vocal femininity. Only 9 (37.5%) trans women perceived their voices as feminine, while 17 (70.7%) desired a more feminine-sounding voice.

**Limitation.** The limited sample size in this study may have constrained the ability to detect significant differences between the analyzed groups using statistical tests.

**Conclusion.** The smoking prevalence was notably high among younger trans women. However, there was no statistically significant difference in vocal self-perception between those who smoked and those who did not. The majority of trans women expressed a desire for their voices to sound more feminine, particularly among smokers.

## Keywords

Smoking; transgender people; gender dysphoria; voice; speech-language pathology; pitch; vocal quality; vocal self-perception; social identity; ideal voice.

**Disclaimer**

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**Contribution of the authors**

**Ana Clara Oliveira Abreu:** Data curation, formal analysis, investigation, methodology, visualization, writing – original draft.

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**Resumen**

**Objetivo.** Verificar la relación entre el tabaquismo, edad, escolaridad y la autopercepción vocal de mujeres trans.

**Métodos.** Estudio observacional transversal cuantitativo realizado con 24 mujeres trans mayores de 18 años, que viven en su género afirmado durante 6 meses. Para la recolección de datos se utilizaron preguntas seleccionadas de la versión portuguesa traducida y autorizada del Trans Woman Voice Questionnaire (TWVQ) y datos sobre edad, educación, ocupación y tabaquismo. Todas las variables se analizaron descriptivamente y la asociación con el tabaquismo se realizó mediante las pruebas Chi-cuadrado de Pearson, Exacta de Fisher, T de Student y Mann Whitney, con un nivel de significación del 5%.

**Resultados.** La edad promedio de las mujeres trans fue de 28,2 +/- 6,5 (rango 21 - 48). La mayoría de las participantes (41,6%) había terminado la escuela secundaria con carreras muy diversas. Respecto al tabaquismo, el 58,3% de las mujeres fuman actualmente o han fumado al menos 100 cigarrillos en su vida. Hubo una asociación estadísticamente significativa entre el tabaquismo y la edad ( $p = 0,001$ ), en la que la edad promedio entre los fumadores (24,9 años) fue menor que la de los no fumadores (32,9 años). No hubo significación estadística entre el tabaquismo, la educación y la autopercepción vocal. Solo 9 (37,5%) mujeres trans actualmente consideran su voz femenina y 17 (70,7%) dijeron que la voz ideal podría sonar más femenina.

**Limitación.** La pequeña casuística puede haber limitado la identificación de diferencias entre los grupos analizados a través de pruebas estadísticas.

**Conclusión.** El tabaquismo fue alto entre las mujeres trans, especialmente las más jóvenes. La autopercepción vocal no fue estadísticamente diferente entre los grupos de fumadores y no fumadores. La mayoría de las mujeres trans dijeron que sus voces podrían sonar más femeninas, especialmente las fumadoras.

**Palabras clave**

Tabaquismo; personas transgénero; disforia de género; voz, patología del habla y lenguaje; tono; calidad vocal; autopercepción vocal; identidad social; voz ideal.

**Introduction**

Smoking is primarily driven by nicotine addiction, one of the over 7,000 substances in tobacco [1]. This addictive compound is found in various forms of tobacco consumption, including cigarettes, pipes, cigars, and e-cigarettes. Exposure to a multitude of chemicals, with at least 70 of them classified as carcinogens, directly impacts public health [2]. It is linked to a range of health issues, such as lung cancer [3], cardiovascular diseases [4], respiratory diseases [5], oral diseases [6], and head and neck cancer [7].

The prevalence of smoking varies among different population groups, as these groups may exhibit distinct vulnerabilities to tobacco use. While research on smoking habits among transgender individuals, who identify with a gender different from their assigned gender at birth, is limited, studies indicate that the smoking rate is higher in this population compared to cisgender individuals (those who identify with the gender assigned at birth) [8]. It is estimated that transgender individuals and other

gender minorities are 2 to 3 times more likely to use cigarettes, e-cigarettes, and cigars [9]. However, despite this elevated smoking rate, no significant differences are observed in smoking cessation success rates compared to non-minority groups [10].

Tobacco use has a wide range of health impacts, including vocal changes. The contact between the laryngeal mucosa [11] and tobacco products can lead to alterations in vocal quality and the histology of the vocal folds. This increases the risk of developing laryngeal disorders such as Reinke's edema and cancer [12]. The interaction of tobacco substances in the laryngeal region also contributes to secretions, coughing, and throat clearing among smokers [13].

