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Fundamental frequency and opinion about transgender women's voice

Frequência fundamental e opinião sobre a voz de mulheres transgênero

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ABSTRACT

OBJECTIVE: The study aimed to determine the average fundamental frequency of transgender women's voices and compare it with their opinions about their voices and the report of their perceptions about the interlocutors' feedback.

METHODS: Cross-sectional study of 25 transgender women between 19 and 46 years of age (mean, 32.2 years). Fundamental frequency variables obtained through Multi-Dimensional Voice Program Advanced (Kay PENTAX®), transgender women's opinions about their voices, and their report on listeners' opinions about their voices, obtained through a semi-structured interview with open questions, were assessed and compared using Fisher's exact test and the Kappa coefficient.

RESULTS: The average fundamental frequency of the transgender women group was 156.10 Hz. The majority of transgender women had a negative opinion about their voice, while the majority of reports on the views of listeners were positive.

CONCLUSIONS: Most transgender women naturally have a higher fundamental frequency without interventions. Additionally, they reported a negative perception of their voices despite listeners reporting a favorable opinion. This suggests that transgender women's vocal satisfaction is not directly related to fundamental frequency; moreover, other vocal markers can be addressed with the help of a speech therapist. Furthermore, we confirm that vocal self-assessment protocols are essential tools in evaluating the transgender population in the gender affirmation process.

KEYWORDS: gender dysphoria; transgender persons; speech therapy; voice; voice quality.

RESUMO

OBJETIVO: O estudo teve como objetivo determinar a frequência fundamental média das vozes de mulheres transgênero e compará-la com suas opiniões sobre suas próprias vozes, além de relatar suas percepções sobre o feedback dos interlocutores.

MÉTODOS: Estudo transversal com 25 mulheres transgênero entre 19 e 46 anos de idade (média de 32,2 anos). As variáveis de frequência fundamental foram obtidas por meio do Multi-Dimensional Voice Program Advanced (Kay PENTAX®), e as opiniões das mulheres transgênero sobre suas vozes, bem como seus relatos sobre as opiniões dos ouvintes a respeito de suas vozes, foram obtidos por meio de uma entrevista semiestruturada com perguntas abertas. Os dados foram avaliados e comparados utilizando o teste exato de Fisher e o coeficiente de Kappa.

RESULTADOS: A frequência fundamental média do grupo de mulheres transgênero foi de 156,10 Hz. A maioria das mulheres transgênero tinha uma opinião negativa sobre sua voz, enquanto a maioria dos relatos sobre as opiniões dos ouvintes foi positiva.

CONCLUSÕES: A maioria das mulheres transgênero tem naturalmente uma frequência fundamental mais alta sem intervenções. Além disso, elas relataram uma percepção negativa de suas vozes, apesar de os ouvintes relatarem uma opinião favorável. Isso sugere que a satisfação vocal das mulheres transgênero não está diretamente relacionada à frequência fundamental; além disso, outros marcadores vocais podem ser abordados com a ajuda de um fonoaudiólogo. Ademais, confirmou-se que os protocolos de autoavaliação vocal são ferramentas essenciais na avaliação da população transgênero no processo de afirmação de gênero.

PALAVRAS-CHAVE: disforia de gênero; fonoterapia; pessoas transgênero; qualidade da voz; voz.

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INTRODUCTION

The voice is the most accessible means of communication, linked to everyone's emotions and personality. Through it, we can express our feelings and thoughts and build different forms of communication. Beyond our behavior, voice and speech can also express traits of culture, regionality, and gender. Therefore, for each person, the voice also becomes part of their identity (Coleman *et al*., 2022; Pereira *et al*., 2018; Watt, Tskhay; Rule, 2018).

