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Dermatoglyphy and vocal condition of professors

Dermatoglifia e condição vocal de professores universitários

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ABSTRACT

Purpose: To investigate the association between the dermatoglyphic profile and the vocal condition of teachers at a public higher education institution. **Methods:** 49 professors participated in the study. After signing the Informed Consent Form, the following instruments were used: sociodemographic questionnaire and Voice Disorder Screening Index (ITDV). Fingerprints were collected using the Integrated Biometric Watson Mini scanner and analysis performed using the Cummins and Midlo protocol. The results were presented in absolute frequency. The Chi-Square Test was performed, with a significance level of 5%, to verify the association of ITDV vocal symptoms with a dermatoglyphic profile. This study was approved by the Research Ethics Committee of a public higher education institution under protocol number 3,372.226. **Results:** There was a prevalence of females among the university professors studied. As for the classification of the dermatoglyphic profile , most had an anaerobic profile. There was a statistically significant association only between dermatoglyphic profile and weekly workload. **Conclusion:** Most subjects with an anaerobic profile had more frequency of vocal symptoms. There was a statistically significant association between weekly working hours and dermatoglyphic profile.

Keywords: Dermatoglyphics; Voice; Faculty; Voice quality; Speech therapy

RESUMO

Objetivo: Investigar a associação entre o perfil dermatoglífico e a condição vocal dos professores de uma instituição pública de ensino superior. **Métodos:** Participaram do estudo 49 docentes. Foram utilizados os seguintes instrumentos de coleta: questionário sociodemográfico e Índice de Triagem para Distúrbios da Voz (ITDV). As impressões digitais foram coletadas por meio do *scanner* Watson Mini da Integrated Biometric e a análise realizada por meio do protocolo de Cummins e Midlo. Os resultados foram expostos em frequência absoluta. Foi realizado o teste Qui-Quadrado, com nível de significância de 5%, para verificação da associação dos sintomas vocais do ITDV com o perfil dermatoglífico. **Resultados:** houve prevalência do gênero feminino entre os docentes universitários estudados. Quanto à classificação do perfil dermatoglífico, a maioria apresentou perfil anaeróbico. Observou-se associação estatisticamente significativa apenas entre perfil dermatoglífico e carga horária semanal. **Conclusão:** a maioria dos sujeitos de perfil anaeróbico teve maior frequência de sintomas vocais. Observou-se associação estatisticamente significativa entre carga horária semanal e perfil dermatoglífico.

Palavras-chave: Dermatoglifia; Voz; Docente universitário; Qualidade vocal; Fonoaudiologia

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INTRODUCTION

Oral communication is one of the most used resources during the professional activities of teachers and is directly connected to voice quality[1]. Therefore, teachers are among the professionals who most experience vocal issues. The scientific production on the subject in speech therapy is vast. According to the literature, the most common symptoms in this population are hoarseness and vocal strain[2,3].

Work-related voice disorder (WRVD) is described as any form of vocal difficulty related to professional activity which diminishes, compromises or impedes performance or communication by the professional, possibly leading to laryngeal alterations[4].

Causes of this disorder involve working conditions and professional activities, including inadequate vocal behaviors and individual predispositions. Additionally, heavy workloads also contribute, denying teachers the vocal rest necessary to recover[5,6].

The understanding teachers have of their own voice is essential for them to identify their abilities and adapt their methodology for transmitting information using appropriate vocal resources. Based on this knowledge, the self-evaluation process becomes more accessible and effective, providing awareness of possible vocal problems to allow for early intervention by trained professionals[5].

Vocal production is known to be related to laryngeal muscle movement. This muscle activity can increase due to greater vocal intensity, fundamental frequency, or speaking time, causing overloading that can affect vocal production during teaching activities[6].