Among the vocal disorders that result from long-term tobacco use, a common finding is a decrease in the mean fundamental frequency ( $f_0$ ) values [13,14]. This effect can be particularly problematic for trans women, as the voice plays a crucial role in expressing and affirming their gender identity. Vocal self-perception directly impacts an individual's quality of life and can be influenced by how others perceive their voice [15]. In this context, trans women frequently seek to develop a voice that aligns with their gender identity, as vocal dissatisfaction becomes an additional vulnerability factor for this population [16].

It is believed that smoking can have a negative impact on the vocal feminization process in trans women and can influence their satisfaction with communication and social participation. It is important to note that hormone therapy alone does not lead to satisfactory changes in the voices of trans women. While no specific studies have been found that directly associate smoking, hormone use, and vocal changes, research suggests that the concurrent use of gender-affirming hormones and tobacco poses a higher risk for other health conditions, such as cardiovascular diseases [17,18].

Investigating the potential influence of smoking habits on the vocal perception of trans women is of utmost importance, as it can provide valuable insights for targeted preventive measures aimed at this population. Smoking is a behavior that can be modified, and quitting this habit would significantly benefit the overall health and social well-being of trans women. Considering the unique challenges these women face concerning mental health and gender identity, the detrimental effects of smoking could further exacerbate issues related to mental well-being and vocal perception. Therefore, acquiring knowledge about the relationship between smoking, age, education level, and vocal self-perception is crucial for informing intervention strategies and promoting improved health outcomes for this population.

The objective of the present study was to examine the relationship between smoking, age, level of education, and vocal self-perception among trans women.

## Methods

This cross-sectional observational quantitative study involved 24 trans women as participants. The study employed a self-administered questionnaire that was electronically distributed to each participant, who then completed it at their premises. Data collection occurred between October 2018 and April 2019, during which 49 trans women were invited to participate. However, 25 individuals declined the invitation. The questionnaire was created using the Google Forms platform (<https://docs.google.com/forms/u/0/>), and access to it was granted to participants only after they agreed to the TCLE Form (Portuguese for Free and Informed Consent Form)—the questionnaire settings allowed for single responses from each participant. The Research Ethics Committee (COEP) approved the study under the number

2,689,576. All participants provided their informed consent by completing the consent form and receiving a copy via email.

The “snowball” technique supported the convenience sampling method employed in this study. This technique involves identifying individuals from the study population who can then recommend others from the same group [19]. In the present study, trans women were initially invited to participate, and, subsequently, they were asked to indicate other potential participants to form the sample. This strategy was utilized to enhance the sample’s diversity by leveraging the initial participants’ social networks and knowledge. It facilitated the inclusion of trans women who might not have been reached through conventional recruitment methods.

The inclusion criteria for participants were as follows: self-identification as a trans woman, literacy, being 18 years of age or older, and having internet access. The only exclusion criterion was being a trans woman who had identified as such for less than six months. No participants were excluded based on these criteria.

Data collection involved gathering information on participants’ age, education, profession, smoking habits, and responses to selected questions from the translated and authorized Portuguese version of the Trans Woman Voice Questionnaire (TWVQ) [20].

The Trans Woman Voice Questionnaire (TWVQ) is a vocal self-perception questionnaire designed explicitly for trans women [21]. It comprises 30 questions that assess various aspects of voice-related experiences, in which the participant must indicate in each of them the frequency with which she experiences certain situations. In this study, five questions were selected from the TWVQ that specifically addressed aspects of voice that smoking habits may influence. These questions include numbers: four (the pitch of my speaking voice is too low), five (the pitch of my voice is unreliable), nine (my voice gets croaky, hoarse or husky when I try to speak in a female voice), eleven (when I speak the pitch of my voice does not vary enough), and twenty-seven (my voice ‘gives out’ in the middle of speaking). Participants were required to rate the frequency of experiencing each situation on a four-point scale, with options ranging from 1 = never or rarely, 2 = sometimes, 3 = often, to 4 = usually or always. Due to the small sample size, the response categories were further redistributed for data analysis into 1 = never or rarely, 2 = sometimes, and 3 = always or almost always, aiming to enhance the data analysis process. The TWVQ also includes two additional questions that assess the participants’ current vocal self-perception and how they perceive their ideal voice. These questions involve classifying the voice as female, neutral, or male. Considering the limited sample size, these response categories were also grouped for better data analysis.