The World Health Organization updated the International Classification of Diseases (ICD-11), replacing the ICD-10, by moving "transsexualism" to a new chapter on "gender incongruence" within "conditions related to sexual health," no longer associating it with personality and behavioral disorders, and recognizing it as an issue of identity, no longer linked to choice or mental illness (Coleman *et al*., 2022; Dornelas *et al*., 2020; Reed *et al*., 2016). In affirming this identity, the voice plays an important role, potentially impacting self-perception and social receptiveness, and is related to the quality of life (Dacakis; Oates; Douglas, 2012; Dornelas *et al*., 2020). Although there is a prevailing binary gender perspective in the literature, not all transgender individuals face challenges in their voice and communication or seek professional support for it, but those who do require support and adjustments for greater vocal satisfaction (Coleman *et al*., 2022; Lobato *et al*., 2017; Reed *et al*., 2016).

One of the acoustic aspects of the human voice is the average fundamental frequency (fo). The fo of the cisgender male (CM) voice is in the frequency range of 80 to 150 Hz, while the fo of the cisgender female (CW) voice is in the range of 150 to 250 Hz (Menezes *et al*., 2024; Schwarz *et al*., 2018). Voices perceived as masculine have a lower fo. There is no definitive consensus in the literature regarding fo for transgender women (TW), which can range from a cisgender men's range (approximately 100-140 Hz) to a neutral range (145-175 Hz) or the range of CW (approximately 180-220 Hz), with a variation between 116.8 Hz and 171 Hz (Dornelas; Ribeiro; Behlau, 2024; Kim, 2020; Owen; Hancock, 2010).

For TW, the acoustic and behavioral aspects of the voice are still barriers to gender affirmation. Often, there is an inconsistency between the voice and gender in the opinion of TW and the listeners. In these cases, it was believed that the increase in vocal pitch was one of the markers that most influenced the identification of cisgender female-attributed traits of the voice (Dornelas; Ribeiro, Behlau, 2024; Owen; Hancock, 2010; Pinho; Bergel, 2001). The vocal satisfaction of TW is not directly linked to fo, but rather to their perception of femininity. Therefore, it is understood that considering the self-perception of TW and the perception of listeners is crucial (Dacakis; Oates; Douglas, 2012; Dornelas; Ribeiro; Behlau, 2024; Kim, 2020; Owen; Hancock, 2010).

Studies in speech and language sciences are constantly growing. More and more speech therapy professionals are integrated into multi-professional teams, contributing to comprehensive care and improving the population's quality of life (Quinn; Swain, 2018). Among the current demands of Speech-Language Pathology, TW is understood to actively seek specialized teams for gender affirmation and voice feminization (Quinn; Swain, 2018; Kawitzky; McAllister, 2020).

The speech therapist is qualified to improve acoustic vocal markers such as intonation, pauses, and fo, providing greater coherence between voice and gender. Thus, in vocal training with TW, the primary aim is to achieve vocal satisfaction through the development of a voice that is in harmony with one's gender identity (Dacakis; Oates; Douglas, 2012; Dornelas; Ribeiro; Behlau, 2024; Kawitzky; Mcallister, 2020; Owen; Hancock, 2010).

With vocal self-assessment, it is possible to measure the satisfaction of TW with their communication (Santos *et al*., 2015). Current literature reports that increased satisfaction with voice changes contributes to greater satisfaction with general health and gender identification among TW (Hancock; Krissinger; Owen, 2011; Santos *et al*., 2015). When the voice does not represent the gender with which the speaker identifies, it can cause discomfort in social interactions and negative experiences at work and school, which may impair social life (Hancock; Krissinger; Owen, 2011). Therefore, experiences with the environment and interlocutors are important variables to consider, mainly because they reflect the harmony in the individual’s social relations (Hancock; Krissinger; Owen, 2011).

The voice is an essential factor in gender perception and is directly related to people’s quality of life. Studies on vocal satisfaction are necessary because they contribute to speech therapy planning. Speech therapy interventions aim to help transgender women achieve a gender identity that aligns with both their perception and listeners' perception of their voice.