Regarding muscle activity, there is a science focused on studying the potential of individuals named dermatoglyphics. This term, little discussed in speech therapy comes from the Latin word *dermo*, which means, "skin", and *glypha*, which means "record". and was introduced by Cummins and Midlo in 1926 at the 42nd Annual Session of the American Association for Anatomy. The study of fingerprints is an identification method for genotypic characteristics to associate individual physical traits with their muscle profile, which can be classified as aerobic, anaerobic, or mixed[7]. The fundamental physical qualities are resistance, muscle contraction speed, and motor coordination and force[8,9].

In dermatoglyphics, three types of pattern are analyzed according to the Vucetich classification: arch (A), characterized by the absence of a nucleus and deltas (D10) and connected to muscle strength potential; loop (L), with only a delta and a nucleus indicating individuals with speed and explosion, and whorl (W), with two deltas and one or two nuclei, highlighting motor coordination and resistance (Figure 1). The analysis of the patterns allows classifying an individual as aerobic, if there is a predominance of the whorl; anaerobic, when the arch or loop predominates and mixed, when 50% of the pattern is whorls[7,10,11].

This method is frequently used in sport studies to identify athletes' muscle potential, mainly high-performance athletes whose development depends both on heredity and environment. Therefore, training is highly important for honing motor abilities, also determined by genotype[7,12].

Vocal conditioning of teachers based on exercise physiology can avoid the onset of symptoms such as hoarseness and fatigue. According to the literature, this professional group are highly susceptible to developing WRVD[2,4]. Therefore, understanding teachers' muscle potential, analyzed using dermatoglyphic assessment, can help in therapeutic planning and for targeted preventative actions.

Based on this understanding of dermatoglyphics, emphasizing muscle potential, the present study seeks to investigate the association between the dermatoglyphic profile and the vocal condition of health professors at a public higher education institution.

Arch (A)	Loop (L)	Whorl (W)
		
• Muscle potential: strength • Low-level of motor coordination • No delta	• Muscle potential: speed and explosion • One delta	• Muscle potential: resistance and motor coordination • Two deltas

Figure 1. Pattern types

METHODS

Study design

This is a quantitative, cross-sectional, descriptive study. The research was approved by the Research Ethics Committee of the State University of Bahia – CEP/ (UNEB), review number 3.372.226, according to Resolution nº 466/12 of the National Research Ethics Commission (CONEP).

Sample

The study was carried out at a public university with health professors from courses including speech therapy, nutrition, medicine, nursing, pharmacy, and physiotherapy.

Inclusion and exclusion criteria were determined for sample selection. The following inclusion criteria were applied: professors of both sexes who teach in the health department of the institution, irrespective of vocal habits or symptoms, who signed the Free and Informed Consent Form (FICF) and participated in data collection in the Clinic of the Speech Therapy Department of the institution. Professors who did not present a fingerprint image, making dermatoglyphic analysis impossible, or who did not complete all steps of the research were excluded.

Collection procedure

Initially, the sample included 54 professors, however, five were excluded, four did not attend the dermatoglyphic data collection session at the previously agreed-on dates, and one professor, following collection and analysis, was classified as the only subject in one of the three dermatoglyphic profiles (mixed profile), which, made statistical calculation impossible according to the study design. Therefore, 49 professors participated in the study, with an average age of 44 years.

For sample recruitment, the project was presented to professors at department staff meetings. We carried out a survey of teacher contacts for those not present at the meetings, so that the research team could invite them to participate in the study. Upon contact, we approached them directly after one of their classes at the university to introduce them to the project in detail and obtain their permission to participate in the research.

After signing the FICF, the professors were asked to fill in a sociodemographic questionnaire and the Screening Index for Voice Disorder (SIVD)[13]. These research instruments were printed on A4 paper and electronically copied, as a form on Google Forms, so that participants could choose the most convenient and practical way to respond. The majority requested the Google Forms link to be sent electronically.

The sociodemographic questionnaire included questions related to general and voice habits, workload and voice use, career time, working dynamics, and work environment (Table 1). The questionnaire sought to understand the profile and the association of certain variables with the dermatoglyphic profile of the sample studied.