The dependent variable in this study was based on the classification criteria for regular smokers established by the Pan American Health Organization (PAHO) [22]. Participants were asked the following question: “Considering a smoker as someone who has smoked at least 100 cigarettes or 5 packs in their lifetime and continues to smoke, how would you classify yourself?” The response options included classifying oneself as a nonsmoker, former smoker, or current smoker. The variable was dichotomized by grouping smokers and ex-smokers to simplify the analysis. The explanatory variables were age, education, and the selected TWVQ questions.

A descriptive analysis was conducted for all variables. The association between the variables and smoking was assessed using statistical tests appropriate for each variable type. Pearson’s chi-square test and Fisher’s exact test were employed for the qualitative variables, while

Student's t-test and Mann-Whitney test were utilized for the quantitative variables. A significance level of 5% was considered for all analyses. The normality of the quantitative variables was assessed using the Shapiro-Wilk test. The statistical software SPSS Statistics 20 was used to perform the analyses.

## Results

A total of 24 trans women participated in the study, with an average age of 28.2 years (SD = 6.5). The age range of the participants varied from 21 to 48 years. Regarding education, 41.6% of the participants had completed high school. The average score on the vocal self-report protocol (TWVQ) was 55.4 (SD = 21.1), with scores ranging from 30 to 100 (Table 1). It is worth noting that all participants (n = 24) reported hormone use.

**Table 1. Sociodemographic and health characteristics of trans women.**

Variables	N=24	%		
<b>Smoking</b>				
Nonsmoker	10	41.67		
Former smoker	5	20.83		
Smoker	9	37.50		
<b>Education</b>				
Elementary school - complete	1	4.16		
High School - incomplete	2	8.33		
High School - complete	10	41.67		
College - incomplete	7	29.17		
College - complete	4	16.67		
	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Age (years)</b>	28.2	6.5	21	48
<b>TWVQ total</b>	55.4	21.16	30	100

The participants in the study had diverse occupational backgrounds. The occupations included beauty professional (n = 7), sex worker (n = 2), singer (n = 2), photographer (n = 2), commercial manager (n = 1), accountant (n = 1), student (n = 1), artist (n = 1), telemarketing operator (n = 1), cleaner (n = 3), pedagogue (n = 1), prosthetic (n = 1), writer (n = 1), YouTuber (n = 1), self-employed (n = 1), unemployed (n = 2). Some participants reported engaging in more than one profession or occupation.

Concerning smoking habits, it was found that 58.3% of the women in the study were classified as current smokers or had smoked at least 100 cigarettes in their lifetime (smoker/ex-smoker). The association between smoking and sociodemographic characteristics was examined, and a statistically significant association was found with age (p=0.001). The average

age of smokers/ex-smokers was 24.9 years, which was lower than that of nonsmokers, who had an average age of 32.9 years. However, no statistical significance was observed between smoking status and the education variables or the scores obtained on the TWVQ (Table 2).

**Table 2. Association between smoking and sociodemographic characteristics of trans women.**

Variables	Nonsmoker		Smoker/ ex-smoker			Value p	
	N=10	%	N=14	%			
Education*							0.473
Complete high school	6	60.0	7	50.0			
Complete or incomplete College	4	40.0	7	50.0			
	Mean	SD <sup>a</sup>	Median	Mean	SD <sup>a</sup>	Median	
Age**	32.9	7.564	34.5	24.9	2.645	25.0	0.001 <sup>b</sup>
TWVQ total***	50.9	19.985	50,5	58.57	22.110	52.5	0.3930

**Notes.** \*Chi-squared; \*\*Test Mann Whitney; \*\*\*Student's t-test; <sup>a</sup> SD: Standard Deviation; <sup>b</sup> means that the p-value was statistically significant ( $\leq 0.05$ ).

The association between smoking and the questions about vocal self-perception did not reach statistical significance. However, it is worth noting that a higher frequency of negative self-perception reports was observed among the smoking/ex-smoker group. Specifically, 85.7% of trans women who were smokers/ex-smokers reported that the pitch of their speaking voice was too low, which showed the strongest statistical association (p-value 0.075) among the vocal self-perception questions. Overall, only 9 (37.5%) participants considered their voice feminine, and 17 (70.7%) stated that their ideal voice could sound more feminine. However, no statistically significant differences were observed between the smoking and non-smoking groups (Table 3).