Given the preceding, we hypothesized that TW would have a lower fo, negative opinion about their voice and that listeners' views would also be harmful. This hypothesis was that the TW analyzed here had a biologically CM larynx, complained about their voice pitch, and had not undergone speech therapy or laryngeal surgery to change their voice.

There are few studies related to the voice of transgender people, highlighting the need to deepen the theme. Aiming at the best speech therapy intervention for this population, we intended to verify the fo acoustic vocal parameter and compare it with the TW's opinion about their voice and the report on listeners' opinions about their voices; both were self-reported.

MATERIAL AND METHODS

A cross-sectional, quantitative, and retrospective study was conducted through a database survey previously approved by the Human Research Ethics Committee (885,069). The sample was established for convenience and consisted of records of individuals diagnosed with gender dysphoria (GD) by the hospital's medical team, seen at a teaching hospital, and who formally consented to participate in the study. All research participants signed the Free and Informed Consent Form.

All subjects with medical records in the database (58 records) underwent speech therapy evaluations, interviews, an otorhinolaryngological medical examination, hearing screening, and voice emission collection, with the results being filed.

Inclusion criteria: TW adult individuals diagnosed with GD undergoing the process of gender affirmation.

Exclusion criteria: having influenza, respiratory allergies, or other illnesses on the day of the assessments; a history of lung disease; having undergone previous speech therapy and/or otorhinolaryngological treatment to address vocal issues (even if already treated) or vocal conditioning through training with vocal techniques; being a voice professional due to probable conditioning and vocal and respiratory training; having hearing loss, as normal hearing is essential for self-monitoring of voice and speech; presenting vocal complaints; identifying as a smoker or alcoholic. The following individuals were excluded: 8 for smoking, 6 for speech therapy, 2 for professional voice use, 1 for otorhinolaryngological treatment, 1 for laryngeal prominence surgery, and 15 for incomplete data.

Hearing screening was performed using pure tone scanning at 1000 to 4000 Hz frequencies at 25 dB, only by air conduction (Ad 229, Interacustics, Denmark). TW individuals who had any failure or did not respond to the pure 25 dB tone were instructed to seek an ENT (Ear, Nose, and Throat specialist) and/or undergo a complete audiological evaluation and were not included in this study.

The voice sample collection was performed through the sustained emission of the vowel “a” with the individual in an upright position. The microphone was positioned horizontally in front and 4 cm from the mouth. In maximum phonation time, the emission was sustained at the usual pitch and loudness after deep inspiration. Voice collection was performed using an omnidirectional condenser microphone (Model ECM 8000; Behringer, Willich-Münchheide II, Germany - ruler-flat frequency response from 15 to 20 kHz, sensitivity 70 dB) and a digital recorder (H4n, Zoom, United States – 96 kHz, 16 bits, set to 50% of input signal pickup level) in a room with environmental noise below 50 dB SPL, verified with a sound pressure meter (Icel DL-4200, Brazil).

For the acoustic analysis of the voice, the initial 5 seconds of the sustained emission of the vowel "a" were used. The beginning of the emission was excluded to avoid interference from the vocal attack, and the end was excluded due to potential instability. The fo measurement was obtained using the Multi-Dimensional Voice Program Advanced (KayPENTAX®, New Jersey, USA), with a sampling rate of 44 kHz and 16-bit analog-to-digital conversion. CW fo values were between 150 and 250 Hz, and CM values were between 80 and 150 Hz (Menezes *et al*., 2024; Schwarz *et al*., 2018).

A questionnaire developed by the researchers was used to collect personal data related to history, habits, and general health, including the length of time they have lived as a woman (in years), the age at which they started wearing gender-congruent clothing, the age at which hormonal treatment began (in years), and the duration of the treatment prescribed by the hospital's endocrinologist (in months). The inclusion and exclusion criteria were determined based on the questionnaire responses.