The Screening Index of Voice Disorder – SIVD[13] was the instrument chosen for the professors' self-perception assessment for being a reliable and highly sensitive instrument that predicts the chances of the professor presenting vocal changes based on the most frequently self-reported symptoms indicated in the DVRT protocol (hoarseness and vocal strain). Furthermore, it is easily and quickly applied and simply understood.

Table 1. Description of research participants

Variable		Absolute value	%
Sex	Female	37	75.5
	Male	12	24.5
Daily hours of voice use (hours)	Up to 7 hours	13	26.5
	Above 8 hours	36	73.5
Voice use intensity	Adequate	11	22.4
	Moderate	27	55.1
	Excessive	11	22.4
Working environment conditions	Excellent	1	2
	Good	37	75.5
	Bad	11	22.4
Noisy environment	Yes	27	55.1
	No	22	44.9

Subtitle: % = percentage

The SIVD consists of 12 vocal symptoms: hoarseness, voice loss, breaking voice, low-pitched voice, phlegm, dry cough, cough with secretion, pain when speaking, pain when swallowing, secretion/phlegm in the throat, dry cough, and strained speech. The answers were measured by indicating these vocal symptoms on a frequency scale (never, rarely, sometimes, or always). The SIVD score is obtained by the subject adding the number of symptoms indicated as "sometimes" and "always". One point is added to each frequency indicated, with 5 points being the cutoff point that determines the level of suspicion for dysphonia.

For the present study, only the values related to the general SIVD and to symptoms of hoarseness and vocal strain were used, since they are the most commonly reported by professors[1,2] and have a direct relationship to the dermatoglyphic profile.

Following the first step, the team contacted the professors again to arrange a date and time to collect their fingerprints. The professors attended the Clinic of the Department of Speech Therapy on the scheduled day. At the clinic, they were led to the acoustic analysis room, where all the information regarding the collection, storage, and analysis process for the fingerprints was reviewed. The fingerprints of all the professors' fingers on both hands were collected using the Integrated Biometric Watson Mini scanner (Toronto, Canada) hooked up to a Lenovo BM5K8TM1 (Bratislava, Slovakia) laptop. Each collection took 10 minutes on average.

Data Analysis

A third step involved tabulating the data using the Statistical Package for the Social Sciences – SPSS, version 20.0, and the program Microsoft Excel for drafting the tables.

The fingerprints were analyzed according to the protocol of Cummins and Midlo (1961). To complete the protocol, it was necessary to: 1) indicate the type of pattern (A = arch, L = loop, W = whorl) (Figure 1), the D10 (index representing the sum of all the deltas and the sum of the number of lines

(*SQTL*) indicating the total lines for each of the ten fingers, and 2) add the types of patterns for all fingers to determine the predominance that indicates the dermatoglyphic profile, and the number for D10 and the SQTL. It is worth noting that the SQTL in the whorl pattern with two deltas is calculated as follows: the number of lines per delta is added to the nucleus and then divided by two. The sum of the deltas is obtained using the equation D10 = ΣL+ 2W, counting only the fingers presenting loops (L) or whorls (W). Each loop has a delta and each whorl has two deltas. Finally, the total deltas found on the fingers of both hands is calculated.

The Chi-square test was used to verify the association between the dermatoglyphics profile and the following variables: time in the profession, weekly workload, hours of professional voice use, general SIVD, vocal strain, and hoarseness. The Chi-square test considered a 5% significance level (p-value ≤ 0.05).

Following the analyses, the results were presented in the tables and figures generated by the SPSS and edited using the Excel program.