## Discussion

The study participants demonstrated a high prevalence of tobacco consumption at some point in their lives, particularly among younger individuals. Among them, 37.5% reported being current smokers, while 20.8% were former smokers. This smoking frequency rate among trans women in the study is higher than the prevalence reported in the general population. According to a Brazilian population survey that evaluated individuals over 18 years of age, the smoking prevalence was reported to be 9.8% [23]. Additionally, a study conducted in Atlanta indicated a male prevalence of 15.4% compared to 8.9% in females [2]. Regarding the trans population, evidence suggests that the smoking prevalence is higher in trans men (26.7%) compared to trans women (13.9%) [24]. Another study conducted in the United States, which compared tobacco use over 30 days between two groups based on gender identity, found a usage rate of 39.7% among trans adults, while the rate in the cisgender population was 25.1% [8]. Another study in San Francisco reported a daily smoking prevalence of 62.3% among trans women in the region [25]. Furthermore, a study focusing on the LGBT+ population found an overall smoking prevalence of 61% in this group, with 8.4% of

**Table 3. Association between vocal self-perception and smoking in trans women.**

	Nonsmoker		Smoker/ ex-smoker		Value p*
	N= 10	%	N=14	%	
<b>The pitch of my speaking voice is too low*</b>					
Never or rarely	5	50.0	2	14.3	0.075
Sometimes/ Always or almost always	5	50.0	12	85.7	
<b>The pitch of my voice is unreliable*</b>					
Never or rarely	4	40.0	3	21.4	0.296
Sometimes/ Always or almost always	6	60.0	11	78.6	
<b>My voice gets croaky, hoarse, or husky when I try to speak in a female voice**</b>					
Never or rarely	7	70.0	9	64.3	0.561
Sometimes/ Always or almost always	3	30.0	5	35.7	
<b>When I speak the pitch of my voice does not vary enough**</b>					
Never or rarely	5	50.0	6	42.9	0.729
Sometimes/ Always or almost always	5	50.0	8	57.1	
<b>My voice 'gives out' in the middle of speaking **</b>					
Never or rarely	5	50.0	6	42.9	0.729
Sometimes/ Always or almost always	5	50.0	8	57.2	
<b>Currently my voice is*</b>					
Feminine	4	40.0	5	35.7	1.000
Neutral	5	50.0	7	50.0	
Masculine	1	10.0	2	14.3	
<b>My ideal voice could sound*</b>					
Feminine	6	60.0	11	78.6	0.393
Neutral	4	40.0	3	21.4	
Masculine	0	0.0	0	0.0	
<b>My ideal voice could sound**</b>					
Feminine	6	60.0	11	78.6	0.324
Neutral	4	40.0	3	21.4	

**Notes.** \*Fisher's Exact Test; \*\* Chi-squared.

that percentage represented by transgender individuals, revealing a difference even between subgroups [26]. The current study revealed a frequency comparable to or higher than the averages reported in these prior investigations while not specifically comparing smoking habits between trans women and trans men. It is worth noting that there is a scarcity of research examining the prevalence of smoking among transgender individuals.

The high smoking rate observed in this study highlights the importance of implementing health promotion and prevention policies explicitly targeted at the transgender population, particularly trans women. A statistically significant association was found between age and smoking habits. The average age of participants who reported smoking (24.9 years) was lower than that of non-smoking participants (32.9 years). This finding suggests that younger individuals may be more amenable to changing their smoking behavior, as they may have had less exposure to addictive substances and harmful agents over time. Therefore, investing in health promotion policies is crucial, particularly among younger individuals. While the present study found a higher prevalence of smoking among younger individuals, a Brazilian survey indicated that young adults (under 25) had the lowest smoking frequency among various age groups [23]. However, it is worth noting that the relationship between age and smoking does not present a pattern when analyzed in different groups. A study conducted among college students revealed that 69.5% of students who reported smoking were under the age of 21 [27]. Among teachers, 64% of smoking participants were 44 or younger [28]. Among female sex professionals, the mean age of smokers was 26.8 [29].

It is imperative to consider additional factors that influence an individual's vulnerability to tobacco use. The variation in vulnerability can help explain the disparate prevalence rates observed across different groups. In addition to personal characteristics, an individual's initiation and continuation of smoking can be influenced by social, familial, economic, and occupational factors. Studies examining the relationship between smoking and marital status, education, skin color, and residential location have demonstrated that unmarried individuals, those with lower education levels [23], non-white individuals, and those residing in urban areas exhibit a higher likelihood of smoking [30,31]. Therefore, it is crucial to comprehend the socioeconomic context of trans women and their unique vulnerabilities and circumstances.