In the same questionnaire, there were two open-ended questions about vocal perception: "What do you think about your voice?" and "What do others think of your voice?" Thus, transgender women's opinions and their reports on listeners' opinions about their voices were evaluated.

The data related to transgender women's vocal perception and listeners' opinions about their voices were reported by the women themselves through a semi-structured interview, without auditory-perceptual judgment. Two speech therapists from the research group conducted the interview with years of experience but no specific training. The listeners included family members, friends, boyfriends, spouses, and coworkers, and their opinions about transgender women's voices were reported by the participants themselves. The speakers' and listeners' views were tabulated and made available to the evaluators as qualitative data (e.g., "My voice is good, very low, high-pitched, nice, etc.").

These data were independently evaluated by two voice-specialist speech therapists with more than ten years of experience and by a lay evaluator with no auditory training in three categories: negative, positive, and neutral (e.g., positive opinion about one's voice, negative opinion about own voice, neutral opinion about own voice). The evaluators were aware that the data came from a transgender women population. The lay evaluator was a social acquaintance of one of the researchers. The category prevailing among the three evaluators was considered for analysis, but interrater and interrater reliability was not assessed.

The descriptive statistical analysis of the variables related to opinions about their voices and the report on listeners' opinions about their voices was performed.

Fundamental frequency variables, TW's opinion on their voice, and the report on listeners' opinions about TW's voice were compared using Fisher's exact test, with a significance level of 5%. We tested the hypotheses of whether having the fo in the CM or CW range influences the assessment of one's voice or the evaluation of voice by others. The kappa coefficient assessed the agreement between speakers' and listeners' opinions about TW's voice. Kappa values >0.75 indicate excellent agreement; those between 0.40 and 0.75 indicate fair to good deal, and values <0.40 indicate poor agreement. The statistical power of the study to detect associations between opinions about one's voice and fo (CM/ CW) was calculated using the pwr package in R software (R Core Team, 2020; Watt; Tskhay; Rule, 2018). Considering a significance level of 5% and the data presented in Table 1, the calculated power was 9.2% (Champely, 2020).

RESULTS

Data from 25 TW were obtained, and they met the inclusion and exclusion criteria and ranged in age from 19 to 46 years (average of 32.2 years). The minimum age for starting self-reported hormonal treatment was 16 years, and the maximum was 32 years, with an average of 19.91 years. The duration of hormonal therapy ranged from a minimum of one month to a maximum of 36 months, with an average of 10.53 months. Regarding the age at which they started wearing gender-congruent clothing, the minimum age was 12 years, and the maximum was 34 years. The duration of living as a woman ranged from a minimum of two years to a maximum of 31 years, with an average of 17.75 years.

Table 1 shows the average fo in the CM and CW range, according to the average positive, negative, or neutral opinions about one's voice and the report on the opinion of others about the TW's voice.

Table 1 – Descriptive mean results of fundamental frequency according to opinion categories

(continua)

			Opinion about own voice		
Frequency range	Sample	f_o average (Hz)	Positive n (%)	Negative n (%)	Neutral n (%)
Cisgender male	12	131.07	3 (25.00)	8 (66.66)	1 (8.33)
Cisgender female	13	179.20	5 (38.46)	7 (53.84)	1 (7.69)

Table 1 – Descriptive mean results of fundamental frequency according to opinion categories

(conclusão)

			Report on listeners' opinions about their voices		
Frequency range	Sample	f_0 average (Hz)	Positive n (%)	Negative n (%)	Neutral n (%)
Cisgender male	12	131.07	7 (58.33)	4 (33.33)	1 (8.33)
Cisgender female	13	179.20	10 (76.92)	3 (23.07)	0

Source: Own authorship.
Note: n: number of individuals; fo: fundamental frequency of voice; Fisher's exact test, p=0.8268: opinion about own voice; Fisher's exact test, p=0.5092: report on listeners' opinions about their voices.