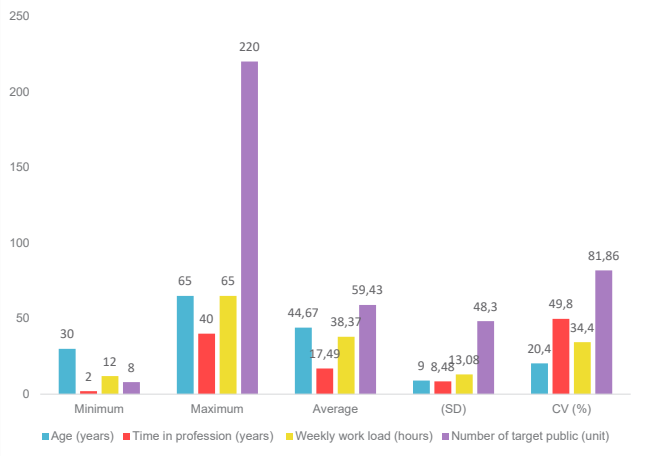

Figure 2. Sociodemographic data for university professors, 2020
Subtitle: SD = Standard Deviation; CV = Coefficient of Variation; % = Percentage

RESULTS

The sample consisted of 49 subjects, with 37 (75.5%) being female. Thirty-six (73.5%) reported more than 8 hours of professional voice use per day and 11 (22.4%) reported excessive intensity of voice use. Thirty-seven (75.5%) regarded their working conditions as "good", while 27 (55.1%) reported a noisy environment (Table 1).

The participating professors' average age was 44.67 years (DP=9.0). The average time in the profession was 17.49 years (DP=8.48) and the average weekly workload was 38.37 hours (DP= 13.08); average class size was 59.43 students (DP=48.3) (Figure 2).

In terms of the dermatoglyphic profile, 45 (91.8%) presented an anaerobic profile. A statistically significant association was only observed between the dermatoglyphic profile and weekly workload (p=0.033). Professional time (p=0.966), hours of professional voice use (p=0.267), SIVD general (p=0.235), voice strain (p=0. 359), and hoarseness (p=0.671) (Table 2) showed no statistical significance.

Table 2. General association between the vocal condition and dermatoglyphic profile

Vocal condition	Dermatoglyphic Profile[1]				Value of p
	Aerobic (8.2%)		Anaerobic (91.8%)		
	Smaller	Larger	Smaller	Larger	
Time in Profession[1]	50%	50%	51.1%	48.9%	0.966
Weekly hours[2]	50%	50%	11.1%	88.9%	**0.033**
Hours of professional use[3]	50%	50%	24.4%	75.6%	0.267
SIVD general[4]	100%	0.0%	73.3%	26.7%	0.235
Fatigue[4]	75%	25%	51.1%	48.9%	0.359
Hoarseness[4]	75%	25%	64.4%	35.6%	0.671

Chi-square test (p≤ 0.05); [1]For Time in Profession: Smaller = 2 to 17 years, Larger = 18 to 40 years; [2]For Weekly Workload: Smaller = 12 to 20 hours and Larger = 21 hours or more; [3]For Hours of Professional Voice Usage: Smaller = up to 7 hours, Larger = above 8 hours; [4]For Fatigue, Hoarseness and General SIVD: Smaller = never and rarely and Larger = sometimes and always
Subtitle: % = percentage; SIVD = Screening Index for Voice Disorder

DISCUSSION

In the present study the average age and female predominance observed corroborate other national studies addressing professors' voice use[1,14,15]. Moreover, hoarseness and vocal tract discomfort symptoms are markedly greater in women[15]. We believe this occurs due to physiological and anatomical aspects since most women have a triangular cleft[16] and are predisposed to greater hormonal variation[17,18].

The average time in the profession was in line with the results from another study involving higher education professionals[1]. Similarly, the average class size was close to other studies that observed averages of between 39 and 51 university students[1,19].

Notably, half the professors reported a noisy teaching environment. One study[20] addressing noise levels at universities (with an average of 35 students per class) showed that professors show greater awareness of noise in the environment than students.'. Moreover, it also showed that noise levels in all classrooms are above those recommended by the national legislation. Therefore, the presence of noise interferes with teaching/learning activities and with professors' voice demands.

Vocal demands such as "talking a lot in closed environments" correspond to the most common conditions in university teaching. At other teaching levels, the literature shows that teachers report discomfort and related symptoms, mainly excessive and inadequate voice use, as well as the presence of muscle tension and unfavorable working environments[2].