Smoking has been associated with vocal changes, resulting in various consequences. Prolonged exposure of the larynx to tobacco can lead to alterations in vocal quality. A previous study identified a correlation between smoking, hoarseness, and a deep voice [14]. It is well established that tobacco use is associated with decreased mean fundamental frequency ( $f_0$ ), speaking fundamental frequency (SFF), vocal range, and minimum intensity [13,32]. Another study involving 80 participants (40 smokers and 40 nonsmokers) reported an average  $f_0$  of 179.36 Hz for female smokers and 204.52 Hz for female nonsmokers. In male participants, the average  $f_0$  was 103.88 Hz for smokers and 114.49 Hz for nonsmokers [13]. Since the decrease in fundamental frequency results in a lower pitch, women perceive the alterations audibly to a greater degree as it deviates from the typical vocal pattern associated with their gender [5]. Vocal training conducted by speech therapists has been shown to be effective in enhancing gender affirmation for trans women through voice modification. A study demonstrated that this type of training resulted in an average increase of 26.5 Hz in the  $f_0$  of the voice during spontaneous speech [33]. This significant change can significantly contribute to trans women obtaining a voice that aligns more closely with their desired gender identity.



The results did not show a significant influence of smoking on the vocal self-perception of trans women. While the group of smokers/ex-smokers (58.5) had higher scores on the TWVQ questionnaire compared to non-smokers (50.9), the difference was not statistically significant in terms of perceiving vocal deviations associated with smoking. When selecting the questions from the TWVQ, we aimed to examine whether the smoking habit could potentially influence the self-perception of trans women about their voices. The lack of a significant relationship can be attributed to the fact that the impact of tobacco on the vocal folds, and subsequently on vocal quality, typically occurs with prolonged use [13]. Additionally, vocal self-perception encompasses more than just biological factors and is intricately linked to one's social identity [15]. The findings of this study suggest that among trans women, vocal self-perception is not solely determined by pitch, which refers to the subjective perception of voice frequency [34]. Studies utilizing acoustic measurements of the f0 should be undertaken to validate this hypothesis.

When queried about their “current voice” and “ideal voice,” irrespective of smoking status, most participants in this study categorized their current voice as “neutral.” Only a small number of trans women have considered their voice feminine. The prevailing sentiment among participants was that the ideal voice could possess more femininity, particularly among smokers. However, it is crucial to acknowledge that the perception and approach toward the voice of trans individuals extend beyond conventional standards of masculinity and femininity. It encompasses a sense of comfort and alignment with their gender expression within society. A study with trans women highlighted that their quality of life is intricately linked to how others perceive their voices [15]. Other components, such as intonation, vocal resonance, prosody and body expression, nonverbal communication, and feminine pragmatics, also hold significant relevance in terms of vocal classification and perception. [35].

### Limitations and recommendations

While smoking is a subject of global research, variations in methodologies exist when defining what constitutes a smoker. Different studies and organizations adopt various criteria to identify individuals as smokers. For instance, some studies and organizations consider individuals who have consumed more than 100 units or 5 packs of cigarettes in their lifetime and continue the habit [36]. Another criterion involves individuals self-reporting the consumption of at least one cigarette per day, with some studies also considering the duration of the habit, such as at least one month or year [37]. The World Health Organization (WHO) defines a smoker as someone who consumes any tobacco product daily or occasionally [38]. These methodological differences can impact the comparability of study findings among smokers. As done in this study, the grouping of smokers with former smokers may have influenced the results. Smoking cessation can potentially reduce the impact of tobacco on the voice, while a lower pitch may persist due to prolonged exposure. However, it is essential to acknowledge the limitation of insufficient information regarding smoking habits in this study.

To obtain more comprehensive insights, future studies should be conducted with larger sample sizes, encompassing a more comprehensive range of age groups and individuals with more prolonged exposure to tobacco. The small sample size in this study may have limited the ability to detect differences between the analyzed groups through statistical tests. The small sample size and convenience sampling method employed in this study prevent generalization of the findings. Therefore, it is crucial to develop prevention and health promotion guidelines tailored to the specific needs of trans women, considering the high prevalence of smoking observed within this population.

## Conclusion

The findings of this study suggest that smoking does not significantly impact the vocal self-perception of trans women. Despite higher scores on the vocal self-perception questionnaire among smokers/ex-smokers, no statistical difference was observed. It is worth noting that smoking prevalence was highest among younger trans women, and a majority expressed a desire for a more feminine voice, particularly among smokers/ex-smokers. The high prevalence of smoking in this population underscores the importance of implementing prevention and health promotion interventions. Additionally, considering the detrimental effects of smoking on achieving a more feminine voice, further research is needed to examine the long-term harm caused by smoking to gender affirmation through voice in trans women.

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