Table 2 shows the general arrangement of the TW data, showing age, fo, frequency range, and report on the opinion of others about their voice and opinion about their voice.

Table 2 – General arrangement of data on age, fundamental frequency, frequency range, opinion on the transgender voice itself, and report on listeners' opinions about their voices

(continua)

Subjects	Age (years)	Fundamental frequency (Hz)	Cisgender frequency range	Opinion about own voice	Report on listeners' opinions about their voices
1	35	129.09	Male	Positive	Positive
2	24	122.00	Male	Negative	Negative
3	29	163.80	Female	Neutral	Positive
4	45	189.38	Female	Positive	Positive
5	40	177.88	Female	Negative	Positive
6	29	190.69	Female	Negative	Negative
7	45	137.09	Male	Negative	Positive
8	19	169.86	Female	Negative	Positive
9	26	144.46	Male	Positive	Negative
10	46	171.32	Female	Negative	Positive

Table 2 – General arrangement of data on age, fundamental frequency, frequency range, opinion on the transgender voice itself, and report on listeners' opinions about their voices

(conclusão)

Subjects	Age (years)	Fundamental frequency (Hz)	Cisgender frequency range	Opinion about own voice	Report on listeners' opinions about their voices
11	19	148.27	Male	Negative	Negative
12	45	172.72	Female	Positive	Positive
13	34	138.23	Male	Neutral	Positive
14	30	134.66	Male	Negative	Negative
15	42	169.40	Female	Positive	Negative
16	32	197.87	Female	Negative	Positive
17	33	146.57	Male	Negative	Positive
18	28	135.58	Male	Negative	Positive
19	30	168.48	Female	Negative	Positive
20	29	161.41	Female	Negative	Negative
21	23	120.96	Male	Positive	Positive
22	28	167.38	Female	Positive	Positive
23	33	106.89	Male	Negative	Neutral
24	37	109.02	Male	Negative	Positive
25	24	229.45	Female	Positive	Positive
Average	32.2	156.10			

Source: Own authorship.

Table 3 shows the concordance results between the report on the opinion of others about their voice and the opinion of the TW group analyzed within the CW group. There was no concordance between the variables.

Table 3 – Results on the concordance between the report on listeners' opinions about their voices and the opinion on the own voice of transgender women with fundamental frequency in the cisgender female group

		Report on listeners' opinions about their voices		
		Neutral	Positive	Negative
Opinion about own voice	Neutral	0	1	0
	Positive	0	4	1
	Negative	0	4	3
p-value	0.727			

Source: Own authorship.
Note: Kappa agreement coefficient; *Statistically significant values (p≤0.05).

Table 4 shows the concordance results between the report on the opinion of others about their voice and the opinion of the TW group analyzed with f_o in the CM range. There was no agreement between the variables.

Table 4 – Results of concordance between the report on listeners' opinions about their voices and the opinion about the voice of transgender women with fundamental frequency in the cisgender male range

		Report on listeners' opinions about their voices		
		Neutral	Positive	Negative
Opinion about own voice	Neutral	0	1	0
	Positive	0	2	1
	Negative	1	4	3
p-value	0.709			

Source: Own authorship.
Note: Kappa agreement coefficient; *Statistically significant values (p≤0.05).

DISCUSSION

In the present study, we obtained data from 25 transgender women (TW) aged 19 to 46 years (mean age, 32.2 years). Their average fundamental frequency (fo) was 156.10 Hz (Table 2), which falls at the lower end of the cisgender women (CW) range (Menezes *et al*., 2024; Schwarz *et al*., 2018) or in the neutral range, according to other authors (Dornelas; Ribeiro; Behlau, 2024; Owen; Hancock, 2010), aligning with their gender identity.