Professors are considered to have greater access to information about vocal health. Therefore, they would have better working conditions involving less voice effort during teaching activities compared with other teaching categories[15]. However, other studies contradict this understanding. In one literature review[21] even with significant vocal knowledge, professors still frequently presented symptoms such as effort to speak, breaking voice, and hoarseness.

The data collected in this study show that the significant majority of professors presented no alterations for the SIVD. According to the authors, the speech therapy assessment using

the instrument found that most professors from the public education sector classified their voices as "adequate" and "very good" similar to the impact they reported on their quality of life[19], thus corroborating our own results.

Related to this, data showed that more than half the professors were satisfied in terms of voice quality, while the others indicated aspects that could be improved, such as tone, intensity, modulation, and resistance[5]. Statistically, more than half the participants responded that their voice use was of moderate intensity, which is generally predominant in this professional class, being a factor that leads to some voice disorders[1].

The analysis showed that most professors had an anaerobic profile, which is also described for most of the population. Therefore, our results agree with the finding of its predominance[9,22]. These individuals presented a prevalence of strength, explosion, and muscle speed, the most common characteristics in the general population.

Another relevant factor was that half of the anaerobic individuals presented vocal strain. Vocal cords together with the elevated intensity magnify the risk of developing voice problems, mainly in the anaerobic population, whose muscle profile predisposes them to strength, explosion, and rapid muscle contraction[9,12].

By contrast, a third of aerobic individuals mentioned this symptom. Fatigue is also known to be caused by lack of training associated with intense voice use: the subjects in the aerobic profile have resistance and motor coordination and are more resistant to tiredness and fatigue[7].

According to voice studies, the main factors that explain vocal fatigue include neuromuscular inefficiency, recruitment of a larger number of muscles, or inadequate muscle conditioning for phonation, which involves a higher energy demand, and/or a recovery deficit after vocal exertion, as well as a lack of cardiovascular training[15].

Being professors of a higher education institution, the most probable causes are the recruitment of a greater number of intrinsic and extrinsic larynx muscles, a lack of pneumo phono-articulatory coordination, and a lack of training. Therefore, a vocal training and conditioning program should be established for the professors, especially for the anaerobic profile seeking to reduce the emergence of vocal pathologies related to fatigue[3,9].

One study involving professors analyzed hoarseness and time in the profession and found that more than half the population presented vocal symptomatology. However, individuals who had been teaching for longer than 15 years were a minority among those reporting problems. An analysis of these data reveals some ambiguity since most professors with complaints had been in the profession for a shorter period. However, the results agree with our own.

Despite observing no statistical significance in the association between dermatoglyphics and time in the profession, individuals who had been in the profession longer tended to develop greater muscle resistance, maybe due to the adaptation of the laryngeal muscle or phenotypic changes over time[23,24]. Therefore, they tend to display a lower predisposition to developing vocal symptoms, as indicated by the general SIDV. It is worth noting that the SIDV is a reliable and highly sensitive self-assessment and epidemiology monitoring instrument for identifying voice disorders[13].

The weekly workload observed between professors with given a dermatoglyphic profile was statistically significant. Anaerobic individuals presented a number of hours of daily voice use greater than aerobic individuals. It was also expected that there would be a higher frequency of altered RVTI, fatigue, and hoarseness, since they were the least resistant profile. Given that this was not observed, we suggest an increase in muscle resistance based on phenotypic modifications due to the voice use time.

One study reports that different factors determine athletes' performance, including motor coordination, mobility, strength, and muscle resistance. These factors are influenced by the genome, environment, health, nutrition, and training[11,12].

The limitations of this study include the small population sample mainly comprising individuals with an aerobic profile. This could have interfered with the results. Being a new field of study in speech therapy, we suggest that further studies should be realized, including other populations with a larger number of teachers.

CONCLUSION

Most university professors with an anaerobic profile showed a higher frequency of vocal symptoms. An association between weekly workload and anaerobic dermatoglyphic profile was observed. Generally, there was a low frequency of the symptoms described by the SIVD, which appeared in both profiles, demonstrating good vocal condition among the participating professors.

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