Additionally, although TW had an overall unfavorable opinion about their voice, they reported that others' views were positive when their fo was above 150 Hz (average of 179.20 Hz) (Table 1). This suggests that f_o /pitch is an important parameter to be considered in speech therapy to enhance both the self-perception of a feminine-sounding voice and the listeners' perception of a feminine-sounding voice, although f_o is not the only vocal marker for gender perception (Dacakis; Oates; Douglas, 2012; Houle; Levi, 2021).

This result agrees with the study by Dahl and Mahler (2020), in which TW was perceived by listeners as CW when they had an average f_o of 165 Hz (range, 150-181 Hz), and with the study by Schmidt *et al*. (2018), which found an average f_o of 172.4 Hz among TW. The f_o must be 150-250 Hz to be perceived as CW. TW rated as having a more feminine-sounding voice had higher f_o values, whereas lower f_o is associated with the perception of a more masculine-sounding voice (Houle; Levi, 2021; Schwarz *et al*., 2017). It is worth noting that there has yet to be a definitive consensus on the f_o for TW in the literature. The neutral range is between 145-175 Hz, the CW range is between 180-220 Hz, and the CM range is approximately 100-140 Hz. Thus, the range can vary between 116.8 Hz and 171 Hz (Dornelas; Ribeiro; Behlau, 2024; Kim, 2020; Owen; Hancock, 2010).

TW's satisfaction with their voices, however, is not always related to increased f_o, as there are other gender markers such as intonation, articulation, and speaking style (Hardy *et al*., 2020; Kim, 2020; Meister *et al*., 2017; Schmidt *et al*., 2018; Schwarz *et al*., 2017). It has been shown that even with a f_o of approximately 200 Hz, some TW are not perceived as CW, thus supporting the idea that f_o will not always be the decisive factor for listeners' vocal perception of femininity, but it can be an indication of satisfaction for TW (Dacakis; Oates; Douglas, 2017; Houle; Levi, 2021; Kim, 2020; Meister *et al*., 2017).

In our study, there was a more pronounced negative opinion about their voice in both *fo* ranges and a more pronounced positive report on the opinion of listeners in both bands, although without statistical significance and no significant correlation between the opinion about their voice and the report on the opinion of others (Tables 3 and 4). Similar to our study, although speakers' and listeners' perceptions of a feminine-sounding voice are strongly correlated, TW tend to classify their voice as more masculine than listeners do (Dahl; Mahler, 2020). It seems that TW's self-perception of their voice tends to be more damaging than that of listeners, regardless of their background. In this context, speech therapy professionals should guide their intervention to achieve vocal satisfaction for the transgender individual.

TW with low vocal self-assessment appears to have more negative voice-related experiences (Dacakis, Oates, Douglas, 2017). TW who complain about their voice quality and a non-gender-appropriate voice often have their voices rated by listeners as more masculine-sounding, whereas those who report being satisfied with their voices often have their voices rated as more feminine-sounding (Diamant; Amir, 2021; Schmidt *et al*., 2018). Therefore, TW's quality-of-life scores improve as their voice is perceived as more feminine or more pleasant and compatible with the desired gender (Barra; Gusmão; Araújo, 2020; Diamant; Amir, 2021; Hancock; Krissinger; Owen, 2011; Quinn; Swain, 2018). Greater well-being has also been reported as a function of the congruence between voice and gender identity in TW, with greater satisfaction with life, quality of life, and self-esteem, and less anxiety and depression being associated with how feminine TW themselves and others perceive their voices (Barra; Gusmão; Araújo, 2020; Diamant; Amir, 2021; Quinn; Swain, 2018; Watt; Tskhay; Rule, 2018). Thus, it is emphasized that speech therapists should aim to align the transgender woman's opinion about her voice with the listeners' views, which is an essential point in achieving the desired vocal satisfaction.

In this study, the onset and duration of hormone treatment varied widely among subjects. Additionally, the literature points out that hormone therapy with female hormones does not result in changes to the structure of the vocal folds or the vocal resonance characteristics of TW. In previous studies of TW (Hardy *et al*., 2020; Nygren *et al*., 2016; Santana *et al*., 2022), participants had their f_0 values within the CM range after initiation of hormone therapy, which was associated with higher vocal satisfaction, improved quality-of-life indices, and lower depression and stress indices. This indicates high levels of vocal satisfaction due to having a voice congruent with their gender identity. Throughout the process of gender affirmation with hormone therapy, self-perception of voice has been reported as more favorable for TM and more damaging for TW (Hancock; Colton; Douglas, 2014; Hembree *et al*., 2017). These results are similar to those obtained in our study, in which TW predominantly considered their voices negatively. This likely occurs because therapy with female hormones does not change the structure of the vocal folds or the vocal resonance characteristics of TW.

Notably, TW, to promote a voice more consistent with their gender identity, may make inadequate compensatory vocal adjustments such as elevation of the larynx in the neck or increased vocal tension. This vocal dissatisfaction underscores the importance of speech therapy. When the voice is inconsistent with gender expression, it can create discomfort in specific social interactions and consequent impacts on quality of life. Additionally, gender expression is reflected in their voice, body, behavior, and attitudes (Quinn; Swain, 2018).

In this sample, many TW started wearing gender-congruent clothing in early adolescence (12 years old), possibly allowing for better adjustments due to the shorter duration of using the CM voice/opposite gender and hormonal/body changes during this phase. However, speech therapy and laryngology should assist with other aspects of vocal femininity and prevent laryngeal injuries due to exertion (Hembree *et al*., 2017).

Since voice is an essential factor in the perception of gender and is directly related to people's quality of life, studies on TW's self-perception of voice and listeners' opinions about their voice can be helpful in the development of specific assessment protocols for speech therapy services and gender affirmation programs. The assessment of vocal satisfaction can be conducted by presenting sociocultural positions in a group, including people with different gender identifications, considering that these may or may not be static over time. This includes evaluating the attributions received from others and how these relate to identifications, desires, and well-being; assessing voice and speech naturalness; and examining voice function and communication about vocal demands (Coleman *et al*., 2022).

The limitations of our study include: 1) the fact that we were unable to provide the raters with audio-recorded voices in a randomized manner for evaluation, which would have allowed us to cross-reference these data with the fundamental frequency values and the opinions expressed by both the transgender women and their reports on listeners' opinions about their voices; 2) the lack of inter-rater reliability analysis; 3) the transgender women's report on listeners' opinions about their voices, which introduced bias into the study; and 4) the need to consider psychosocial factors that may influence transgender women's vocal perception. These aspects could be investigated in future studies.

TW with a f_o above 150 Hz had higher acceptance scores regarding whether their voice was rated positively than TW with a f_o below 150 Hz. These results suggest that a voice with a higher f_o brings greater vocal satisfaction and increased congruence with gender identity, thereby improving their gender affirmation and, consequently, their quality of life.

Although not statistically significant, there was an evident discrepancy between the TW's opinions about their voices and their report on listeners' views. Most TW had a negative opinion about their voices, while most listeners' views were positive. This suggests that the vocal satisfaction of TW is not directly related to f_o, as there are other gender markers such as intonation, articulation, and speaking style. It also highlights the need for follow-up with a speech therapist to adjust their expectations and improve their voices. Additionally, it was verified that vocal self-assessment protocols are fundamental tools in the evaluation of the transgender population during the gender transition process.

Future research should further explore the relationship between vocal self-perception and listeners' opinions about the voices of transgender individuals with a broader sample of participants. Longitudinal studies are crucial for understanding how vocal perceptions and gender identities evolve over time, using vocal self-perception protocols. Additionally, considering psychosocial factors that may influence transgender women's vocal perception would be valuable. These lines of inquiry offer promising opportunities to advance our understanding of voice perception among transgender individuals, contributing to improved clinical practices and interventions in speech therapy and gender affirmation.

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